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Abstract

We view debt covenants as monitoring technologies that differ in intensity and allocation of control rights, thereby shaping corporate financial behaviour. We construct a novel dataset combining Compustat information with covenant data extracted from EDGAR filings through automated Python-based text analysis over 1995Q3–2020Q3. We classify covenants into maintenance capital covenants, maintenance performance covenants, and covenant-lite incurrence covenants, and firms according to their dominant financing behaviour, distinguishing leverage-adjustment-oriented firms from firms relying more heavily on financial flexibility through internal financing and debt maturity management. To account for the resulting heterogeneity, we estimate firm-level dynamic models and summarize the resulting parameters using a multivariate meta-analytic framework. We find that performance and limitation covenants are associated with greater financial flexibility, whereas capital covenants are associated with faster leverage adjustment. These findings suggest that covenant design shapes not only creditor protection but also firms' dynamic capital structure choices.

Keywords: Covenants; Language Models; Meta-analysis; Dynamic Panel Data Models; Corporate Capital Structure.

JEL classification: C23; C30; G21; G30; D22.

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Non-technical abstract

Debt contracts often include financial covenants, contractual clauses that allow lenders to monitor firms and intervene when financial conditions deteriorate. Although these clauses are widespread, they differ substantially in the restrictions they impose and in the control rights they grant to creditors. Existing research has mainly focused on what happens when firms violate covenants, while much less is known about how different covenant structures influence firms' financial decisions before any violation occurs.

This project develops a new dataset combining accounting information with millions of pages of U.S. Securities and Exchange Commission (SEC) filings processed through automated text analysis. We classify different types of financial covenants and investigate how they are associated with firms' financing behaviour, including leverage adjustment, the use of internal funds, and debt maturity choices.

The results show that debt covenants are far from homogeneous. Capital, performance and covenant-lite provisions are associated with different financial strategies and different forms of creditor monitoring. Moreover, covenant structures have changed substantially over the last twenty-five years, with a gradual shift from capital-based restrictions toward performance-based monitoring. These changes became particularly pronounced after the global financial crisis.

Overall, the project shows that the design of debt contracts is an important determinant of corporate financial behaviour. Rather than simply protecting creditors, different covenant structures are associated with different ways in which firms manage leverage, financial flexibility, and debt maturity. These findings contribute to the current debate on the increasing use of covenant-lite lending and provide new evidence on how contractual design influences corporate financing decisions.

1 Introduction

Debt contracts embed covenants, contractual provisions through which creditors mitigate credit risk and reduce agency conflicts between shareholders and lenders. By constraining managerial discretion and allocating conditional control rights to creditors, covenants influence corporate financial policies and investment decisions (Bradley and Roberts, 2015). When a covenant is violated—often referred to as a technical default—creditors may renegotiate contract terms, impose additional restrictions, or accelerate debt repayment. Through these mechanisms, covenants represent an important channel through which creditors shape corporate behaviour.

A large literature examines covenant violations and creditor intervention following technical default (e.g., Roberts and Sufi, 2009; Nini et al., 2012; Demerjian and Owens, 2016). Comparatively less attention has been devoted to how different covenant structures affect firms' financing decisions before violations occur. We address this question by distinguishing between maintenance capital covenants, maintenance performance covenants, and incurrence covenants. These covenant categories differ in monitoring intensity, frequency of creditor intervention, and allocation of control rights between borrowers and lenders.

We investigate whether different covenant structures are associated with systematic differences in corporate financial behaviour. Specifically, we study three key margins of debt policy: the speed of adjustment toward target leverage (Flannery and Rangan, 2006), the sensitivity of financing decisions to internal funds (Jensen, 1986), and the interaction between short- and long-term debt choices (Barclay and Smith, 1995). We examine both persistent differences in covenant exposure and changes in covenant design associated with major institutional and macroeconomic developments, including the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) of 2005 and the global financial crisis of 2008.[1]

To conduct the analysis, we construct a novel dataset that combines Compustat information with covenant data extracted from EDGAR filings through automated Python-based text analysis over the period 1995Q3–2020Q3. We classify covenants into maintenance capital covenants, maintenance performance covenants, and covenant-lite incurrence covenants, each associated with distinct monitoring mechanisms. We also classify firms according to their dominant financing behaviour, distinguishing leverage-adjustment-oriented firms from firms that rely

[1] To our knowledge, Devos et al. (2017) is the only study that directly relates covenant intensity to leverage adjustment speed.

more heavily on financial flexibility through internal financing and debt maturity management.

Our analysis speaks to the ongoing debate on the rise of covenant-lite lending (Becker and Ivashina, 2016; Bräuning et al., 2025). This trend is often interpreted as evidence of weaker creditor discipline, reflecting the shift toward originate-to-distribute lending models, the growing role of non-bank institutions, and the increasing participation of mutual funds in leveraged loan markets (Tung, 2021). By distinguishing between covenant types and linking them to firms' dynamic financial policies, we provide evidence on whether covenant design merely reflects creditor protection or also shapes how firms manage leverage, internal funds, and debt maturity.

We also contribute methodologically by proposing a tractable approach to analysing high-dimensional heterogeneity in corporate capital structure dynamics. The joint presence of multiple covenant types, their varying intensity, and their interaction with firm characteristics and institutional changes generates an empirical setting in which conventional panel regressions with many interaction terms become difficult to interpret. Rather than imposing restrictive parametric structures, we estimate heterogeneous firm-level dynamic models that capture key dimensions of financial behaviour. We then summarize the resulting behavioural parameters using a multivariate meta-analytic framework in which covenant characteristics act as moderators. This two-stage approach allows us to relate firm-level financial behaviour to covenant structures, firm characteristics, and institutional changes. We find that covenant types are associated with markedly different financial policies. Performance and limitation covenants are linked to greater financial flexibility, reflected in stronger sensitivity to free cash flow and tighter interactions across debt maturities. In contrast, capital covenants are associated with faster leverage adjustment. These findings suggest that covenant design shapes not only creditor protection but also the dynamic mechanisms through which firms manage capital structure.

The paper proceeds as follows. Section 2 introduces the data and discusses covenant and financial-behaviour heterogeneity. Section 3 presents the methodology, including the dynamic models, hypotheses, and two-stage meta-analytic framework. Section 4 reports the results. Section 5 concludes and discusses directions for future research. Additional details are provided in Appendix A.1.

2 The Data

Our analysis utilizes a quarterly frequency panel dataset derived from the merge of Compustat financial data and the EDGAR/SEC (Securities and Exchange Commission) information about covenant types outlined in credit contracts. Compustat complete and accurate financial data are available for 436,981 observations, 12,191 firms over the period 1975Q4–2020Q3 (a median and maximun of 23 and 180 quarters, respectively). The definition of Compustat variables used along the paper is in the Appendix, Section A.1.4.

The EDGAR/SEC data are leveraged to derive covenants through textual analysis implemented in Python: for 4,533 companies, randomly extracted from Compustat, we scanned, over the period 1995Q3-2022Q1 with the last quarters used as check, the files 10-K (21.37%), 10-Q (70.43%), 10-KSB (1.55%), 10-QSB (4.51%), 10-K405 (2.15%) and 8-K files. Globally, we read 25 years and 4 documents per year with an average 60-pages length: 6000 pages per firm for 4,533 firms results in 27,198,000 pages investigated, more than 27 million pages to capture 12 types of covenants, 12 types of violations and 8 consequences for a total of 32 cases. More details about SEC structure and examples of pages are in the Appendix, sections A.1.1 and A.1.2.

The match between Compustat and SEC provides 3,753 firms over the common period 1995Q3-2020Q3 (168,407 observations with a median and maximum of 41 and 101 quarters, respectively) with both accounting and covenant information. These companies are also available over the longer period 1975Q4-2020Q3. The comparison between samples is in Appendix, Section A.1.5

2.1 Identifying covenant heterogeneity

Identifying whether a loan contract contains financial covenants is only the first step toward understanding how debt contracts shape corporate behaviour. Existing textual approaches typically focus on detecting the presence of covenants, while treating covenant intensity and covenant type as homogeneous. However, debt contracts differ substantially in the monitoring mechanisms they impose, the frequency with which creditors can intervene, and the allocation of control rights between borrowers and lenders. Capturing this heterogeneity requires moving beyond a simple covenant indicator.

Our textual-analysis procedure therefore proceeds in two stages. In the first stage, we identify the presence of financial covenants in SEC filings using a dictio-

nary of covenant-related terms, which allows us to construct the binary indicator $cov = 1$ (Appendix A.1.3). In the second stage, we exploit the detailed contractual language contained in SEC filings to classify covenants according to their economic function. Conditional on $cov = 1$, we search for specific keywords associated with distinct covenant provisions and map them into economically meaningful covenant categories. Table 1 reports the dictionaries used in this classification procedure.

Table 1: Definitions of covenants – Python procedure Step II

Specific Type	Keywords	Variables involved
Maintenance Capital (*cov_capH*)		
cov_netpat	'maintenance of minimum net working capital and tangible net worth levels', 'sales of assets', 'minimum tangible net worth', 'assets', 'shares', 'net worth covenant', 'net worth covenants', 'working capital covenants', 'working capital covenant'	Tangible net worth & net worth & working capital
cov_indexpat	'asset coverage ratio', 'debt service coverage ratio', 'debt service coverage covenants', 'debt service coverage covenant', 'coverage covenant', 'coverage ratio covenants', 'coverage ratio covenant', 'debt to net worth covenants', 'debt to net worth covenant', 'debt to balance sheet covenants'	Debt service coverage
Maintenance Performance (*cov_perfH*)		
cov_ebitda	'EBITDA', 'EBITDA to consolidated fixed charge', 'EBITDA to debt'	EBITDA
cov_indexred	'maximum quarter losses', 'minimum net profits', 'minimum earning', 'fixed charge coverage', 'coverage ratio covenants', 'coverage ratio covenant'	Charge coverage
cov_cashin	'cash flow coverage ratio', 'cash flow to debt', 'minimum cash flow', 'debt to cash flow covenant', 'debt to cash flow covenants'	Cash flow
cov_indexfin	'minimum leverage ratio', 'interest coverage ratio', 'interest spread', 'interest coverage', 'coverage covenant', 'coverage ratio covenants', 'coverage ratio covenant', 'total debt to capitalization covenant', 'total debt to capitalization covenants'	Interest coverage
Incurrence Limitation (*cov_limL*)		
cov_invstmn	'limitations to capital expenses', 'capital expenses', 'capital expenditure restriction', 'capital expenditure restrictions'	Limitations to investments
cov_borrows	'limitations to other debts'	Limitations to other debts
cov_dvds	'restrictions which relate to the payment of cash dividends', 'limitations to dividends payments', 'prohibition to pay cash', 'dividends', 'dividend', 'dividend restriction', 'dividend restrictions'	Limitations to dividends
cov_vst	'short term debt', 'liquidity covenants', 'liquidity covenant', 'quick ratio', 'quick ratio covenant', 'quick ratio covenants', 'current ratio', 'current ratio covenant', 'current ratio covenants'	Short-term debt
cov_vlt	'long term debt'	Long-term debt

We distinguish three broad categories of financial covenants. First, *maintenance capital covenants* impose continuous compliance with balance-sheet-related thresholds, such as minimum net worth or debt-service coverage ratios. Second, *maintenance performance covenants* require periodic compliance with earnings-, profitability-, or cash-flow-based measures, such as EBITDA, interest coverage, or cash-flow coverage ratios. Both categories are covenant-heavy provisions, implying regular monitoring and the possibility of creditor intervention following a breach. Third, *incurrence covenants* (or covenant-lite provisions) do not require continuous compliance. Instead, they restrict specific corporate actions—such as additional borrowing, capital expenditures, or dividend payments—once predefined thresholds are crossed, thereby preserving greater managerial discretion and limiting creditor intervention.

This classification is economically important because covenant types differ in monitoring intensity and in the allocation of control rights between creditors and shareholders (Christensen and Nikolaev, 2012; Davydenko et al., 2020; Bräuning et al., 2025). Maintenance covenants grant creditors stronger and more frequent

monitoring rights, whereas incurrence covenants primarily constrain specific actions while leaving day-to-day control in the hands of management. Consequently, different covenant structures may induce different patterns of leverage adjustment, financing flexibility, and debt-maturity management.

The joint distribution of covenant types, displayed in Tables 2 and 3, reveals a highly concentrated structure centred on single capital covenants combined with one or more limitation covenants. Approximately 84% of observations contain exactly one capital covenant, most frequently paired with one limitation covenant (62%) and, to a lesser extent, with one performance covenant (24%). Performance covenants rarely appear in isolation and are typically layered onto existing covenant packages. Anyway, high-intensity combinations involving multiple covenant types occur infrequently. Overall, the evidence suggests that limitation covenants constitute the contractual backbone of most agreements, whereas performance covenants are typically layered onto otherwise standard covenant packages rather than used in isolation.

Table 2: How many covenants

Covenants #	Total	%	Capital	%	Performance	%	Limitation	%
0	21,328	12.66	21,329	12.67	104,111	61.82	32,986	19.59
1	9,172	5.45	140,751	83.58	42,559	25.27	108,904	64.67
2	63,099	37.47	6,327	3.76	18,741	11.13	24,309	14.43
3	41,584	24.69			2,962	1.76	2,193	1.30
4	23,221	13.79			34	0.02	15	0.01
5	7,083	4.21						
6	2,289	1.36						
7	579	0.34						
8	47	0.03						
9	5	0.00						
Average number	2.4		0.91		0.53		0.97	
Composition			43.26%		16.26%		40.47%	
Main component			Net worth 97.85%		EBITDA 61.29%		Dividends 88.49%	

Note: Composition is given by the share of each type of covenant over the sum of the three types of covenants.

About 87% of firm-quarter observations contain at least one covenant, indicating that covenant use is pervasive throughout the sample period. Against this backdrop, the composition of covenant structures shifts markedly over time, as indicated in Table 4 and Figure 1.

The composition of covenant structures shifts markedly over time: within

Table 3: Most Common Covenant Combinations

Covenant Structure	Share (%)
1 Capital + 1 Limitation	62.16
1 Capital + 1 Performance	24.22
1 Capital + 2 Limitation	13.40
No Covenants	12.67
1 Capital + 2 Performance	10.03
0 Performance + 1 Limitation	36.70
2 Performance + 1 Limitation	8.25

Table 4: Estimated shifts in composition

	Dependent variable		
	$Capital$	$Performance$	$Limitation$
$trend$	-0.001681^{***}	0.001539^{***}	0.000142^{***}
	(0.000045)	(0.000057)	(0.000046)

Notes: Fixed-effects estimated trend for each share of covenant type. Cluster standard errors in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

firms, capital covenants steadily decline (an average quarterly change of about -0.17 percentage points) while performance covenants rise (+0.15 percentage points), with limitation covenants remaining broadly stable (about 0.014 percentage points per quarter).

In Figure 1 we show the shifting composition of covenant structures by exploiting a four-quarter moving average to remove the seasonal pattern. We observe a decline of capital covenants from around 55–58% of covenant composition in the late 1990s to about 38% by 2020, producing an overall mean of 43.3%. Performance covenants instead show a strong upward trend, from around 4–8% in the mid-1990s they rose continuously to about 21–25% after 2015, producing an overall mean of 16.3%. Limitation/incurrence covenants are comparatively stable, with a mild upward trend early on, mostly fluctuating between 37-50% on, and stabilization later to around 40–41% by 2020, producing an overall mean of 40.5%

The transition becomes especially pronounced from the early 2000s and intensifies after the global financial crisis, suggesting a gradual reallocation from capital-based restrictions toward performance-based monitoring and creditor discipline, while limitation covenants remain relatively stable.

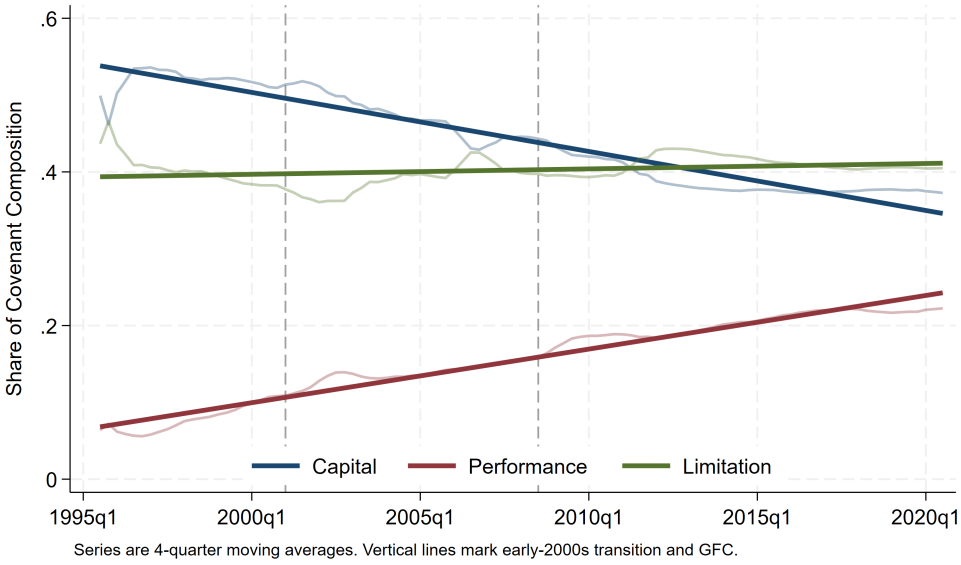


Figure 1: Shifting Composition of Covenant Structures

2.2 Identifying financial behaviour heterogeneity

The recent conclusion of the literature on corporate finance is that no single theory has, thus far, been able to entirely explain capital structure decisions and debt dynamics. Theories seem to explain behaviour in specific subsamples (Shyam-Sunder and Myers, 1999). DeAngelo and Roll (2015) suggest best potential models to be either flexible target leverage models with flexible boundaries or dynamic with heterogenous speeds of adjustment (SOAs). A mixed evidence emerges from the survey conducted by Graham and Harvey (2001).

Bontempi, Bottazzi, et al. (2020) propose a multilevel index to classify companies into groups according to their dominant financial behaviour. A group includes firms exhibiting a target leverage adjustment, meaning that the speed of adjustment is the main margin of behaviour. Another group includes firms exhibiting a flexible financial behaviour, meaning that availability of internal funds and the possibility to manage debt maturities are the main margins of behaviour.

The implementation of the Bontempi, Bottazzi, et al. (2020)'s methodology in our sample identifies clusters of persistent and homogeneous financial behaviours, as presented in Table 5 and further discussed in the Appendix, Section A.1.6.[2]

[2]To identify the clusters we exploit both annual and quarterly data to check for robustness of the results. The index is generated for both short-term and long-term debts by exploiting the minimum required temporal span of 12 years for annual data and 40 quarters for quarterly data. The estimation

The classification should be interpreted as summarizing predominant financing behaviour rather than assigning firms to mutually exclusive theoretical categories. For simplicity, we indicate in parentheses the labels used to distinguish between static and dynamic trade-off companies (TOs and TOd) where target adjustment prevails, and pecking-order (PO) and maturity-timing (MT) regimes where financial flexibility prevails.

Table 5: Distribution by multilevel index and size.

LDA **Index**	**Size (N. of employees)**						**Total**
	1–49	50–249	250–999	1,000–2,499	2,500–4,999	≥ 5,000	Total
TOs	7.35	4.55	8.46	10.03	9.90	7.67	7.96
TOd	35.87	20.89	12.37	7.50	9.06	7.64	11.95
PO	25.93	31.41	30.42	39.87	49.39	50.53	40.47
MT	30.84	43.15	48.75	42.60	31.64	34.16	39.61
SDA **Index**							**Total**
TOs	11.85	4.07	6.21	7.95	6.41	7.76	6.87
TOd	39.20	45.53	38,35	46.12	51.17	48.17	45.47
PO	16.67	17.49	17.05	13.95	13.44	14.96	15.50
MT	32.29	32.90	38.38	31.98	28.98	29.12	32.15

Note: Definitions of long-term (LDA) and short-term debt (SDA) are in Appendix, Section A.1.4. Long-term debt is about 76% of total debt, on average; 6.4% of observations has only short-term debt, 79% has both long- and short-term debt, and 14.6% has only long-term debt. The table refers to 1995Q3-2020Q3 period.

Table 5 show that capital-structure behaviour varies systematically with firm size. Dynamic TO behaviour is most prevalent among the smallest firms (35.9% of firms with 1–49 employees) and declines sharply as with size, whereas PO behaviour becomes increasingly dominant among larger firms, accounting for roughly half of firms with more than 2,500 employees. MT behaviour is comparatively more common among medium-sized firms, while static TO behaviour remains relatively limited across all size classes. To summarise, small firms behave more dynamically, large firms rely more on PO behaviour, intermediate firms exhibit more mixed/MT structures.

The short-term debt results display a much more concentrated pattern around dynamic TO behaviour. Across all size classes, dynamic TO firms are the dominant group, accounting for roughly 38–51% of observations and becoming more preva-

period spans from 1975Q4 to 2020Q3. Using the longest Compustat window to classify firms' financial behaviour is attractive because these clusters are meant to capture relatively persistent financing behaviour rather than quarter-specific covenant effects.

lent among larger firms. MT behaviour represents the second-largest category and is relatively stable across firm sizes, while PO behaviour remains comparatively limited and slightly declines with size. Static TO behaviour is concentrated among the smallest firms and becomes less important for larger organizations.

As our empirical analysis is about capital structure dynamics, adjustment behaviour, substitution/complementarity between maturities, and covenant design, we need a figure emphasizing secular trends, co-movement between long-term debt, LDA, and short-term debt, SDA, and stability or shifts in total leverage. The evolution of corporate debt structure, and the interaction between long-term and short-term financing over time are depicted in Figure 2, by using quarterly means + four-quarter moving averages.

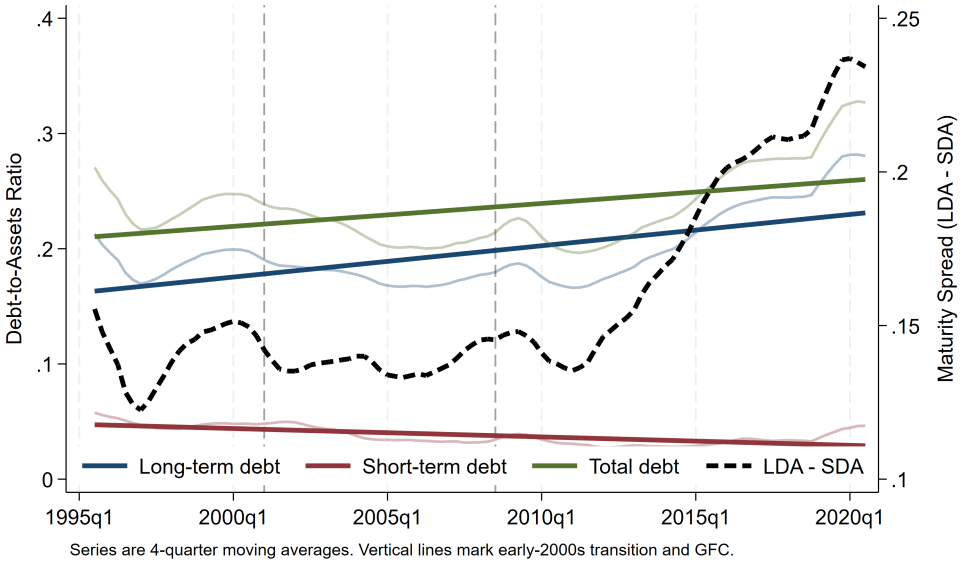


Figure 2: Evolution of Corporate Debt Structure

The evolution of corporate debt structure mirrors the broader shift in covenant design. While total leverage remains relatively stable, firms progressively substitute toward longer-term debt financing, as reflected in the widening maturity spread (LDA–SDA), especially after the global financial crisis. This pattern is consistent with gradual changes in monitoring intensity, creditor discipline, and debt adjustment dynamics. The relative stability of total debt ratios suggests that firms adjust financing structure mainly through maturity substitution rather than changes in aggregate leverage.

3 Methodological implications

Figure 4 summarizes the empirical logic of the paper. Covenant types and their intensity affect firms through different contractual channels—monitoring intensity, restrictions on borrower actions, and the allocation of control rights. These effects interact with firms' underlying financial behaviour, firm characteristics, and macro-institutional conditions, and are reflected in the estimated behavioural parameters for leverage adjustment, free cash flow sensitivity, and debt maturity interaction.

While the hypotheses on the relationship between heterogeneous covenants and heterogeneous financial behaviours can be sketched by exploiting interactions in a pooled dynamic specification as in Subsection 3.1, the empirical implementation is better suited as depicted in Subsection 3.2. Indeed, heterogeneous dynamic models and the subsequent meta-regression allow us to test whether covenant design and redesign explain cross-firm heterogeneity in three financial behaviour parameters: the speed of adjustment toward long-term debt equilibrium, the sensitivity of long-term debt to free cash flow, and the substitution/complementarity between short- and long-term debt. The meta-regression framework also allows for testing for robustness of our results by comparing stock of covenant variables, composition changes, and first-to-last covenant measures.

Figure 3: Conceptual framework: covenant heterogeneity and corporate financial behavior

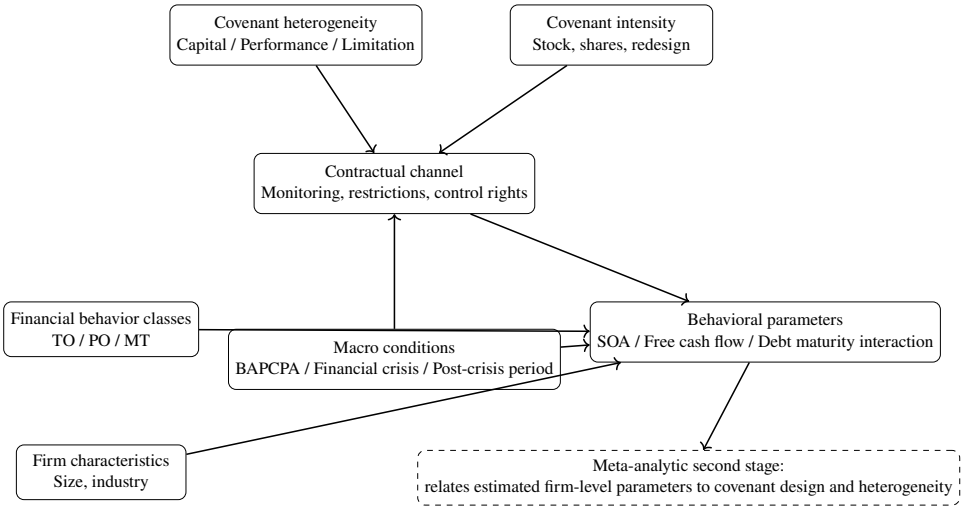


Figure 4: Conceptual framework: covenant heterogeneity and corporate financial behavior

3.1 Model and hypotheses

An appealing framework to condense our hypotheses on the relationship between covenants and financial behaviour could be to exploit interactions inside the EqCM/ECM/$ARDL(1,1)$ dynamic stochastic process for long- and short-term debt (l, s):

$$\begin{aligned}\Delta L_{it}^{(l,s)} &= \mu_i^{(l,s)} + \lambda_t^{(l,s)} + \\ &+ \phi^{(l,s)} \Delta L_{it}^{(s,l)} + \gamma^{(l,s)\prime} X_{it}^{PO/MT} + \\ &+ \pi^{(l,s)} \left[L_{it-1}^{(l,s)} - \beta^{(l,s)\prime} X_{it-1}^{TO} \right] + \epsilon_{it}^{(l,s)} \end{aligned} \tag{1}$$

The dynamic model in (1) describes how long-term leverage (l) and short-term leverage (s) behave in the short-run consistently with a long-run cointegration relationship. Specifically, the model separates the long-run and short-run dynamics and directly calculates the time it takes for leverage to adjust towards the long-run equilibrium after a change in the X_{it-1}^{TO} variables. If X_{it-1}^{TO} and $L_{it-1}^{(l,s)}$ variables are non-stationary, they should be cointegrated for the model to be meaningful, which implies in economic terms a long-term or equilibrium relationship between them.

The X_{it-1}^{TO} (7×1) column vector includes the TO explanatory variables measuring effects of taxations, failure risk, agency costs, asymmetric information. The variables are described in the Appendix, Section A.1.4 and include cash dividends $(DIVA)$, the relative cost of debt $(rcostd1)$, non-debt tax shields $(ndts)$ and non-debt tax shields interacted with positive lagged taxable income $(ndts\_lGAIN)$, guarantees and intangible assets ($Tang$ and $Intan$), profitability $(ebit\_ta)$.[3]

The key TO parameter is $\pi^{(l,s)}$ measuring the speed of adjustment, SOA.

The $X_{it}^{PO/MT}$ (5×1) column vector includes the PO/MT explanatory variables (defined in the Appendix, Section A.1.4): free cash flow $(fcf$, cash flow minus capital expenditures and cash dividends); financial slack $(DWC1)$, R&D expenses (rd_ta) and a dummy for non-innovating observations (rd_dum), the interaction of the market-to-book ratio with an index that increases with the rating of long-term and short-term debts ($mbRLDA$ and $mbRSDA$).

[3] We prefer to risk the inefficiency and multicollinearity between fcf, in the PO/MT vector, and $ebit\_ta$, in the TO vector, rather than the estimation bias that might results from omitting either one.

The key PO/MT parameters are $\gamma_{fcf}^{(l,s)}$ capturing the sensitivity to internal funds (included in the $\gamma^{(l,s)}$ vector), and $\phi^{(l,s)}$ capturing substitutability/complementarity across debt maturities.[4]

A central challenge is that covenant provisions are persistent: once introduced, they typically remain in force for multiple periods. As a result, identification cannot rely solely on high-frequency variation in covenant levels. Instead, we distinguish between

1. *persistent covenant exposure* to capture the contractual regime under which the firm operates. It can be measured by lagged covenant stock, $cov\_k_{i,t-1}, k \in \{capH, perfH, limL\}$, or lagged covenant composition, $sharecov\_k_{i,t-1}, k \in \{capH, perfH, limL\}$.

2. *covenant redesign* to capture changes in creditor control structure such as adoption, tightening, or switching across covenant types. This can be measured by $\Delta cov\_k_{i,t-1}, k \in \{capH, perfH, limL\}$, or $\Delta sharecov\_k_{i,t-1}, k \in \{capH, perfH, limL\}$, or initial and final levels, cov_k_{i,t_i^I-1} and $cov\_k_{i,t_i^F-1}, k \in \{capH, perfH, limL\}$, or first-to-last covenant redesign, to check for regime-dependence robustness.

3. *Post-GFC* structural reallocation in creditor monitoring technologies.

To incorporate covenant design into the financing rule, we could extend the baseline model by allowing covenant types to affect each of the key behavioural margins, leverage adjustment, internal-funds sensitivity, and maturity substitution. An example of augmented specification for case 1. stock of covenants would be:

$$\begin{aligned}\Delta L_{it}^{(l,s)} = {} & \mu_i^{(l,s)} + \lambda_t^{(l,s)} + \sum_k \delta_k^{(l,s)} cov\_k_{i,t-1} + \\ & + \phi_0^{(l,s)} \Delta L_{it}^{(s,l)} + \sum_k \phi_k^{(l,s)} \Delta L_{it}^{(s,l)} \times cov\_k_{i,t-1} + \\ & + \gamma_1^{(l,s)\prime} X_{1it}^{PO/MT} + \gamma_{0,fcf}^{(l,s)} fcf_{it} + \sum_k \gamma_{k,fcf}^{(l,s)} fcf_{it} \times cov\_k_{i,t-1} + \\ & + \pi^{(l,s)} \left[-\beta^{(l,s)\prime} X_{it-1}^{TO} \right] + \pi_0^{(l,s)} L_{it-1}^{(l,s)} + \sum_k \pi_k^{(l,s)} L_{it-1} \times cov\_k_{i,t-1} + \epsilon_{it}^{(l,s)}\end{aligned} \tag{2}$$

[4] We consider possible reduced form effects, due e.g. to the simultaneous issue of short-term and long-term debt (79% of observations). Short-term debt and long-term debt behave differently and they might be substitutable: this could be induced by the trade-off between long-term debt with a higher interest rate and short-term debt with lower interest rate but rollover uncertainty (Broner et al., 2013).

According to model in equation (2), we set a number of hypotheses.

H1. Capital structure behaviour Firms following dynamic TO behaviour should exhibit stronger error-correction dynamics than firms classified as MT or PO firms. In the ECM framework, this implies more negative SOA parameters for dynamic TO firms:

$$\pi^{TOd} < \pi^{MT}, \pi^{PO}.$$

Static TO firms are expected to display weaker adjustment than dynamic TO firms, since their financing behaviour is less responsive to short-run deviations from target leverage.

H1a. Covenant effects are heterogeneous across financial behaviour regimes The effect of covenants should be strongest among firms whose financing behaviour is consistent with TO adjustment, because active leverage rebalancing increases the relevance of creditor monitoring and contractual restrictions. Therefore, covenant interactions with dynamic TO behaviour should be particularly important for SOA:

$$\frac{\partial \pi}{\partial cov\_k} \quad \text{is stronger for TOd firms.}$$

For PO/MT firms, covenant effects are expected to operate less through target adjustment and more through free-cash-flow sensitivity and maturity substitution, since financing decisions are primarily shaped by internal funds and external financing frictions. These firms are expected to exhibit weaker covenant transmission.

H2. Covenants type and Speed of Adjustment TO firms adjust leverage toward a target ratio, but the speed may be slowed by adjustment costs, informational frictions, or managerial discretion. Capital covenants, cov_capH, which are monitored regularly and impose continuous restrictions on balance-sheet variables such as leverage or net worth, are expected to reduce these frictions and induce faster adjustment. A similar effect could be induced by incurrence (limitation) covenants, cov_limL, which restrict specific corporate actions—such as issuing new debt or paying dividends—but only when the firm undertakes those actions. These covenants are state-contingent and do not bind continuously.

$$\frac{\partial \pi}{\partial cov\_capH} < 0, \qquad \frac{\partial \pi}{\partial cov\_limL} < 0.$$

Performance covenants, cap_perfH, instead, impose continuous restrictions based on state-contingent earnings or cash-flow measures and increase the likelihood of lender intervention in response to adverse performance shocks. They are expected to weaken mechanical adjustment toward target leverage:

$$\frac{\partial \pi}{\partial cov\_perfH} > 0.$$

These effects can be especially true among TO firms (an effect more negative).

H2a. Limitation Covenants and Continuous Adjustment Incurrence covenants have weaker effects on continuous adjustment dynamics, implying:

$$\frac{\partial \pi}{\partial cov\_limL} < \frac{\partial \pi}{\partial cov\_capH}$$

H3. Covenant type and free-cash-flow sensitivity. Maintenance performance covenants increase dependence on internal funds, amplifying the sensitivity of debt issuance to free cash flow, particularly for PO firms:

$$\frac{\partial \gamma_{fcf}}{\partial cov\_perfH} < 0.$$

Limitation covenants are also expected to increase free-cash-flow sensitivity by restricting payouts, new borrowing and discretionary investment choices, although their effect may be weaker:

$$\frac{\partial \gamma_{fcf}}{\partial cov\_limL} \leq 0.$$

The effect of capital covenants is expected to be more ambiguous, since balance-sheet restrictions may either discipline leverage or become less binding when firms renegotiate debt structures.

H4. Covenant type and debt maturity substitution. Covenants should affect financial flexibility through the way firms substitute between short- and long-term debt. In the long-term debt equation, a negative coefficient on ΔSDA indicates substitution between short- and long-term debt. Performance and limitation covenants can alter the relative attractiveness of different debt maturities, either by restricting long-term borrowing , increasing rollover discipline, or forcing firms to rely heavily on short-term instruments under creditor supervision. Hence, they are expected to

reinforce maturity substitution:

$$\frac{\partial \phi}{\partial cov\_perfH} < 0, \qquad \frac{\partial \phi}{\partial cov\_limL} < 0.$$

Capital covenants may have a weaker or more crisis-dependent effect on ϕ, because balance-sheet restrictions can alter the relative cost of short- versus long-term borrowing without directly restricting maturity choice.

H5. Crisis exposure and covenant transmission. The global financial crisis and the post-crisis credit environment should alter the transmission of covenant design. Capital covenants are expected to become less effective after the crisis, reflecting renegotiation, covenant-lite structures, or weaker balance-sheet-based monitoring. Therefore, the post-crisis interaction of capital covenants is expected to attenuate their disciplining effect, meaning that:

$$\frac{\partial \pi}{\partial cov\_capH} \quad \text{and} \quad \frac{\partial \gamma_{fcf}}{\partial cov\_capH} \quad \text{and} \quad \frac{\partial \phi}{\partial cov\_capH}$$

should become less negative, or possibly positive, in the post-crisis period. Performance and limitation covenants are expected to preserve more stable disciplining effects across periods.

H6. Covenant composition and contractual redesign. Changes in covenant composition should capture contractual redesign rather than persistent monitoring intensity. An increase in the share of performance covenants is expected to increase free-cash-flow sensitivity and strengthen maturity discipline:

$$\frac{\partial \gamma_{fcf}}{\partial \Delta sharecov\_perfH} < 0, \qquad \frac{\partial \phi}{\partial \Delta sharecov\_perfH} < 0.$$

An increase in the share of capital covenants may have weaker or more ambiguous effects, particularly after the crisis, if capital-based restrictions become less central to creditor monitoring.

3.2 Why meta-analysis rather than pooled interactions?

If our aim is to understand how heterogeneous covenants influence heterogeneous corporate behaviours and test the hypotheses of Subsection 3.1, the pooled interaction-based dynamic panel model in equation (2) is affected by a series of

drawbacks. Estimating specification (2) requires GMM estimator to solve the endogeneity of the lagged dependent variable because of individual heterogeneity.[5] To allows for the possibility to estimate the effects of covenants under the case they are persistent and affected by almost only between variation as well as the effects of other individual characteristics, like size and industry, we need to implement the Correlated Random Effects GMM-level estimation (Bontempi and Ditzen, 2025).

However, in doing so, we must face a large number of interaction terms involving covenant types, covenant intensity, crisis periods, firm characteristics, and financial behaviour classes. Such a specification would quickly become highly parameterised and difficult to summarize and interpret, particularly because firms may simultaneously face more than one type of covenant.

Also, in equation (2), the covenant effects may become hard to distinguish from the underlying behavioural regime. If TO and PO firms respond differently even absent covenants, pooled interactions can mix up differences in baseline financial behaviour, and differences due to covenant design. Indeed, covenant structures do not merely constrain leverage levels; they shape the mechanisms through which firms adjust capital structure, manage internal funds, and coordinate debt maturity choices. These effects are heterogeneous across firms, financing regimes, and macro-financial environments.

Hence, we propose an alternative empirical strategy designed to disentangle heterogeneity in firms' financial behaviour from heterogeneity in contractual features and that proceeds in two steps.

1. We first estimate firm-level behavioural parameters from a fully heterogeneous version of dynamic model in equation (1). This gives us firm-specific speed of adjustment, free-cash-flow, and maturity-substitutability parameters and standard errors.

2. We then relate the firm-specific estimated parameters to covenant structures and redesign, firm characteristics, clusters of dominant financial behaviour and periods after the financial crisis using a meta-analytic framework. Here the hypotheses depicted above are valid in terms of individual, firm level, parameters π_i, γ_{fcfi} and ϕ_i obtained from Subsection 3.3

Steps 1 and 2 represent a clean way to separate behavioural type (TO, PO/MT), from contractual environment (capital/performance/limitation covenants). They

[5] The other variables are at least predetermined.

preserve firm-level heterogeneity, avoid over-parametrization, and provides a clearer and more tractable mapping between contractual features and financial behaviour. They allow us to analyse high-dimensional interactions between covenant types, firm characteristics, and financial behaviour while maintaining tractability and interpretability.

3.3 Step 1: Fully heterogeneous dynamic model.

We estimate firm-level behavioural parameters from the fully heterogeneous EqCM dynamic model for long- and short-term debt (l, s):

$$\begin{aligned}\Delta L_{it}^{dm(l,s)} = \mu_i^{(l,s)} + \nu_{1i}^{(l,s)} \Delta EPU_t + \nu_{2i}^{(l,s)} \Delta VIX_t + \\ + \phi_i^{(l,s)} \Delta L_{it}^{dm(s,l)} + \gamma_i^{(l,s)\prime} X_{it}^{dm(PO/MT)} + \\ + \pi_i^{(l,s)} \left[L_{it-1}^{dm(l,s)} - \beta_i^{(l,s)\prime} X_{it-1}^{dm(TO)} \right] + \varepsilon_{it}^{(l,s)}\end{aligned} \tag{3}$$

Although the strong unbalancedness of the panel prevents the reliable implementation of standard cross-sectional dependence tests, the first-stage heterogeneous ECM in equation (3) is designed to mitigate both long-run common factors and short-run macro-financial shocks possibly generating common dependence of firms.

First, the term $\lambda_t^{(l,s)}$ captures period-specific unobservable aggregate shocks affecting firms jointly that, if not accounted for, may generate weak-form cross-sectional dependence (Chudik et al., 2011). In estimating the fully heterogeneous model, we use cross-sectionally demeaned variables (upscript dm) as suggested by Moral-Benito (2013) and Alvarez and Arellano (2022), to remove persistent common components.

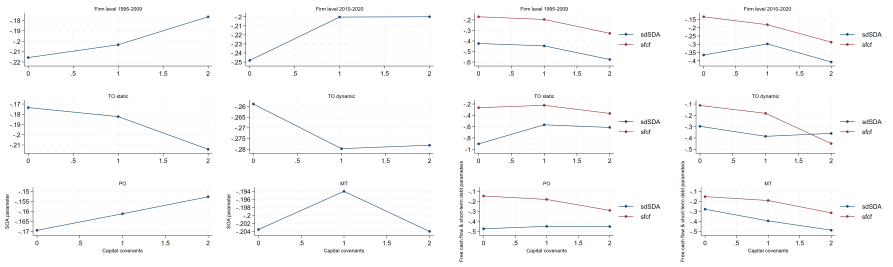
Second, to capture short-run aggregate financial and policy uncertainty, we allow firms to respond heterogeneously to changes in normalized financial uncertainty (VIX, Exchange, 2009) and economic policy uncertainty (EPU, Baker et al., 2016), through firm-specific loadings $\nu_{1i}^{(l,s)}$ and $\nu_{2i}^{(l,s)}$, respectively.

Overall, this structure mitigates both long-run and short-run sources of common dependence before the estimated firm-level ECM parameters are employed in the meta-regression analysis.

Firm-level model (3) were estimated for firms with at least 15 quarterly observations, to avoid estimates become unstable with short firm histories. To maintain coherence between the first-step behavioural estimation and second-step covenant

characterization, the heterogeneous ECM equations are estimated over the same period for which covenant information is available, 1995Q3-2020Q3. Although longer accounting histories could increase estimation precision, restricting the estimation window avoids attributing pre-covenant financial dynamics to subsequently observed contractual structures. We checked robustness of results to the use of the longer period 1975Q4-2020Q3 in the first stage.

The estimates revel a situation of complex heterogeneity as depicted in Figure 5, for example, in the case of capital covenants. The scatters evidence confirms substantial heterogeneity in the covenant–adjustment relation: capital covenants are associated with stronger error correction mainly among dynamic TO firms and in the post-crisis period, while the relation is weaker or non-linear for other behavioural regimes.



(a) *SOA* (b) *Parameters of fcf and dSDA*

Figure 5: Average parameters plotted over capital covenants

3.4 Step 2: Meta analysis.

The subsequent meta-regression excludes firms with degenerate or non-positive coefficient standard errors, as these indicate unstable first-stage estimation and would distort meta-analytic weighting.[6]

For each "study" of our N firms, and from equation (3), we obtain, among the others, the SOAs, $\hat{\pi}_i^{(l,s)}$, the $\hat{\phi}_i^{(l,s)}$ parameters measuring substitutability in debt maturity, and the $\hat{\gamma}_{fcfi}^{(l,s)}$ parameters of free cash flow, which are estimates of the unknown true effect $\pi^{(l,s)}$, $\phi^{(l,s)}$ and $\gamma_{fcf}^{(l,s)}$. We also have estimates, $\hat{\sigma}_{\pi_i}^{(l,s)}$, $\hat{\sigma}_{\phi_i}^{(l,s)}$

[6]Firms were not excluded on the basis of coefficient significance, since insignificant first-stage estimates constitute economically meaningful evidence of heterogeneous financial behaviour. The meta-regression framework is specifically designed to explain both the magnitude and the variation of firm-level adjustment parameters across firms.

and $\hat{\sigma}^{(l,s)}_{\gamma_{fcfi}}$ of their standard error, $i = 1, 2, \ldots, N$.

Hence, we check whether the between-unit heterogeneity can be explained by p unit-level covariates (moderators, Viechtbauer et al., 2015) with random effects accounting for potential additional variability (residual heterogeneity) unexplained by the included moderators.

For the case of long-term debt, we exploit multivariate RE meta-regression where we considers the vector $(1 \times d)$ $\hat{\boldsymbol{\theta}}_i^{(l)\prime} = \left(\hat{\pi}_i^{(l)}, \hat{\gamma}_{fcfi}^{(l)}, \hat{\phi}_i^{(l)}\right)'$ of the $d = 3$ estimates measuring SOA, free cash flow and substitutability in debt maturity, and we estimate:

$$\hat{\boldsymbol{\theta}}_i^{(l)} = \mathbf{X}_i^{(l)}\boldsymbol{\beta}^{(l)} + \mathbf{u}_i^{(l)} + \boldsymbol{\varepsilon}_i^{(l)}$$

where $\mathbf{u}_i^{(l)} + \boldsymbol{\varepsilon}_i^{(l)} \sim \mathcal{N}_d(\mathbf{0}, \boldsymbol{\Lambda}_i + \boldsymbol{\Sigma})$. The term $\boldsymbol{\Lambda}_i$ represents the within-unit covariance matrices, while the term $\boldsymbol{\Sigma}$ represents the between-unit covariance matrix to be estimated. The term $\mathbf{X}_i^{(l)} = \mathbf{x}_i^{(l)} \otimes I_d$ is a $(d \times dp)$ matrix with $\mathbf{x}_i^{(l)}$ the $(1 \times p)$ vector of moderators with the corresponding unknown $(1 \times p)$ parameters for each estimated slope $\boldsymbol{\beta}_{\pi}^{(l)\prime}$, $\boldsymbol{\beta}_{\gamma_{fcf}}^{(l)\prime}$, $\boldsymbol{\beta}_{\phi}^{(l)\prime}$. Thus, $\boldsymbol{\beta}^{(l)} = \left(\boldsymbol{\beta}_{\pi}^{(l)\prime}, \boldsymbol{\beta}_{\gamma_{fcf}}^{(l)\prime}, \boldsymbol{\beta}_{\phi}^{(l)\prime}\right)'$ is the $(dp \times 1)$ vector of unknown parameters of moderators. We assume within-unit covariances 0 and perform a sensitivity analysis to different magnitudes of correlations in our multivariate meta-analysis results. We let the between-unit covariances to be unstructured, meaning that all variances and covariances to be distinctly estimated. Further details on meta-results are in the Appendix, Section A.1.7.

We use covenants as main moderators to explicitly models the impact of different covenants. To check the robustness of our findings, we assess whether our results are driven by structural breaks and the unbalanced nature of the panel, in Table 6, to heterogeneity across financial behaviour regimes, in Table 7, to firm size heterogeneity, in Table 8, and to industry heterogeneity, in Table 9. This helps to investigate if estimates change across units, identify types of covenants that contribute to this variability and generalize findings across different clusters (tested by multilevel analysis).

Table 6 considers time variation and post-crisis effects, to account for potential structural changes in both covenant design and corporate financial behaviour. Also, a potential concern is that the unbalanced nature of the panel may influence the results. To address this issue, we partition firms into three groups based on their exposure to the post-crisis period. Specifically, we define as the benchmark the firms almost absent in the 2010Q1-2020Q4 period (with at most 7% of their temporal

Table 6: Multivariate meta-regression estimates - average role of covenants and crisis

	π_i		γ_{fcfi}		ϕ_i	
cov_capH	-0.035	-0.125**	-0.068	-0.252***	-0.052	-0.159
	(0.0268)	(0.0509)	(0.0523)	(0.0902)	(0.0689)	(0.1172)
Transition		0.149***		0.300***		0.117
		(0.0625)		(0.1164)		(0.1535)
2010q1-2020q3		0.084		0.274*		0.350*
		(0.0818)		(0.1551)		(0.2046)
cov_perfH	0.014	0.051**	-0.104**	-0.105**	-0.172***	-0.230***
	(0.0090)	(0.0244)	(0.0190)	(0.0495)	(0.0242)	(0.0593)
Transition		-0.047*		-0.000		0.043
		(0.0267)		(0.0541)		(0.0662)
2010q1-2020q3		-0.041		-0.022		0.074
		(0.0227)		(0.0561)		(0.0696)
cov_limL	0.002	-0.006	0.039	0.071	-0.106**	-0.096
	(0.0144)	(0.0289)	(0.0290)	(0.0531)	(0.0374)	(0.0666)
Transition		-0.007		-0.101		0.035
		(0.0351)		(0.0674)		(0.0862)
2010q1-2020q3		0.048		0.087		-0.075
		(0.0404)		(0.0797)		(0.1021)
constant	-0.203***	-0.204***	-0.274***	-0.280***	-0.542***	-0.560***
	(0.0155)	(0.0159)	(0.0316)	(0.0332)	(0.0406)	(0.0416)
Transition	0.048***	0.049***	0.017	0.019	-0.032	-0.019
	(0.0148)	(0.0151)	(0.0281)	(0.0302)	(0.0370)	(0.0381)
2010q1-2020q3	0.046***	0.043***	0.036	0.025	0.060*	0.061*
	(0.0134)	(0.0148)	(0.0255)	(0.0286)	(0.0338)	(0.0374)
# obs.	0.000	0.000*	0.001	0.001*	0.001	0.001
	(0.0003)	(0.0003)	(0.0005)	(0.0005)	(0.0007)	(0.0007)
I^2	86.06	84.40	98.42	98.23	97.60	97.29

Note: Covenants stock are centred on averages (0.91 for capital, 0.55 for performance, 0.97 for limitation). # obs. is the number of quarters used to estimate individual parameters. Coefficients represent differences relative to firms mainly in pre-crisis period (0-7% of their time series), manufacturing, very large ($\geq 5,000$), with MT behaviour. Transition period (7-51% of time series in 2010Q1-2020Q4); 2010Q1-2020Q4 (> 51% in 2010Q1-2020Q4). $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

observations), while we consider the differences with firms in the Transition period (with more than 7% and up to 51% of temporal observations in the 2010Q1-2020Q4 period), and firms mostly after the crisis, with more that 51% of their temporal observations in the 2010Q1-2020Q4 period). This classification allows us to assess whether our results are driven by firms that are primarily observed in specific sub-periods, for example the aftermath of the global financial crisis, during which both the use and the nature of covenants evolved significantly.

Table 6 uses the stock of covenants to capture persistent monitoring regime and structural covenant environment. It provides strong evidence that the role of covenant structures changes materially after the global financial crisis, particularly through their interaction with leverage adjustment dynamics. The benchmark corre-

sponds to large manufacturing MT firms with average covenant intensity and limited post-2010 exposure, so the transition and 2010–2020 coefficients capture deviations associated with firms increasingly operating in the post-crisis environment.

Performance covenants are associated with a reduced speed of adjustment, particularly in the pre-crisis period, while they tend to increase the effects of free cash flow and substitutability in debt maturity, reinforced by limitation covenants. After the crisis, capital covenants reduce the speed of adjustment, free cash flow and substitutability.

The most robust result concerns the ECM speed of adjustment. Capital covenants are associated with faster adjustment before the crisis (negative π_i), but this relationship reverses during the transition period, where the positive interaction indicates substantially weaker adjustment dynamics. Meanwhile, the positive post-crisis intercept shifts in the speed of adjustment equations suggest that leverage adjustment became generally slower after the crisis. In contrast, performance covenants display the opposite pattern: although their average effect is limited, the post-crisis interactions become negative, suggesting that performance-based monitoring increasingly strengthens adjustment after 2010. Limitation covenants show comparatively weaker and less systematic effects.

The crisis period also appears to alter the relationship between covenants and financing flexibility. Performance and limitation covenants maintain relatively stable disciplinary effects throughout the post-crisis period, continuing to preserve negative free-cash-flow sensitivity and debt maturity substitution dynamics. Capital covenants instead exhibit a structural break during the transition period, where their interaction effects become positive and partially reverse the pre-crisis disciplining role, particularly with respect to free-cash-flow sensitivity. This suggests that post-crisis creditor monitoring increasingly shifted away from capital-based restrictions toward performance-oriented contractual mechanisms.

Overall, the results suggest that the post-2008 environment was characterized not simply by weaker covenant protection, but by a reallocation in the type of monitoring embedded in debt contracts: capital-based restrictions became less effective in enforcing adjustment, while performance-based covenants gained importance as mechanisms of creditor discipline and financial control.

As robust checks, we add first-to-last covenant redesign which does not change the results. We also exploit initial and final levels to check for regime-dependence robustness which suggests that performance covenants matter both initially and finally for γ_{fcfi} and ϕ_i, while final capital covenants are negatively related to γ_{fcfi}.

We finally checked for changes in composition (flow effects or changes in creditor control structure) to capture reallocation between covenant types, especially after 2000 and post GFC (decline in capital covenants, rise in performance covenants). However, contractual redesign effects, covenant tightening/loosening, shifts in monitoring technology, creditor renegotiation dynamics, post-crisis covenant restructuring do not add anything respect to transition in the GFC.

By using covenant composition respect to limitation covenants, we confirm that more performance covenants are associated with higher γ_{fcfi} and ϕ_i, while more capital covenants contribute to reduce π_i in the transition and post-crisis periods. Capital covenants display a structural post-crisis change: their pre-2010 association with π_i and γ_{fcfi} is offset, and reversed, among firms mostly observed after 2010. By contrast, performance and limitation covenants exhibit more stable disciplinary roles, with no significant crisis interactions. The decline in residual heterogeneity, particularly for π_i, suggests that crisis exposure and covenant-period interactions explain an important share of cross-firm variation in financial behaviour.

We next examine whether the effects of covenant differ across financial behaviour regimes. Table 7 shows that the richer specification explains a meaningful share of previously unexplained heterogeneity and much of the remaining cross-firm variation is explained once covenant transmission is allowed to differ by crisis exposure, behaviour, size, and industry. The results of Table 7 confirm that covenant effects vary across behavioural regimes but remain consistent with the baseline findings. In particular, performance covenants tend to increase the speed of adjustment in TO regimes, while limitation covenants exhibit stronger effects in PO/MT specifications. Firm size heterogeneity is in Table 8. While the magnitude of the coefficients varies across size categories, the qualitative relationships between covenant types and financial behaviour remain consistent, suggesting that our findings are not confined to a particular segment of the firm size distribution. Industry heterogeneity is reported in Table 9. The estimates reveal some variation in the magnitude of the effects, reflecting differences in industry-specific financial structures. However, the overall patterns linking covenant types to financial behaviour persist across industries. The richer model confirms the central idea: covenant effects are highly heterogeneous and remain concentrated in specific financial behaviours like TO.

The constant terms of Table 7 indicate that, at the average of the covenants on capital (0.91), performance (0.55) and limitation (0.97), for the large (≥ 5,000 employees) MT manufacturing firms, with an average of 66 quarters (16 years)

Table 7: Multivariate meta-regression estimates - clusters of homogeneous financial behaviours

	π_i		γ_{fcfi}		ϕ_i	
TO static	0.002	0.007	-0.016	-0.027	-0.031	-0.030
	(0.0152)	(0.0152)	(0.0316)	(0.0330)	(0.04039)	(0.0419)
cov_capH		-0.207**		0.006		-0.046
		(0.1031)		(0.2120)		(0.2759)
cov_perfH		0.087***		-0.147*		0.013
		(0.0364)		(0.0821)		(0.1034)
cov_limL		0.015		0.018		0.116
		(0.1112)		(0.1086)		(0.1418)
TO dynamic	-0.055***	-0.058***	0.018	0.003	0.096***	0.089**
	(0.0142)	(0.0150)	(0.0252)	(0.0307)	(0.03587)	(0.0402)
cov_capH		-0.116		-0.345*		-0.273
		(0.1016)		(0.1873)		(0.2663)
cov_perfH		0.141***		0.000		0.043
		(0.0367)		(0.0723)		(0.0979)
cov_limL		-0.203***		0.036		0.070
		(0.0621)		(0.1142)		(0.1498)
PO	0.024***	0.025***	0.011	0.002	-0.018	-0.017
	(0.0087)	(0.0085)	(0.0177)	(0.0182)	(0.0236)	(0.0239)
cov_capH		-0.055		0.032		0.008
		(0.0623)		(0.1260)		(0.1699)
cov_perfH		0.035*		-0.042		0.039
		(0.0198)		(0.0444)		(0.0570)
cov_limL		-0.010		0.045		0.120
		(0.0342)		(0.0725)		(0.0958)
constant	-0.204***	-0.197***	-0.280***	-0.268***	-0.560***	-0.575***
	(0.0159)	(0.0159)	(0.0332)	(0.0337)	(0.04160)	(0.0428)
# obs.	0.000*	0.001*	0.001*	0.001	0.001	0.001
	(0.0003)	(0.0003)	(0.0005)	(0.0005)	(0.0007)	(0.0007)
I^2	84.40	79.63	98.23	96.58	97.29	93.35

Note: Covenants stock are centred on averages (0.91 for capital, 0.55 for performance, 0.97 for limitation). # obs. is the number of quarters used to estimate individual parameters. Coefficients represent differences relative to firms mainly in pre-crisis period, manufacturing, very large ($\geq 5,000$), with MT behaviour. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

almost absent over the period 2010q1-2020q3 (0% to 7% of their time series), the average of SOA_i is -0.197, the average free cash flow parameter is -0.268 and the average maturity substitutability is -0.575.

4 Main Results

Stylized fact 1: Financial behaviour is highly heterogeneous across firms and covenants shape this heterogeneity. A large share of the variation in estimated parameters is attributable to cross-firm differences. In particular, between-firm variation accounts for 78% of the total variance in the speed of adjustment (SOA),

Table 8: Multivariate meta-regression estimates - size

	π_i		γ_{fcfi}		ϕ_i	
1–49	-0.038	-0.014	0.053	0.083	0.179***	0.225**
	(0.0248)	(0.0416)	(0.0416)	(0.0784)	(0.0578)	(0.0994)
cov_capH		-0.034		-0.461		0.731*
		(0.1592)		(0.2881)		(0.4066)
cov_perfH		0.023		0.107		-0.132
		(0.0889)		(0.1610)		(0.2140)
cov_limL		-0.078		0.170		-0.341*
		(0.0817)		(0.1449)		(0.1958)
50–249	-0.025**	-0.032**	0.057**	0.097***	0.123***	0.091**
	(0.0126)	(0.0143)	(0.0243)	(0.0309)	(0.0320)	(0.0373)
cov_capH		0.044		-0.082		0.063
		(0.0874)		(0.1737)		(0.2292)
cov_perfH		-0.033		0.138*		-0.200**
		(0.0329)		(0.0716)		(0.0863)
cov_limL		-0.032		0.072		-0.053
		(0.0458)		(0.0913)		(0.1188)
250–999	0.012	0.006	0.053**	0.050**	0.100***	0.101***
	(0.0109)	(0.0110)	(0.0223)	(0.0232)	(0.0292)	(0.0303)
cov_capH		-0.122		-0.264		0.165
		(0.0787)		(0.1655)		(0.2138)
cov_perfH		0.010		0.036		-0.159**
		(0.0252)		(0.0547)		(0.0716)
cov_limL		-0.044		0.116		-0.106
		(0.0431)		(0.0919)		(0.1190)
1,000–2,499	0.010	0.004	0.016	0.014	0.013	0.028
	(0.0110)	(0.0112)	(0.0237)	(0.0240)	(0.0302)	(0.0314)
cov_capH		-0.138*		-0.285		-0.035
		(0.0802)		(0.1739)		(0.2232)
cov_perfH		0.014		0.026		-0.091
		(0.0244)		(0.0559)		(0.0704)
cov_limL		0.043		0.065		0.061
		(0.0425)		(0.0939)		(0.1213)
2,500–4,999	0.013	0.017	0.032	0.039	0.004	0.044
	(0.0124)	(0.0132)	(0.0271)	(0.0282)	(0.0337)	(0.0362)
cov_capH		-0.069		-0.056		-0.140
		(0.0978)		(0.2205)		(0.2679)
cov_perfH		-0.009		-0.070		-0.229***
		(0.0274)		(0.0604)		(0.0767)
cov_limL		0.019		0.220*		-0.020
		(0.0512)		(0.1142)		(0.1428)
I^2	84.40	79.63	98.23	96.58	97.29	93.35

Note: Covenants stock are centred on averages (0.91 for capital, 0.55 for performance, 0.97 for limitation). Coefficients represent differences relative to firms mainly in pre-crisis period, manufacturing, very large ($\geq 5,000$), with MT behaviour. For simplicity, we report the effects of covenants if significant in some case. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 9: Multivariate meta-regression estimates - industry

	π_i		γ_{fcfi}		ϕ_i	
1-NoDur	0.027	0.019	0.016	0.010	0.009	0.026
	(0.018)	(0.018)	(0.038)	(0.038)	(0.046)	(0.048)
cov_capH		-0.196		0.034		0.647**
		(0.123)		(0.258)		(0.318)
cov_limL		0.133**		0.160		-0.024
		(0.060)		(0.122)		(0.154)
2-Durbl	0.007	-0.010	0.054	0.055	0.077	0.068
	(0.022)	(0.023)	(0.047)	(0.048)	(0.058)	(0.060)
cov_capH		-0.551***		-0.175		-0.058
		(0.153)		(0.334)		(0.433)
4-Energy	-0.036**	-0.070***	0.105***	0.039	-0.145***	-0.138***
	(0.017)	(0.018)	(0.037)	(0.039)	(0.046)	(0.050)
cov_capH		0.157		0.697***		0.287
		(0.114)		(0.248)		(0.305)
cov_limL		0.125**		0.152		0.016
		(0.056)		(0.125)		(0.161)
5-Chem	-0.008	-0.029	-0.005	-0.004	-0.012	0.007
	(0.022)	(0.023)	(0.048)	(0.049)	(0.059)	(0.061)
6-BusEq	-0.007	-0.012	0.102***	0.099***	0.046	0.033
	(0.013)	(0.013)	(0.027)	(0.028)	(0.035)	(0.037)
cov_perfH		0.034		0.019		-0.162*
		(0.032)		(0.065)		(0.088)
7-Telcm	0.002	-0.008	0.178***	0.174***	-0.072	-0.044
	(0.019)	(0.020)	(0.041)	(0.042)	(0.053)	(0.056)
cov_capH		-0.299**		0.299		0.099
		(0.147)		(0.351)		(0.436)
cov_perfH		0.076*		0.020		-0.010
		(0.040)		(0.097)		(0.123)
9-Shops	-0.029*	-0.035**	0.104***	0.095***	0.101**	0.098**
	(0.016)	(0.016)	(0.034)	(0.034)	(0.042)	(0.044)
10-Hlth	-0.018	-0.024	0.061**	0.017	0.034	-0.008
	(0.014)	(0.015)	(0.029)	(0.034)	(0.039)	(0.043)
cov_capH		-0.216**		0.038		0.353
		(0.102)		(0.201)		(0.280)
cov_perfH		0.040		-0.119		-0.204**
		(0.034)		(0.076)		(0.096)
cov_limL		0.121**		0.075		-0.149
		(0.058)		(0.117)		(0.161)
12-Other	0.000	-0.009	0.050*	0.054*	-0.055	-0.048
	(0.013)	(0.013)	(0.027)	(0.028)	(0.034)	(0.036)
cov_capH		-0.169*		0.021		0.179
		(0.089)		(0.188)		(0.236)
cov_perfH		0.062**		-0.050		-0.076
		(0.029)		(0.063)		(0.081)
cov_limL		0.010		0.253**		0.017
		(0.049)		(0.108)		(0.1342)
I^2	84.40	79.63	98.23	96.58	97.29	93.35

Note: Covenants stock are centred on averages (0.91 for capital, 0.55 for performance, 0.97 for limitation). Coefficients represent differences relative to firms mainly in pre-crisis period, manufacturing, very large ($\geq 5,000$), with MT behaviour. To improve readability, we report the effects of covenants if significant in some case. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Fama and French (2002) industries: 1-NoDur: Consumer Nondurables (Food, Tobacco, Textiles, Apparel, Leather, Toys); 2-Durbl: Consumer Durables (Cars, TVs, Furniture, Household Appliances); 3-Manuf: Manufacturing (Machinery, Trucks, Planes, Off Furn, Paper, Com Printing); 4-Energy: Oil, Gas, and Coal Extraction and Products; 5-Chems: Chemicals and Allied Products; 6-BusEq: Business Equipment (Computers, Software, and Electronic Equipment); 7-Telcm: Telephone and Television Transmission; 9-Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops); 10-Hlth: Healthcare, Medical Equipment, and Drugs; 12-Other: Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment.

and more than 95% for both free cash flow sensitivity and debt maturity substitutability. This finding confirms the presence of strong and persistent heterogeneity in financial behaviour, motivating our firm-level estimation approach.

Stylized fact 2: Covenant effects differ according to financial behaviour parameters. We find that different covenant types are associated with markedly different financial policies. Performance and limitation covenants are linked to financial flexibility (stronger sensitivity to free cash flow, and tighter interactions between debt maturities). In contrast, capital covenants are linked to speed of adjustment.

Stylized fact 3: Financial conditions shape the role of covenants. The effects of covenants vary across time, particularly around the global financial crisis. Shifts in credit market conditions and contractual enforcement reverse the effect of capital covenants (reduces speed of adjustment and financial flexibility). Performance covenants confirm their effects, while limitation covenants appear the more neutral.

Stylized fact 4: The effects of covenants is related with firms' underlying financial behaviour. The impact of covenants varies significantly across financial regimes. They are particularly concentrated in TO firms, with performance covenants reducing the speed of adjustment. In PO firms, performance covenants are associated with slower adjustment and a stronger role of internal funds. These findings indicate that covenant design interacts with firms' underlying financing behaviour rather than exerting uniform effects.

Stylized fact 5: Covenant effects are heterogeneous across firm characteristics and industries. We document substantial variation in covenant effects across firm size and industries. In particular, limitation covenants play a prominent but heterogeneous role across sectors, reflecting differences in financial structures and constraints. While they tend to strengthen maturity interactions and amplify cash flow sensitivity in some industries, they reduce adjustment dynamics in others. This heterogeneity underscores the importance of considering both firm characteristics and industry context when assessing the role of covenants.

Overall, these findings indicate that covenant design is a key determinant of heterogeneity in corporate financial behaviour and that its effects depend critically on firm characteristics, financial regimes, and macroeconomic conditions.

5 Conclusion

This paper studies how different covenant structures are associated with heterogeneous corporate financial behaviour. We construct a novel dataset that combines Compustat information with covenant data extracted from SEC filings through automated Python-based text analysis and classify covenants into maintenance capital covenants, maintenance performance covenants, and covenant-lite incurrence covenants. We further classify firms according to their dominant financing behaviour and estimate heterogeneous firm-level dynamic models that capture leverage adjustment, financial flexibility, and debt-maturity management.

Our main finding is that covenant types are associated with systematically different financial policies. Performance and limitation covenants are linked to greater financial flexibility, reflected in stronger sensitivity to free cash flow and tighter interactions between short- and long-term debt. In contrast, capital covenants are associated with faster leverage adjustment. These patterns suggest that covenant design affects not only creditor protection but also the dynamic mechanisms through which firms manage capital structure.

More broadly, our results contribute to the debate on the rise of covenant-lite lending (Becker and Ivashina, 2016; Bräuning et al., 2025). The expansion of covenant-lite structures is often interpreted as evidence of weaker creditor discipline resulting from the growing role of non-bank lenders and the development of originate-to-distribute lending models. Our findings suggest a more nuanced interpretation. Covenant-lite contracts may not simply weaken monitoring; rather, they appear to be associated with financing regimes that place greater emphasis on financial flexibility. Consequently, understanding covenant heterogeneity is essential for evaluating the implications of recent changes in credit markets.

Methodologically, we show that a combination of firm-level dynamic estimation and meta-analytic techniques provides a tractable way to analyse high-dimensional heterogeneity in corporate finance. Rather than imposing restrictive interaction structures, this approach allows behavioural parameters to vary across firms and relates this variation to covenant characteristics, firm attributes, and institutional changes. The evidence indicates that covenant heterogeneity represents an important source of variation in corporate financial behaviour and should be incorporated more explicitly into empirical studies of capital structure.

5.1 Discussion and future research

Our analysis documents systematic relationships between covenant design and corporate financial behaviour, but it does not fully identify causal covenant effects. Covenant types are not randomly assigned, and firms may select into different contractual arrangements based on unobserved characteristics and financing needs. Although we mitigate simultaneity by using lagged covenant measures, controlling for firm characteristics, industry affiliation, and major institutional changes such as BAPCPA and the global financial crisis, some endogeneity concerns inevitably remain.

A second limitation concerns the timing of behavioural classification. Firms are classified using their long-run financing behaviour, implying that classification may itself be influenced by covenant exposure during the sample period. Consequently, behavioural classes should be interpreted as summaries of persistent financing regimes rather than purely exogenous firm traits. Future research could evaluate the stability of these classifications by comparing estimates obtained using only pre-covenant or early-period information.

A third limitation concerns the precision of firm-level parameter estimates. Dynamic models estimated separately for each firm may generate noisy coefficients, particularly for firms with shorter time series or unstable leverage dynamics. The meta-analytic framework is designed precisely to summarize and interpret this heterogeneity, but future work could explore alternative hierarchical or Bayesian approaches that jointly estimate firm-level behaviour and covenant effects.

More generally, future research could investigate the determinants of covenant choice, the evolution of covenant structures over the life cycle of firms, and the interaction between covenant design, creditor composition, and macro-financial conditions. These questions would further improve our understanding of how debt contracts shape corporate financial behaviour.

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A.1 Appendix

A.1.1 Details on SEC forms

The inclusion of covenants in debt agreements can vary depending on several factors, including the size of the company, the type of debt instrument, and the specific terms negotiated between the borrower and the lender. While many publicly traded companies disclose debt covenants in their SEC filings, not all companies, especially private ones, have their covenants listed with the SEC. The extent of disclosure depends on the company's reporting requirements and the materiality of the covenants. For a thorough understanding of a specific company's debt covenants, reviewing their SEC filings (such as 10-Ks and 10-Qs) is essential.

- 10-K Annual report – Provides audited annual financial statements, a discussion of material risk factors for the company and its business, and a management's discussion and analysis of the company's results of operations for the prior fiscal year. Filings with "/A" appended to the form type code indicate an amendment. For example, the form type "10-K/A" would indicate an amendment to a Form 10-K filing. Form shall be filed within the following period: (a) 60 days after the end of the fiscal year covered by the report (75 days for fiscal years ending before December 15, 2006) for large accelerated filers (as defined in 17 CFR 240.12b `https://www.law.cornell.edu/cfr/text/17/240.12b-2`) Example: date report 1997 12 31 and date filed 1998 4 15

- 10-Q Quarterly report – Provides unaudited quarterly financial statements, updates regarding material risks that the company faces, and management's discussion and analysis of the company's results of operations for the prior fiscal quarter.

- 10-K405 was a form used by the Securities and Exchange Commission (SEC) prior to 2003. SEC Form 10-K405 was used to indicate that an officer or director of a company failed to file Form 4, or similar insider trading disclosure forms, on time. Failure to file these forms means that the officers of the company did not disclose their insider trading activities within the required time frame. SEC Form 4: Statement of Changes in Beneficial Ownership is a document that must be filed with the Securities and Exchange Commission (SEC) whenever there is a material change in the holdings of

company insiders. Insiders consist of directors and officers of the company, as well as any shareholders, owning 10% or more of the company's outstanding stock. The forms ask about the reporting person's relationship to the company and about purchases and sales of such equity shares.

- 10-KSB, 10-QSB were a special reporting form for small businesses prior to 2009. It was phased out by the SEC in order to streamline the disclosure requirements of small businesses and their investors. Since 2009, there are no special small business forms and smaller reporting companies use the standard forms used by other companies, such as the Form 10-K.

- 8-K Current report – Discloses material events or information that the company chooses or is required to make public prior to its next scheduled quarterly or annual report. Form 8-K provides investors with current information to enable them to make informed decisions. Companies typically provide a number of 8-Ks throughout the year, whenever significant corporate events take place that trigger a disclosure. Companies must file 8-Ks promptly, rather than waiting until their next periodic report, such as the quarterly report (on Form 10-Q) or annual report (on Form 10-K). Companies are required to make most 8-K disclosures within four business days of the triggering event and in some cases even earlier. The public can find 8-Ks on the SEC's EDGAR website.

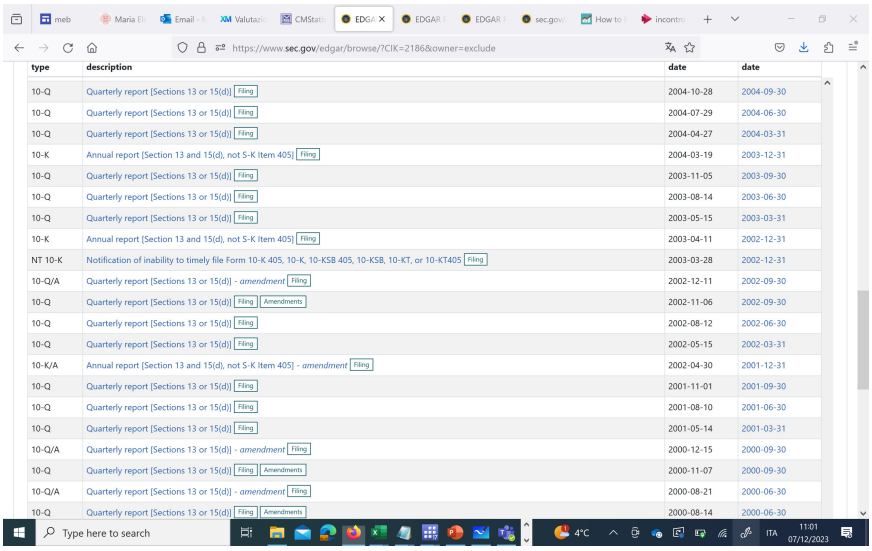
A.1.2 Examples of SEC forms

Figure A.1 reports an example for company CIK code 2186 BK Technologies Corp (Radio & Tv Broadcasting & Communications Equipment). This firm has former names: BK Technologies, Inc. - filings through 2019-03-28; RELM WIRELESS CORP - filings through 2018-06-04; ADAGE INC - filings through 1997-12-03, see `https://www.sec.gov/edgar/browse/?CIK=2186&owner=exclude`.

In 2007q1, 2007q2, 2007q3 we find covenants on net worth. In 2007q4 we find covenants on ebit. In 2007q1 we find violations on net worth, and a consequence in term of increased interest rate, no violations in the subsequent quarters. The text downloaded from SEC 10 Q datereport 2007 03 31 (datefiled 2007 05 08) reports

> ... We have a revolving credit facility ("Facility") for up to $3.5 million. The Facility is secured by substantially all of our assets, principally trade

Figure A.1: Screenshot from SEC CIK code 2186



receivables and inventory. The facility contains customary financial and restrictive covenants with which we must comply. . . . .

. . . .As of March 31, 2007, we were not in compliance with the covenant stipulating that we will maintain a cumulative net profit at the end of each quarter for 2007. . . . Compliance with this covenant was waived by the lender for the quarter ended March 31, 2007. We have no borrowings outstanding under the revolving line of credit as of March 31, 2007. . . .

. . . We may be subject to the risk of fluctuating interest rates in the ordinary course of business for borrowings under our revolving credit facility, which bear interest at a variable rate. The lender presently charges interest at prime plus 0.5%....

In 10 Q datereport 2007 06 30 (datefiled 2007 08 08):

. . . .In May 2007, the Company and Silicon Valley Bank amended the Company's secured revolving credit facility with borrowing availability of up to $3.5 million. The parties replaced the credit facility's net profit covenant that required the Company to maintain a cumulative net profit at the end of each quarter for 2007, with a tangible net worth covenant, among other amendments. The tangible net worth covenant requires that the Company maintain for each of the last three quarters of 2007 a "tangible net worth" (as defined in the credit agreement, as amended, for the credit facility) of at least

$28 million, increasing by (a) 50% of quarterly profits and (b) 75% of the amount received in respect of issuances of equity and the principal amount of the issuance of "subordinated debt" (as defined in the credit agreement, as amended, for the credit facility), in each case received after April 1, 2007. Reference is made to the Company's Current Report on Form 8-K dated May 23, 2007, as filed with the Securities and Exchange Commission on May 29, 2007, for the text of the amendment to the credit agreement for the credit facility. . . ..

. . . The Facility contains customary financial and restrictive covenants with which we must comply. As of June 30, 2007, we were in compliance with all such covenants. We have no borrowings outstanding under the revolving line of credit as of June 30, 2007. . . ..

In 10 Q datereport 2007 09 30 (datefiled 2007 11 13):

. . . In September 2007, prior to declaration of the foregoing cash dividend, the Company and Silicon Valley Bank amended the Company's secured revolving credit facility with borrowing availability of up to $3,500 to permit the payment of the cash dividend and reduce the amount of the "tangible net worth" covenant to $25,000 from $28,000. Reference is made to the Company's Current Report on Form 8-K dated September 28, 2007, as filed with the Securities and Exchange Commission on October 1, 2007, for the text of the amendment to the credit agreement for the credit facility. . . .

. . . .We have a revolving credit facility ("Facility") for up to $3.5 million. The Facility is secured by substantially all of our assets, principally trade receivables and inventory. The Facility contains customary financial and restrictive covenants with which we must comply. As of September 30, 2007, we were in compliance with all such covenants. We have no borrowings outstanding under the Facility as of September 30, 2007. The Facility expires on January 1, 2008. We expect to either renew or replace the Facility prior to its expiration. . . .

In 10 K datereport 2007 12 31 (datefiled 2008 03 05):

. . . In December 2007, we established a secured revolving credit facility with RBC Centura Bank (RBC) to replace a secured revolving credit facility with Silicon Valley Bank (SVB), which was due to expire on January 1, 2008. The RBC facility provides borrowing availability of up to $10 million. The secured revolving credit facility with SVB had borrowing availability of up to $3.5 million. There were no borrowings outstanding under the SVB facility on the date of termination, nor were there any borrowings under

the RBC facility as of December 31, 2007. The RBC facility is available on a revolving basis during the period commencing on December 6, 2007 and ending on December 5, 2009. Under the loan agreement for the RBC facility, advances are generally subject to customary borrowing conditions, including the accuracy of representations and warranties, compliance with financial maintenance and restrictive covenants and the absence of events of default. For instance, we are required to maintain: (x) a ratio of "Funded Debt to EBITDA" (as defined in the loan agreement), calculated on a rolling 4 quarters basis, of not greater than 2.5:1.0 and (y) "Tangible Net Worth" (as defined in the loan agreement) of at least $22,000,000. . . .

. . . As of December 31, 2007, we were in compliance with all covenants under these loan agreements with RBC. . . .

In 10 Q datereport 2008 09 30 (datefiled 2008 11 06):

. . . Under the terms and conditions of the Loan and Security Agreement, advances are generally subject to customary borrowing conditions, including the accuracy of representations and warranties, compliance with financial maintenance and restrictive covenants and the absence of events of default. For instance, the Company is required to maintain at all times, tested on the last day of each month: (1) a ratio of "quick assets to current liabilities" minus "deferred revenue" (all as defined in the Loan and Security Agreement) of at least 1.75 : 1.00 and (2) "tangible net worth" (as defined in the Loan and Security Agreement) of at least $24 million increasing by (i) 50% of quarterly net profits and (ii) 75% of net proceeds derived from issuances of equity and issuances of subordinated debt. Violation of this covenant is not an event of default when no borrowings are outstanding. Furthermore, the Company is prohibited from paying cash dividends on its common stock. . . .

. . . .The Company was in compliance with all covenants under the Loan and Security Agreement as of the date of this report. As of October 23, 2008, . . .

Going on with the searches, in 2011q1-2011q4 we found covenants on net worth and dividends, and in 2011q2-2011q4 consequences for interest rate and cessation/repayment of debt in case of violations, included in two amendments of the covenant's contract.

A.1.3 First step of Python script for SEC

The first step of our textual analysis exploits a list of terms apt to identify the presence of financial covenants. This first step contributed to define the binary variable $cov = 1$ (we also checked the coherence between $cov = 1$ and $viol = 1$), according to the list of keywords reported in Table A.1.

Table A.1: Definitions of covenants & violations – Python procedure I step

Keywords	
COV = {	VIOL = {
'Company is subject to a number of covenants',	'Our failure to meet these covenants',
'the performance or observance of any of the covenants',	'violation of the covenants',
'Our failure to meet these covenants',	'Our failure to comply with these covenants',
'violation of the covenants',	'in violation of covenant',
'covenants contained in certain of our loan agreements',	'in violation of a covenant',
'in compliance with all of the covenants',	'in default of a covenant',
'restrictions',	'in default of covenant',
'Our failure to comply with these covenants',	'in technical violation of covenant',
'in the event of a covenant violation',	'in technical violation of a covenant',
'would have been in violation',	'in violation of financial covenant',
'whether or not in compliance',	'in violation of a financial covenant',
'in violation of covenant',	'in default of financial covenant',
'in violation of a covenant',	'in default of a financial covenant',
'in default of a covenant',	'in technical violation of financial covenant',
'in default of covenant',	'in technical violation of a financial covenant',
'in technical violation of covenant',	'in technical default of financial covenant',
'in technical violation of a covenant',	'in technical default of a financial covenant',
'in violation of financial covenant',	'in technical default of covenant',
'in violation of a financial covenant',	'in technical default of a covenant',
'in default of financial covenant',	'not in compliance',
'in default of a financial covenant',	'out of compliance',
'in technical violation of financial covenant',	'received waiver',
'in technical violation of a financial covenant',	'received a waiver',
'in technical default of financial covenant',	'obtained waiver',
'in technical default of a financial covenant',	'obtained a waiver',
'not in compliance',	'granted waiver',
'out of compliance',	'granted a waiver',
'received waiver',	'did not meet',
'received a waiver',	'unable to maintain',
'obtained waiver',	'were in compliance with all, except',
'obtained a waiver',	'were in compliance with all covenants, except',
'covenant',	'were in compliance with all but',
'covenants',	'were in compliance with all covenants but',
'violation'	'failed to meet'
}	}

A.1.4 Accounting variables

To maintain comparability with the literature, we excluded: firms classified as 8-Utils: Utilities and 11-Money: Finance (Fama and French, 2002 classification); companies involved in major mergers (Compustat footnote code AB); firms-quarter observations with missing data on total assets and total financial debt, total financial debt negative or higher than total assets, gross tangible and intangible capital stocks higher than total assets. Table A.2 reports the definition of variables used in the model.

A.1.5 Sample composition

Table A.3 compares the full sample for which balance sheets data are available (it covers the 1975Q4-2020Q3 period and was used to generate the multilevel index) with the two subsamples for which we did not and did search covenants on SEC filings, "Non-Python sample" and "Python-sample", respectively. The last columns under "Covenants sample" report the subsample on which we implemented our investigation of the link between heterogeneous covenants and heterogeneous financial margins over the 1995Q3-2020Q3 period. The subsamples are representative of firms' characteristics in terms of both size and industry.[7]

A.1.6 Further details on covenants and financial behaviour.

The landscape of covenants is quite heterogeneous. Covenant composition varies systematically with firm size, as shown in Table A.4. Relative to very large firms (≥ 5000 employees), smaller firms rely significantly more on capital and limitation covenants and substantially less on performance covenants. The differences are strongest among firms with fewer than 250 employees and decline monotonically with size, suggesting that larger firms adopt relatively more performance-based monitoring structures, whereas smaller firms depend more heavily on balance-sheet and contractual restrictions.

Relative to manufacturing firms, covenant composition varies substantially across industries (Table A.5). The most pronounced differences arise in the Business

[7] The companies searched on SEC are slightly larger and more frequent in the Health industry, because of SEC requirements. Characteristics that are positively (negatively) correlated with the presence of covenants, and thus over- (under-) represented in the working sample, are controlled for in all estimated models.

Table A.2: Variable definitions

Variable	Definition
Debt variables	
SDA_{it}	$\frac{DLC_{it}}{AT_{it}}$. Bank debt represents on average about 40% of DLC.
LDA_{it}	$\frac{DLTT_{it}}{AT_{it}}$. Bonds, proxied by $DD + DN$, represent on average about 71% of $DLTT$.
Financial flexibility variables	
fcf_{it}	$\frac{ICF_{it} - INV_{it} - DV_{it}}{AT_{it}}$
$DWC1_{it}$	$\Delta\left(\frac{NWC}{AT}\right)_{it}$
rd_ta_{it}	$\frac{XRD_{it}}{AT_{it}}$
rd_dum_{it}	Indicator equal to one if rd_ta_{it} is missing
$mbRLDA_{it}$	$\left(\frac{PRCC_{it}CSHO_{it} + DLC_{it} + DLTT_{it}}{AT_{it}}\right) RLC_{it}$
$mbRSDA_{it}$	$\left(\frac{PRCC_{it}CSHO_{it} + DLC_{it} + DLTT_{it}}{AT_{it}}\right) RSC_{it}$
Target adjustment variables	
$DIVA_{it}$	$\frac{DV_{it}}{AT_{it}}$
$rcostd1_{it}$	$\frac{DVC_{it}}{PRCC_{i,t-1}CSHO_{i,t-1}} - \frac{XINT_{it}}{FD_{i,t-1}}(1 - TaxRate_t)$
$ndts_{it}$	$\frac{DP_{it}}{AT_{it}}$
$ndts\_lGAIN_{it}$	$ndts_{it} \times GAIN_{it-1}$, where $GAIN$ is positive $ebit\_ta$
$Tang_{it}$	$\frac{PPENT_{it}}{AT_{it}}$
$ebit\_ta_{it}$	$\frac{IB_{it} + XINT_{it} + TXT_{it}}{AT_{it}}$
$Intan_{it}$	$\frac{INTAN_{it}}{AT_{it}}$

Variable definitions. ICF is operating cash flow; INV is net investment in fixed assets; NWC is net working capital; RLC is a long-term S&P issuer-credit-rating index ranging from 0 (unrated) to 1 (AAA); RSC is a short-term S&P issuer-credit-rating index ranging from 0 (unrated) to 1 (A-1+); $lGAIN$ equals one if $ebit\_ta_{i,t-1} > 0$, and zero otherwise. $TaxRate$ is the statutory corporate tax rate.

Compustat item definitions. AT = total assets; DLC = debt in current liabilities (note payable, NP, comprising items like bank acceptances, bank overdrafts, bank and savings and loans' short-term borrowing, line(s) of credit, note payable to banks and others) and debt due within one year ($DD1$). $DLTT$ = interest-bearing obligations due after the current year. It comprises senior and subordinated debt-convertible ($DCVT$) + debt-subordinated (DS) + debt-notes, all notes and debentures/bonds when presented together (DN) + debt-debentures, all long-term debentures or bonds which are neither convertible nor subordinated, mortgage bonds (DD) + long-term debt-other ($DLTO$) + debt-capitalized lease obligations ($DCLO$). DV = cash dividends; DVC = common dividends; XRD = research and development expense; $PRCC$ = fiscal-year-end common share price; $CSHO$ = common shares outstanding; FD = DLC + $DLTT$ = total debt financing; $XINT$ = interest and related expense; IB = income before extraordinary items; TXT = income taxes; DP = depreciation and amortization expense; $PPENT$ = net property, plant, and equipment; $INTAN$ = intangible assets.

Construction details. ICF is constructed from IBC, $XIDOC$, DPC, $ESUBC$, $SPPIV$, $FOPO$, $EXRE$, $TXDC$, and $FSRCO$. INV is constructed from $CAPX$, AQC, $IVCH$, $SPPE$, SIV, $FUSEO$, $IVSTCH$, and $IVACO$. NWC is constructed from $WCAPC$, $CHECH$, $DLCCH$, $RECCH$, $INVCH$, $APALCH$, $TXACH$, $AOLOCH$, and $FIAO$. All cash-flow items are defined according to Compustat cash-flow format code SCF. Accounting variables are in thousands of USD.

Table A.3: Comparison of samples by size, employment, and industry

	Starting sample		Non-Python sample		Python sample		Covenants sample	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Panel A. Firm size distribution								
1–49 employees	32,349	7.40	23,624	8.81	8,725	5.17	8,645	5.13
50–249 employees	80,393	18.40	49,772	18.56	30,621	18.14	30,551	18.14
250–999 employees	89,066	20.38	54,853	20.46	34,213	20.27	34,113	20.26
1,000–2,499 employees	67,503	15.45	39,618	14.77	27,885	16.52	27,859	16.54
2,500–5,000 employees	47,368	10.84	28,647	10.68	18,721	11.09	18,695	11.10
≥5,000 employees	120,302	27.53	71,647	26.72	48,655	28.82	48,544	28.83
Total	436,981	100.00	268,161	100.00	168,820	100.00	168,407	100.00
Panel B. Employment distribution								
Mean		9,469.61		9,276.85		9,772.00		9,742.50
Median		1,036		900		1,300		1,300
Std. dev.		34,198.67		34,205.43		34,185.97		34,101.74
Panel C. Fama–French 12-industry distribution								
Unclassified	167	0.04	167	0.06	0	0.00	0	0.00
1-NoDur	25,826	5.91	16,864	6.29	8,962	5.31	8,895	5.28
2-Durbl	13,699	3.13	8,709	3.25	4,990	2.96	4,981	2.96
3-Manuf	61,073	13.98	39,295	14.65	21,778	12.90	21,756	12.92
4-Energy	34,375	7.87	21,909	8.17	12,466	7.38	12,441	7.39
5-Chems	13,472	3.08	8,151	3.04	5,321	3.15	5,314	3.16
6-BusEq	85,816	19.64	51,669	19.27	34,147	20.23	34,098	20.25
7-Telcm	20,063	4.59	12,789	4.77	7,274	4.31	7,265	4.31
9-Shops	35,085	8.03	21,378	7.97	13,707	8.12	13,704	8.14
10-Hlth	64,550	14.77	34,995	13.05	29,555	17.51	29,467	17.50
12-Other	82,855	18.96	52,235	19.48	30,620	18.14	30,486	18.10
Total	436,981	100.00	268,161	100.00	168,820	100.00	168,407	100.00

Notes: The table compares the starting Compustat sample and the two subsamples of companies not searched on SEC and searched on SEC (period 1975Q4-2020Q3), and the covenants sample containing both Compustat and SEC data ((period 1995Q3-2020Q3). Percentages are column percentages. Panel A reports the distribution by average employee-size class. Panel B reports summary statistics for the number of employment. Panel C reports the Fama and French (2002) 12-industry distribution. 1-NoDur: Consumer Nondurables (Food, Tobacco, Textiles, Apparel, Leather, Toys); 2-Durbl: Consumer Durables (Cars, TVs, Furniture, Household Appliances); 3-Manuf: Manufacturing (Machinery, Trucks, Planes, Off Furn, Paper, Com Printing); 4-Energy: Oil, Gas, and Coal Extraction and Products; 5-Chems: Chemicals and Allied Products; 6-BusEq: Business Equipment (Computers, Software, and Electronic Equipment); 7-Telcm: Telephone and Television Transmission; 9-Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops); 10-Hlth: Healthcare, Medical Equipment, and Drugs; 12-Other: Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment.

Table A.4: Covenant Composition by Firm Size (number of employees)

	Capital	Performance	Limitation
1–49	0.101^{***}	-0.175^{***}	0.073^{***}
50–249	0.094^{***}	-0.132^{***}	0.038^{***}
250–999	0.058^{***}	-0.069^{***}	0.011^{**}
1,000–2,499	0.027^{***}	-0.016^{**}	-0.011^{**}
2,500–5,000	0.001	0.014	-0.015^{***}
Benchmark	Very large firms (≥ 5,000 employees)		
Observations	147,079		
Clusters (gvkey)	3,729		

Notes: Cluster standard errors at the firm level. Coefficients represent differences relative to very large firms. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Equipment and Healthcare sectors. Firms in these industries employ significantly higher shares of capital covenants and significantly lower shares of performance covenants. Healthcare firms also exhibit a substantially greater reliance on limitation covenants. In contrast, Energy and Telecommunications firms allocate a smaller proportion of covenants to capital-based restrictions, while Telecommunications firms rely somewhat more heavily on performance covenants. Retail firms (Shops) and firms classified as Other industries exhibit significantly lower shares of limitation covenants relative to manufacturing firms. Overall, the results indicate that covenant structures are tailored to industry-specific characteristics, including asset composition, growth opportunities, and monitoring requirements, rather than reflecting a uniform contractual design across sectors. The particularly high use of capital covenants and low use of performance covenants among Business Equipment and Healthcare firms is consistent with the prevalence of intangible assets and growth opportunities in these sectors, which may reduce the usefulness of accounting-performance-based restrictions and increase reliance on alternative contractual protections

The evidence based on the number of covenants, in Table A.6, largely complements the composition results reported in Table A.5. Business Equipment and Healthcare firms employ substantially fewer performance covenants than manufacturing firms, while also using fewer limitation covenants. In contrast, Energy and Telecommunications firms tend to employ a greater number of covenants across all categories, including capital, performance, and limitation covenants. These findings suggest that the lower shares of capital covenants observed for some industries

Table A.5: Covenant Composition by Industry

	Capital	Performance	Limitation
1-NoDur	0.011	-0.023^{*}	0.012
2-Durbl	-0.001	0.004	-0.003
4-Energy	-0.019^{**}	0.009	0.010
5-Chems	0.004	-0.005	0.001
6-BusEq	0.061^{***}	-0.073^{***}	0.012^{*}
7-Telcm	-0.020^{**}	0.026^{*}	-0.006
9-Shops	0.013	0.008	-0.021^{***}
10-Hlth	0.084^{***}	-0.121^{***}	0.037^{***}
12-Other	0.013^{**}	0.010	-0.024^{***}
Benchmark	3-Manuf: Manufacturing firms		
Observations	147,079		
Clusters (gvkey)	3,729		

Notes: Cluster standard errors at the firm level. Coefficients represent differences relative to manufacturing firms. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Industries as in Fama and French (2002): 1-NoDur: Consumer Nondurables (Food, Tobacco, Textiles, Apparel, Leather, Toys); 2-Durbl: Consumer Durables (Cars, TVs, Furniture, Household Appliances); 3-Manuf: Manufacturing (Machinery, Trucks, Planes, Off Furn, Paper, Com Printing); 4-Energy: Oil, Gas, and Coal Extraction and Products; 5-Chems: Chemicals and Allied Products; 6-BusEq: Business Equipment (Computers, Software, and Electronic Equipment); 7-Telcm: Telephone and Television Transmission; 9-Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops); 10-Hlth: Healthcare, Medical Equipment, and Drugs; 12-Other: Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment.

do not necessarily reflect fewer capital covenants in absolute terms; rather, they may result from a larger overall covenant package. Overall, the results indicate that industry differences arise both from the total intensity of covenant usage and from the relative allocation of covenant types within loan contracts.

Table A.6: Number of Covenants by Industry

	Capital Covenants	Performance Covenants	Limitation Covenants
1-NoDur	0.003	-0.065	0.010
2-Durbl	0.010	0.034	0.021
4-Energy	0.075***	0.093*	0.166***
5-Chems	0.039*	0.013	0.014
6-BusEq	-0.002	-0.250***	-0.067***
7-Telcm	0.061***	0.114**	0.071**
9-Shops	0.022	0.020	-0.037
10-Hlth	-0.002	-0.393***	-0.074***
12-Other	0.024*	0.028	-0.057***
Benchmark		Manufacturing firms	
Observations		168,407	
Clusters (gvkey)		3,753	

Notes: Cluster standard errors at the firm level. Coefficients represent differences relative to manufacturing firms. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.The larger number of observations is due to zeros in the stock of covenants (missing in the shares). Industries as in Fama and French (2002): 1-NoDur: Consumer Nondurables (Food, Tobacco, Textiles, Apparel, Leather, Toys); 2-Durbl: Consumer Durables (Cars, TVs, Furniture, Household Appliances); 3-Manuf: Manufacturing (Machinery, Trucks, Planes, Off Furn, Paper, Com Printing); 4-Energy: Oil, Gas, and Coal Extraction and Products; 5-Chems: Chemicals and Allied Products; 6-BusEq: Business Equipment (Computers, Software, and Electronic Equipment); 7-Telcm: Telephone and Television Transmission; 9-Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops); 10-Hlth: Healthcare, Medical Equipment, and Drugs; 12-Other: Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment.

In Table A.7 we use the MT model as the reference category to test systematic differences in covenant composition across capital structure models. Firms classified under the dynamic TO model exhibit significantly higher shares of capital/limitation covenants and lower shares of performance covenants relative to MT firms, whereas PO firms display the opposite pattern, with fewer capital/limitation covenants and substantially more performance covenants. Static TO firms differ less sharply from MT firms, showing slightly lower capital covenant intensity and no statistically significant difference in performance or limitation covenants. Overall, the results suggest that covenant design varies meaningfully with firms' financing behaviour and underlying capital structure dynamics.

An interesting aspect of debt ratios derives from the decomposition of variabil-

Table A.7: Covenant composition across capital structure regimes

	Capital	Performance	Limitation
TOs	-0.020^{**}	0.008	0.012
TOd	0.035^{***}	-0.046^{***}	0.011^{*}
PO	-0.024^{***}	0.035^{***}	-0.010^{**}
Benchmark		MT firms	
Observations		124,981	
Clusters (gvkey)		2,617	

Note: Cluster standard errors at the firm level. Coefficients represent differences relative to MT firms. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

ity, reported in Table A.8. Between variability is the largest component of total variability for long-term debt.

Table A.8: Descriptive statistics and variance decomposition of debt ratios

Debt	Median	Mean	Std. dev.	% Between i	% Between t	% Within i
LDA	0.1454	0.1958	0.2044	64.74	1.83	33.44
SDA	0.0074	0.0379	0.0793	39.50	0.40	66.10
TDA	0.2008	0.2338	0.2152	64.47	2.01	33.53
TDM	0.1448	0.2163	0.2315	65.30	2.87	31.83

Note: Period 1995Q3-2020Q3 (period 1975Q4-2020Q3 gives similar results). Computations implemented by the author-written procedure `pantarei`. TDA is at book value (divided by total assets, AT); TDM is at market value (divided by $PRCC \times CSHO + DLTT + DLC$, with $PRCC$ common share price and $CSHO$ number of shares outstanding).

A.1.7 Further details on meta-analysis.

The goal of meta-analysis is to combine these estimates in single results to obtain valid inference about the parameters in the population of firms, $\pi^{(l,s)}$, $\phi^{(l,s)}$ and $\gamma_{fcf}^{(l,s)}$ according to the random effects model (Hedges, 1983; DerSimonian and

Laird, 1986). For example, in the case of SOAs, we have:

$$\begin{aligned}
\hat{\pi}_i^{(l,s)} &= \pi_i^{(l,s)} + \varepsilon_i^{(l,s)} = \pi^{(l,s)} + u_i^{(l,s)} + \varepsilon_i^{(l,s)} \\
\varepsilon_i^{(l,s)} &\sim \mathcal{N}\left(0, \hat{\sigma}_{\pi i}^{(l,s)2}\right) \\
u_i^{(l,s)} &\sim \mathcal{N}\left(0, \tau_\pi^{(l,s)2}\right) \quad \text{REML, ML, EB} \\
u_i^{(l,s)} &\sim \left(0, \tau_\pi^{(l,s)2}\right) \quad \text{DerSimonian and Laird (1986)}
\end{aligned} \tag{A.1}$$

Random-effects meta-regression models based on different techniques are used to increase the robustness of our findings. Among the various methods we tested, REML, ML (Raudenbush, 2009), EB (Berkey et al., 1995) and DerSimonian and Laird (1986), we tend to prefer REML which is robust with respect to ML, EB and DerSimonian and Laird, 1986).

The study effect sizes are different, $\pi_i^{(l,s)} \neq \pi_j^{(l,s)}$ for $i \neq j$ at random. The between-unit variability is captured by $\tau_\pi^{(l,s)2}$, the heterogeneity parameter. The within-unit variance, $\hat{\sigma}_{\pi i}^{(l,s)2}$ is assumed to be known from our estimates.

The target of inference is $\pi^{(l,s)}$, the population parameter, which is estimated as the weighted average:

$$\hat{\pi}^{(l,s)} = \mathbb{E}\left(\hat{\pi}_i^{(l,s)}\right) = \frac{\sum_{i=1}^{N} w_{\pi i}^{(l,s)} \hat{\pi}_i^{(l,s)}}{\sum_{i=1}^{N} w_{\pi i}^{(l,s)}}$$

based on an inverse-variance estimation method (Whitehead and Whitehead, 1991) where $w_{\pi i}^{(l,s)} = \dfrac{1}{\hat{\sigma}_{\pi i}^{(l,s)2} + \hat{\tau}_\pi^{(l,s)2}}$; the variance of $\hat{\pi}^{(l,s)}$ is estimated by $\hat{Var}(\hat{\pi}^{(l,s)}) = 1/w_{\pi.}^{(l,s)}$, with $w_{\pi.}^{(l,s)} = \sum_{i=1}^{N} w_{\pi i}^{(l,s)}$.

Funnel plots are used to explore the presence of small-study effects (Sterne and Egger, 2001) through a scatterplot of firm-specific effect sizes on the x-axis against the measures of firm precision such as standard errors: we use the number of quarters used to estimate the unit-specific model.

In our case, we expect that the effect-size estimates for the units with few quarters will be more variable than those for companies with many quarters: the scatter will be wider at the base of the plot creating, in the absence of bias, a symmetrical inverted funnel shape around the red line representing the SOA for long-term debt according to our multilevel index (heterogeneity between clusters, Sutton, 2009). An example for the long-term debt SOA (= -0.195 in TOs-panel 1;

= -0.293 in TOd-panel 2; = -0.181 in PO-panel 4; = -0.217 in MT-panel 5) is in Figure A.2.

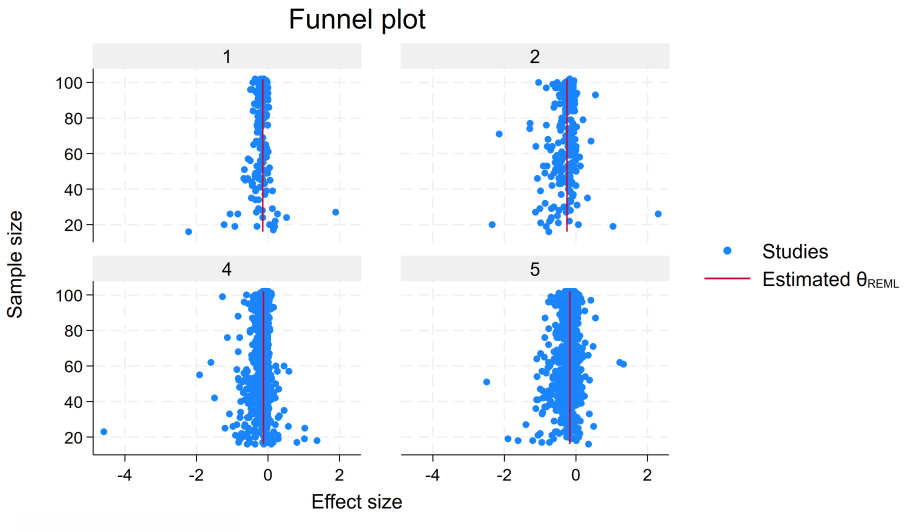


Figure A.2: Funnel plots of the SOAs for long-term debt according to the multilevel index

The funnel plots suggest that the distribution of firm-level SOA estimates is broadly centred around negative values across all financial-behaviour groups, consistent with overall leverage convergence in the ECM framework. The dispersion of estimates is nevertheless substantial, confirming the presence of strong cross-sectional heterogeneity and motivating the meta-regression approach.

Dynamic TO firms (panel 2) display the widest spread of SOA estimates, including both strongly negative and positive values, indicating highly heterogeneous adjustment dynamics across firms despite a negative average SOA. This is consistent with active but heterogeneous leverage rebalancing behaviour. In contrast, MT firms (panel 5) exhibit a much tighter concentration around the pooled estimate, suggesting comparatively more stable and homogeneous adjustment behaviour. PO firms (panel 4) are characterized by a left-skewed distribution with several strongly negative outliers, indicating that a subset of firms adjusts leverage aggressively despite the average behaviour being closer to weak adjustment. Static TO firms (panel 1) show relatively limited dispersion and estimates clustered near zero, consistent with weaker adjustment dynamics.

Overall, the approximate symmetry of the funnels around the REML estimate suggests no major systematic small-sample distortion, while the substantial

dispersion across groups supports the interpretation that financing behaviour and covenant structures jointly generate heterogeneous leverage adjustment dynamics across firms.

Forest plots (Lewis and Clarke, 2001) can synthesise the estimates according to group-specific results, presenting the number of firms within each group, the plot of the effect sizes with their CIs as whiskers extending from each side of the point and spanning the width of the CI, the values of effect sizes and their CIs, and the p-values of the corresponding significance tests. See Figures A.3, A.4 and A.5.

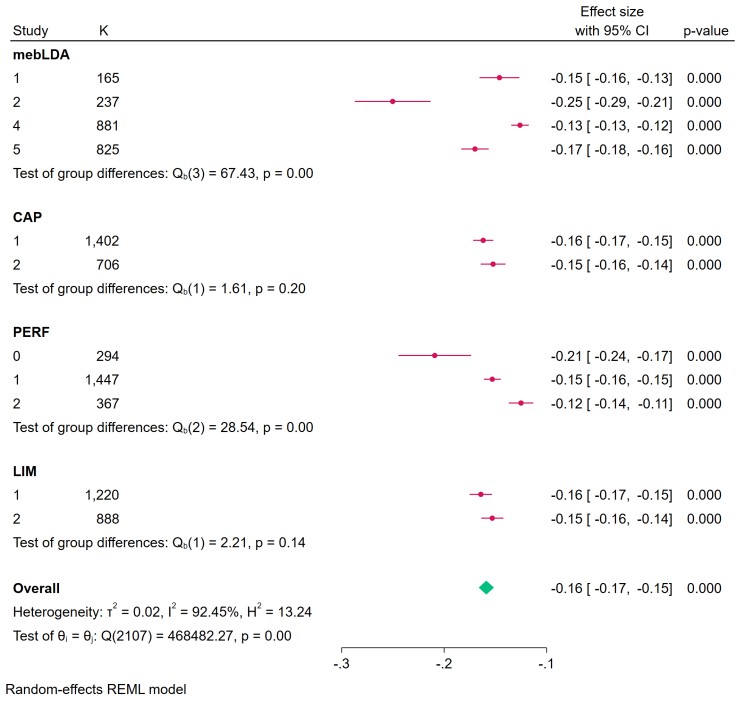


Figure A.3: Forest plot of the SOAs for long-term debt according to financial behaviour and covenants

The forest plot of SOA is very informative because it summarizes the average magnitude of the SOA parameter across behavioural and covenant groups while formally testing group heterogeneity. The main result is extremely clear. All groups exhibit significantly negative SOA parameters, confirming systematic leverage convergence across firms. However, the speed of adjustment differs substantially across financing regimes and covenant structures.

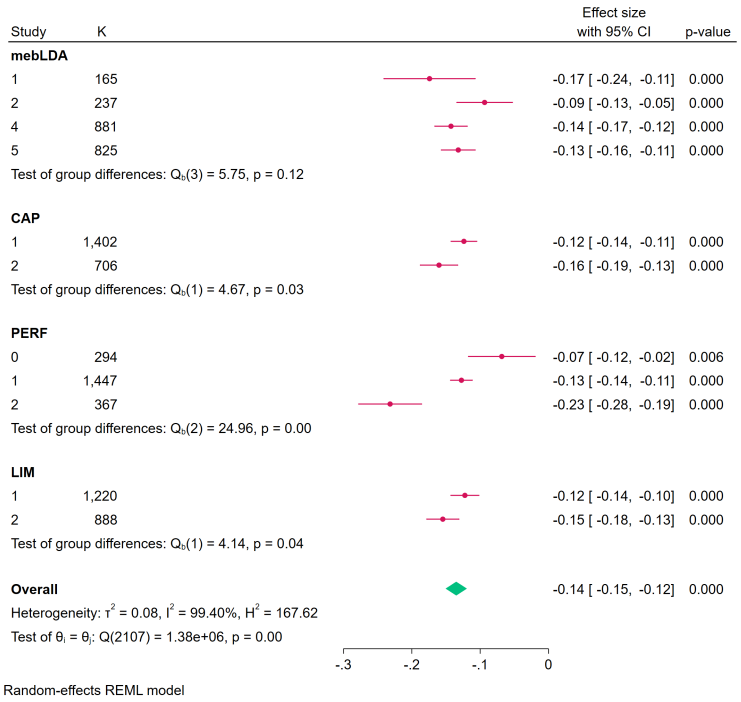


Figure A.4: Forest plot of the free cash flow for long-term debt according to financial behaviour and covenants

The strongest findings are that dynamic TO firms (plot 2) exhibit the most negative SOA (-0.25), implying faster average adjustment than other groups despite the stronger dynamic heterogeneity observed in the funnel plots and meta regressions. Static TO and PO firms display much less negative SOA parameters (around -0.15 to -0.13), indicating weaker average leverage correction. MT firms lie in between.

The covenant grouping is even more striking. Firms with high capital covenant intensity (CAP=2) display slightly less negative SOA estimates (-0.15) than low-capital-covenant firms (-0.16), suggesting weaker leverage discipline. The effect is strongest for performance covenants: -0.21 for no performance covenants, -0.15 for medium intensity, and -0.12 for high intensity. This strongly supports the idea that performance covenants are associated with less aggressive leverage correction. Similarly, stronger limitation covenant intensity is associated with less negative SOA (-0.15 vs -0.16).

The between-unit variance of SOA, $\tau_{\pi}^{(l)2}$, is estimated to be 0.02. The heterogeneity statistic I_{π}^{2} is 92.45%, which means that 92% of the variability in the effect-size estimates is because of the cross-sectional heterogeneity rather than the

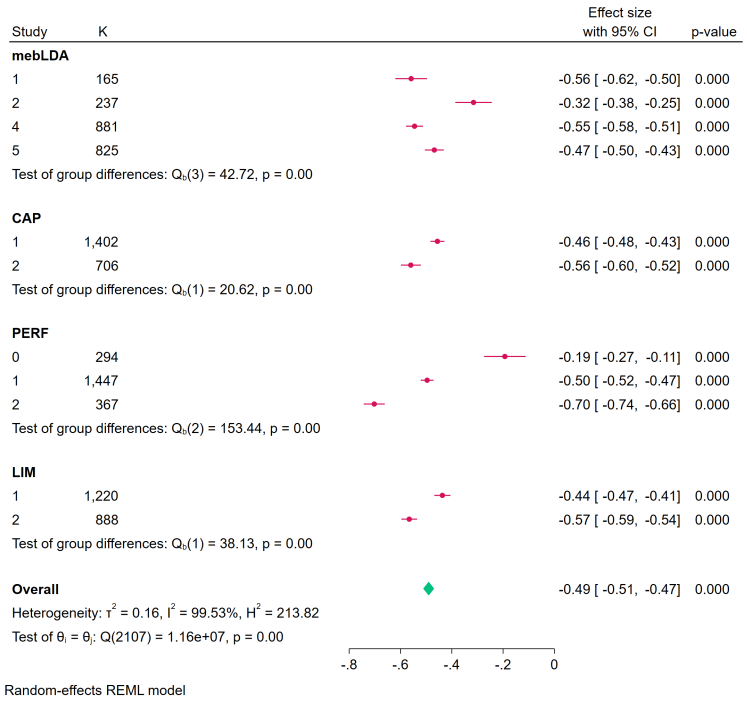


Figure A.5: Forest plot of substitutability in maturities for long-term debt according to financial behaviour and covenants

sampling variation. According to Higgins et al. (2003), this corresponds to "large heterogeneity" and strongly supports the use of random-effects meta analysis rather than homogeneous panel estimators. The very large and highly significant Q_b tests indicate that average SOA differs systematically across covenant and behavioural groups, validating the move from pooled estimation toward heterogeneous meta-regression.

The forest plot for free cash flow, in Figure A.4, confirms that particularly performance covenants strengthen the negative effect. The same it is true for performance and limitation covenants on substitutability of maturities in Figure A.5.

The forest plot averages differ somewhat from the meta-regression conditional effects because the forest plot is unconditional/descriptive, while the meta models partial out crisis exposure, size, industry, and interactions. In a nutshell, the forest plot shows raw structural differences, while the meta regressions explain them.

A.1.8 Results from pooled interacted dynamic model.

The pooled interacted model in equation (2) was estimated by exploiting the Correlated Random Effects GMM-Level estimation of Bontempi and Ditzen (2025) with cluster standard errors. The results are in Table A.9.

Table A.9: Condensed Panel-GMM Evidence

	π	γ_{fcf}	ϕ	Other effects
cov_capH			Reduce	
TOs				Pos. relation with ΔL^l
TOd				
PO		Increase		
MT				
cov_perfH			Increase	
TOs		Increase		
TOd	Reduce			
PO			Increase	
MT		Increase	Increase	Endog. due to heterog.
				Pos. relation with ΔL^l
cov_limL	Reduce			Endog. due to heterog.
TOs				Endog. due to heterog.
TOd			Reduce	
PO				
MT				Pos. relation with ΔL^l
Estimated parameters				
Overall	-0.096***	-0.016	-0.517***	
TOs	-0.095***	-0.107***	-0.610***	
TOd	-0.174***	-0.026*	-0.505***	
PO	-0.052***	0.006	-0.597***	
MT	-0.080***	-0.050***	-0.504***	

Note: The first row of each covenant type is the effect estimated over the full sample, while TOs, TOd, PO and MT rows reports the effects estimated in the subsamples of dominant financial behaviour. Covenants stock are centred on averages (0.89 for capital, 0.49 for performance, 0.95 for limitation). Covenants redesign, $\Delta sharecov\_k_{i,t-1}, k \in \{capH, perfH, limL\}$, is never statistical significant.

Dynamic TO firms exhibit the strongest error-correction behaviour, whereas static TO and MT firms adjust more gradually toward equilibrium. Across specifications, short-term and long-term debt display strong substitution effects, while free-cash-flow sensitivity varies considerably across behavioural regimes and for PO

firms it becomes statistically significant due to the effect of capital and performance covenants. Among dynamic TO firms, performance covenants are associated with weaker adjustment, whereas they are associated with greater flexibility in maturity management in PO/MT firms.

The results reveal substantial heterogeneity in long-term debt adjustment dynamics across financing regimes, and the pooled interactions average over highly heterogeneous covenant transmission mechanisms. Covenant interactions matter, particularly for the role of free cash flow. Individual averages of covenants are crucial as they separate within vs between effects, and show that persistent firm characteristics matter for leverage dynamics. All aspects motivate the fully heterogeneous firm-level estimation and meta-regression analysis, where covenant structures and other moderators are used to explain cross-sectional differences in SOA, free-cash-flow sensitivity, and debt maturity substitution dynamics. While panel GMM estimate average structural patterns, the meta regressions decompose those averages into heterogeneous transmission channels.

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