

PRICING THE UNSEEN

**HOW INTANGIBLE ASSETS AFFECT INVESTOR REACTIONS
TO PAYMENT CHOICE IN PUBLIC M&A**

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Pricing the Unseen: How Intangible Assets Affect Investor Reactions to Payment Choice in Public M&A

Abstract:

This paper investigates whether target intangible asset intensity moderates the well-documented stock-payment discount in bidder announcement returns for acquisitions of publicly traded targets. In particular, the analysis examines whether stock payment functions as a risk-sharing mechanism under valuation uncertainty. Using data on public U.S. mergers and acquisitions from 2000 to 2022, the results confirm the persistence of a stock-payment discount. However, no robust evidence is found that this discount is attenuated for targets with higher intangible intensity. These findings suggest that, in acquisitions of publicly traded targets, target intangible asset intensity does not materially influence how investors interpret the choice of payment. Accordingly, stock payment does not appear to function as a risk-sharing mechanism in this setting. Overall, the paper contributes by providing updated evidence on the stock-payment discount and by examining whether target-side valuation uncertainty, proxied by intangible asset intensity, helps explain variation in bidder announcement returns.

Keywords:

Mergers and acquisitions, Method of payment, Bidder announcement returns, Intangible assets, Valuation uncertainty

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1 Introduction

Mergers and acquisitions (M&A) are significant corporate events that have substantial implications for firm value. Empirical research consistently demonstrates that bidder announcement returns vary systematically across payment methods. Foundational studies show that stock-financed acquisitions of publicly traded targets yield significantly lower cumulative abnormal returns (CARs) than cash-financed acquisitions (Travlos, 1987), a finding confirmed across multiple periods and samples (Heron and Lie, 2002; Betton, Eckbo, and Thorburn, 2008; Malmendier, Opp, and Saidi, 2016).

Although this stock-payment discount is well established, its underlying economic mechanism remains debated. A prevalent explanation is that stock financing signals bidder overvaluation. Under conditions of asymmetric information, managers may issue equity when they perceive the firm as overvalued, resulting in negative announcement effects (Myers and Majluf, 1984; Shleifer and Vishny, 2003; Rhodes-Kropf, Robinson, and Viswanathan, 2005).

A puzzling insight in this context, however, is that stock-financed acquisitions of privately held targets do not generate the same negative announcement returns as acquisitions of publicly traded targets. Instead, they often yield positive abnormal returns (Chang, 1998). This difference has been challenging for researchers to reconcile with the overvaluation explanation alone. Officer, Poulsen, and Stegemoller (2009) suggest that greater valuation uncertainty for private targets provides an alternative explanation. Privately held firms generally disclose less public information and exhibit greater information asymmetry, thereby increasing valuation uncertainty. In these cases, stock payment can serve as a risk-sharing mechanism that mitigates adverse selection, consistent with Hansen's (1987) theoretical model. Consequently, the market may interpret stock financing more favorably under valuation uncertainty.

While Officer et al. (2009) primarily examine private targets, they acknowledge that valuation uncertainty can also influence public firms. Building on this, the present study investigates whether a comparable risk-sharing mechanism operates in acquisitions of publicly traded targets. If stock payment serves as a risk-sharing mechanism under valuation uncertainty (Hansen, 1987; Officer et al., 2009), the negative announcement returns typically associated with stock-financed acquisitions of public targets should be less pronounced when targets are more difficult to value.

This perspective becomes particularly relevant in the modern economy, where firm value increasingly depends on intangible assets such as intellectual property, goodwill, and software (Peters and Taylor, 2017). Because intangible assets are inherently difficult to observe and value (Financial Accounting Standards Board, 2001a; 2001b), they may exacerbate valuation uncertainties in acquisitions, potentially strengthening the role of a risk-sharing mechanism. Consequently, if intangible assets reflect greater valuation uncertainty, the negative announcement return of stock-financed public acquisitions could be attenuated when targets exhibit higher intangible asset intensity. The central research question is therefore:

Does the established gap in bidder announcement returns between stock- and cash-financed acquisitions of publicly traded targets vary systematically with the target's intangible asset intensity?

To address this question, the analysis partially replicates the approach of Officer et al. (2009), who demonstrate that bidder announcement returns vary with the level of target valuation uncertainty. Their study employs several proxies for uncertainty, primarily focusing on the

target's development stage¹ and idiosyncratic volatility. Building on this framework, the present study examines whether valuation uncertainty related to intangible assets influences investors' reactions to acquisition financing decisions. Target intangible asset intensity² is measured using the estimate developed by Peters and Taylor (2017). Unlike conventional accounting measures that capture only book-recorded intangible assets, this measure offers a more comprehensive proxy for intangible assets and their associated valuation uncertainty.

The study examines U.S. M&A transaction announcements from 2000 to 2022, using SDC Platinum M&A announcement data, CRSP daily trading data, and Compustat accounting data. Following data cleaning, the final sample consists of 1,218 observations. The empirical methodology proceeds in two main steps. First, an event study estimates bidder CARs around the announcement. Second, a cross-sectional ordinary least squares (OLS) regression tests whether target intangible intensity moderates the documented difference in announcement returns between stock- and cash-financed acquisitions. The analysis incorporates a comprehensive set of control variables for bidder, target, and deal characteristics to address potential confounding effects. Several robustness checks are also conducted to ensure the results hold under varying assumptions. Finally, as a complementary analysis, a Probit regression examines whether higher target intangible intensity is associated with a greater likelihood of stock financing.

The event study finds a significant negative CAR for acquiring firms around the acquisition announcement. This is consistent with recent M&A research on publicly traded targets (Betton et al., 2008; Officer et al., 2009; Filipović and Wagner, 2025). The OLS regression further provides evidence of a stock-payment discount, where stock-financed acquisitions document significantly lower bidder announcement returns than cash-financed transactions, in line with prior findings (Travlos, 1987; Heron and Lie, 2002; Betton et al., 2008; Malmendier et al., 2016). In contrast, target intangible intensity is not significantly related to bidder announcement returns, either directly or through interaction with the stock payment variable. This suggests that target intangible intensity does not systematically moderate the market's differential reactions to cash versus stock financing. Robustness checks using alternative measures of intangible intensity, different market models, alternative event windows, and subsample analyses confirm that the main findings remain consistent.

These results indicate that the risk-sharing mechanism (Hansen, 1987; Officer et al., 2009) may be less relevant in acquisitions of publicly traded targets. Public firms tend to be more mature and exhibit greater transparency due to disclosure requirements. This may reduce valuation uncertainty around their intangible assets and limit the relevance of stock payment as a risk-sharing tool. Instead, investors might pay greater attention to other bidder, target, or deal-specific characteristics, such as tender offer status or acquirer leverage, which are significant in the regression analyses and may be more salient at announcement.

Moreover, the Probit regression reveals an additional, and somewhat unexpected result. Specifically, higher target intangible intensity increases the likelihood of cash financing. This contrasts with the expectation that greater valuation uncertainty would make stock financing more attractive as a risk-sharing mechanism. One possible interpretation is that managers might not primarily view intangible assets as a source of valuation uncertainty, but rather as an indicator of valuable growth opportunities or potential synergies. As a result, bidders might be more willing to use cash to avoid diluting potential upside, as discussed by Filipović and Wagner (2025).

¹ Development stage is a binary variable equal to 1 if the target has sales below USD 500,000 or if R&D expenditures exceed sales.

² For the remainder of the paper, target intangible asset intensity is referred to as target intangible intensity.

Overall, the results provide updated evidence on the stock-payment discount, but do not show that it varies systematically with target intangible intensity. While the analysis was motivated by the possibility that stock payment could function as a risk-sharing mechanism under valuation uncertainty, the findings suggest that this mechanism does not appear to play a central role in shaping investor reactions. However, these findings should be interpreted with caution. Measurement challenges related to intangible assets, limited statistical power, and the sample composition may affect the ability to detect a moderating effect. The absence of a statistically significant moderating effect should therefore not be seen as definitive evidence that target intangible intensity plays no role in acquisition outcomes. Rather, within this empirical setting, no robust effect is found.

The remainder of the paper proceeds as follows. Section 2 presents the related literature. Section 3 describes the data and sample selection. Section 4 outlines the empirical methodology. Section 5 presents empirical results. Section 6 discusses the empirical findings and limitations. Section 7 concludes.

2 Related Literature

Extensive M&A research documents that bidder announcement returns vary systematically across payment methods. Prior literature consistently documents that stock-financed acquisitions of publicly traded targets generate significantly lower bidder CARs than cash-financed transactions (Travlos, 1987; Heron and Lie, 2002; Betton et al., 2008; Malmendier et al., 2016). A widely cited explanation for the stock-payment discount is that managers exploit bidder overvaluation by issuing equity when their firm is perceived to be overvalued (Myers and Majluf, 1984; Shleifer and Vishny, 2003; Rhodes-Kropf et al., 2005). In such a context, stock payment conveys negative information about the bidder's valuation, leading investors to react unfavorably.

Another relevant but less examined mechanism operates on the target side. Officer et al. (2009) find that stock payment can result in less negative announcement returns when the target is difficult to value, suggesting a risk-sharing mechanism consistent with the framework of Hansen (1987). Most evidence for this mechanism stems from acquisitions of privately held targets, where limited disclosure is believed to increase valuation uncertainty. Consequently, it is unclear whether the risk-sharing mechanism similarly influences market reactions to acquisitions of publicly traded targets or if greater information availability reduces its impact.

At the same time, the growing importance of intangible assets (Peters and Taylor, 2017) may render targets structurally more difficult to value, due to the subjective nature of intangible assets (Financial Accounting Standards Board, 2001a; 2001b). This dynamic could therefore amplify valuation uncertainty in acquisition settings. Accordingly, Filipović and Wagner (2025) find that acquisition announcements emphasizing intangible assets are associated with lower bidder announcement returns.

Prior research thus addresses both target-side valuation uncertainty in shaping market reaction to payment choice and the role of intangible assets in acquisitions. However, it has not directly examined whether the stock-payment discount varies with target intangible intensity.

This paper thus contributes to the literature in three ways. First, it integrates the payment-method literature with the rise of intangible assets as a structural source of valuation uncertainty. Building on the method outlined by Officer et al. (2009), this study introduces the intangible capital measure developed by Peters and Taylor (2017) as the central proxy for target valuation uncertainty. In contrast to recent work by Filipović and Wagner (2025), which primarily relies

on textual measures of intangible emphasis in announcements, this approach focuses on the target's underlying intangible capital. By incorporating both recorded and internally generated intangible investments, the Peters and Taylor (2017) measure captures a broad dimension of firms' intangible capital base. Thus, it provides an alternative structural proxy for target valuation uncertainty.

Second, the paper shifts attention to target-side valuation uncertainty and its effect on acquirer announcement returns. Building on the research by Officer et al. (2009), the study investigates whether a similar risk-sharing mechanism applies to publicly traded targets.

Third, it provides updated evidence on the stock-payment discount in a contemporary setting where intangible assets constitute a larger share of firm value. Much of the foundational evidence on stock versus cash financing examines earlier periods when tangible assets accounted for a larger share of firm value. This makes it interesting to reassess both the persistence of the stock-payment discount and the relevance of stock as a risk-sharing mechanism.

3 Data

3.1 Data on Takeover Announcements

Data on takeover announcements are obtained from the Securities Data Company (SDC) Platinum Mergers and Acquisitions database. The sample period from January 1, 2000, to December 31, 2022, is chosen to capture multiple market cycles and varying economic conditions.³

The sample consists of transactions in which both the acquiring and target firms are based in the United States (U.S.). The U.S. market is selected due to its large size and the availability of comprehensive data. Limiting the analysis to a single country also mitigates cross-country effects and ensures comparability across transactions. Additionally, restricting the sample to the United States facilitates direct comparisons with prior studies, such as Travlos (1987), Betton et al. (2008), Officer et al. (2009), Malmendier et al. (2016), and Filipović and Wagner (2025), all of which examine U.S. M&A transactions.

The study considers only transactions in which both the acquirer and the target are publicly listed. Acquisitions of public and private targets have historically exhibited different abnormal announcement returns (Betton et al., 2008; Officer et al., 2009; Filipović and Wagner, 2025). While prior research on risk-sharing has largely focused on privately held targets (Officer et al., 2009), restricting the sample to publicly traded targets allows the analysis to examine whether a similar mechanism operates in acquisitions of public targets.

In line with prior literature (Bargeron, Schlingemann, Stulz, and Zutter, 2008; Filipović and Wagner, 2025), repurchases, exchange offers, self-tenders, and recapitalizations are excluded from the sample, as these transactions reflect capital structure adjustments rather than acquisitions. The sample is further restricted to completed transactions with a deal value of at least USD 10 million (Eckbo, Makaew, and Thorburn, 2018) to avoid economically insignificant transactions. Moreover, the acquirer should hold no more than 15% of the target six months prior to the announcement, and the acquisition should result in ownership of at least

³ The years following 2022 are characterized by substantial fluctuations in the value of intangible assets. Combined with a decline in M&A activity, this reduces the number of comparable transactions and motivates restricting the sample to 2000–2022. Importantly, the main results remain robust when the sample period is extended to 2000–2024.

80% upon completion (Filipović and Wagner, 2025; Schneider and Spalt, 2025). These criteria ensure that the transaction results in a genuine change of control, not just a marginal increase in ownership, thereby allowing clearer interpretation of announcement effects.

Only transactions with a clearly identified consideration structure are included, and the sample is restricted to cash-only, stock-only, and mixed cash-and-stock deals.⁴ Regulated utilities (SIC 4900–4999) and financial firms (SIC 6000–6999) are further excluded from the sample in line with standard M&A practice (e.g., Bonetti, Duro, and Ormazabal, 2020; Filipović and Wagner, 2025).

Applying these criteria yields an initial sample of 1,676 transactions, which is subsequently refined through data cleaning. SDC Platinum is also used to obtain deal-level characteristics needed to construct the independent and control variables used in the analysis. For full information on the sample screening criteria used, see Appendix A.

3.2 Sample Refinement

Starting with 1,676 transactions, the sample is refined through several data-cleaning steps. First, the acquirer must have trading data available in the Center for Research in Security Prices (CRSP) database, and accounting data for both the target and the acquirer must be available in Compustat. Moreover, all observations must have data available in the WRDS Peters and Taylor Total Q dataset, which records the replacement cost of intangible capital, constructed following the methodology outlined by Peters and Taylor (2017). Observations with missing data in any database are excluded. Second, to ensure that prices reflect new information efficiently, consistent with the assumptions underlying the event study methodology (MacKinlay, 1997), the sample is limited to firms trading on major U.S. stock exchanges to ensure sufficient market liquidity. Thus, only bidders listed on the New York Stock Exchange (NYSE) and NASDAQ are retained. These restrictions result in a final sample of 1,218 transactions. The final sample selection is presented in Table 1, distributed by the acquirer’s industry and payment method.

The resulting sample is somewhat smaller than the samples used in recent M&A studies.⁵ However, while the imposed restrictions reduce the overall sample size, they ensure a more consistent and high-quality dataset, enabling the construction of key variables and improving comparability across observations. At the same time, these requirements may introduce sample selection bias, as included firms are more likely to be larger and more transparent. This limitation should be considered when interpreting the empirical findings. In addition, the smaller sample size may reduce statistical power, particularly when estimating interaction effects. To address this concern, a statistical power analysis is conducted in Section 5 to assess whether the sample is sufficiently powered to detect economically meaningful effects.

⁴ SDC Platinum defines cash transactions as acquisitions in which the only consideration offered is cash, earnouts, or assumption of liabilities, or any combination thereof. Stock transactions are those in which the only consideration is a form of stock. Mixed transactions involve a combination of cash (or cash-equivalent consideration) and stock.

⁵ For example, Malmendier et al. (2016) examine 2,082 transactions, and Filipović and Wagner (2025) examine 3,698 transactions.

Table 1: Sample Distribution

Table 1 shows the distribution of the final sample by acquirer industry (Panel A) and announcement year (Panel B). The sample includes U.S. M&A transactions between publicly traded acquirers and targets obtained from the SDC Platinum database for the period 2000–2022. Transactions must have a deal value of at least USD 10 million and result in a genuine change of control, defined as the acquirer obtaining at least 80% ownership upon completion. In addition, the acquirer must have held less than 15% of the target’s shares six months prior to the announcement. Only completed transactions are included. Repurchases, exchange offers, self-tenders, recapitalizations, regulated utilities (SIC 4900–4999), and financial firms (SIC 6000–6999) are excluded from the sample. The sample is further restricted to acquirers listed on the NYSE or Nasdaq. Transactions are categorized by payment method as cash, stock, or mixed consideration. The deal information is merged with accounting data from Compustat and daily trading data from CRSP through the WRDS platform. Data on firm’s intangible replacement costs are obtained from the Peters and Taylor Total Q dataset available through WRDS. After merging these datasets and removing observations with missing key variables, the final sample consists of 1,218 completed transactions. Acquirer industries are classified using two-digit SIC codes. Column N reports the number of transactions, and % shows the percentage of total observations.

	Cash	Stock	Mixed	N	%
<i>Panel A: Acquirer SIC Code</i>					
01–09 Agriculture, Forestry, Fishing	1	0	0	1	0.08
10–14 Mining	11	26	35	72	5.91
15–17 Construction	1	3	7	11	0.90
20–39 Manufacturing	383	128	122	633	51.97
40–48 Transportation & Communication	29	29	26	84	6.90
50–51 Wholesale Trade	22	2	9	33	2.71
52–59 Retail Trade	39	11	11	61	5.01
70–89 Services	166	84	73	323	26.52
Total	652	283	283	1218	100.00
<i>Panel B: Announcement Year</i>					
2000	34	48	31	113	9.28
2001	32	40	24	96	7.88
2002	28	18	12	58	4.76
2003	27	17	16	60	4.93
2004	31	15	13	59	4.84
2005	38	16	24	78	6.40
2006	53	9	9	71	5.83
2007	50	6	14	70	5.75
2008	23	5	11	39	3.20
2009	26	8	17	51	4.19
2010	41	8	8	57	4.68
2011	13	3	9	25	2.05
2012	35	3	8	46	3.78
2013	30	4	4	38	3.12
2014	22	15	12	49	4.02
2015	30	10	17	57	4.68
2016	36	7	13	56	4.60
2017	21	5	9	35	2.87
2018	22	11	10	43	3.53
2019	14	12	7	33	2.71
2020	10	11	4	25	2.05
2021	16	3	8	27	2.22
2022	20	9	3	32	2.63
Total	652	283	283	1218	100.00

3.3 Intangible Intensity Development Over Time

Figure 1: **Target Intangible Intensity Over Time**

Figure 1 presents the annual median intangible asset intensity for target firms in transactions conducted between 2000 and 2022. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction.

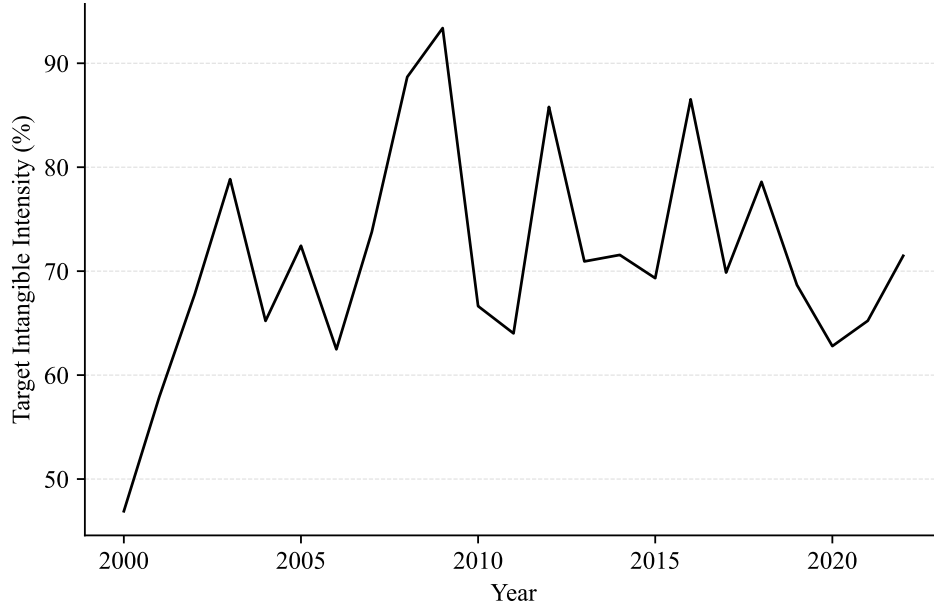


Figure 1 illustrates the development of target intangible intensity over the sample period. Intangible assets are measured using the method proposed by Peters and Taylor (2017), which estimates the replacement cost of a firm's intangible capital. The measure combines the book value of externally purchased intangible assets with estimates of internally generated intangible capital. The method for estimating internally generated capital incorporates both knowledge capital, proxied by research and development (R&D) expenditure, and organizational capital, proxied by a fraction of sales, general and administrative (SG&A) expenditures. Target intangible intensity is then calculated as intangible assets divided by total assets.

In line with the broader structural transformation documented in the literature (Peters and Taylor, 2017; Filipović and Wagner, 2025), the sample confirms the growing importance of intangible assets in the U.S. economy. Intangible intensity shows a pronounced increase early in the sample, before settling at a higher average level. Throughout the period, the series exhibits considerable volatility, reflecting the underlying valuation uncertainty that intangible intensity is intended to capture. The sharp decline around 2020 likely reflects the COVID-19 pandemic, which caused substantial market turbulence and uncertainty. Overall, the persistent fluctuations across the sample period underscore the challenges associated with valuing intangible assets.

3.4 Summary Statistics

Table 2 presents summary statistics for the main variables used in the analysis. The dependent variable is the acquirer CAR in the $[-1, 1]$ event window. The mean acquirer CAR is -1.48%, and the median is -0.65%. The CAR magnitude is consistent with prior research, which finds

Table 2: Summary Statistics

Table 2 reports summary statistics for the variables used in the empirical analysis, including means, medians, standard deviations, and interquartile ranges. The dependent variable, cumulative abnormal return (CAR), measures the acquirer's abnormal stock return over the $[-1, 1]$ event window, estimated using the Carhart four-factor model. The payment method variables are binary indicators equal to 1 if the acquisition is announced to be financed with stock, cash, or a combination of both (mixed consideration), respectively, and 0 otherwise. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction.

	Mean	Median	St. dev.	p25	p75
CAR $[-1, 1]$	-0.0148	-0.0065	0.0845	-0.0553	0.0254
Stock	0.2323	0.0000	0.4225	0.0000	0.0000
Cash	0.5353	1.0000	0.4990	0.0000	1.0000
Mixed	0.2323	0.0000	0.4225	0.0000	0.0000
Target Intangible Intensity	0.8342	0.6977	0.7197	0.3834	1.0306
Acquirer Tobin's Q	2.4385	1.8648	1.8554	1.3786	2.7498
Target Tobin's Q	2.2048	1.6245	1.7384	1.2003	2.5254
Acquirer Leverage	0.2272	0.2059	0.1904	0.0691	0.3324
Acquirer Stock Run-Up	0.0002	-0.0035	0.1245	-0.0648	0.0554
Relative Deal Size	0.4003	0.1898	0.5227	0.0465	0.5385
Tender Offer	0.2274	0.0000	0.4193	0.0000	0.0000
Target Size	19.8423	19.8845	1.8563	18.5277	21.1067

lower announcement returns for acquisitions of publicly traded targets than for private targets. This supports the view that negative-to-zero acquirer CARs are typical in public acquisitions.⁶

The independent variable target intangible intensity has a mean of 0.83 and a median of 0.70. Because Peters and Taylor's (2017) measure includes both recorded items and uncanceled internally generated intangible investments, the ratio may exceed 1.0. This is reflected in the upper percentiles of the distribution, where the 75th percentile exceeds 1.0 (1.03).

All continuous variables, except target size, are winsorized at the 1st and 99th percentiles to reduce the influence of extreme observations. Target size is measured as the natural logarithm of market capitalization, where the logarithmic transformation already mitigates the effect of extreme values. This approach follows Filipović and Wagner (2025) and ensures that results are not unduly influenced by outliers. Prior to winsorization, several variables exhibit substantial skewness and kurtosis, indicating heavy-tailed distributions. As shown in Appendix B, winsorization effectively reduces these distortions, thereby improving the robustness of the analysis without materially changing the economic interpretation of the variables.

Overall, the summary statistics indicate that the sample characteristics and announcement returns broadly align with established patterns in the M&A literature (e.g., Malmendier et al., 2016; Filipović and Wagner, 2025).

⁶ Betton et al. (2008) document an average bidder CAR of -0.87% in their public target subsample, while acquisitions of private targets report a mean CAR of 1.76%. Filipović and Wagner (2025) report an average acquirer CAR of -1.47% for public targets, while the private target subsample exhibits a mean CAR of 1.51%.

4 Methodology

4.1 Ideal Methodology

An ideal research design would rely on an exogenous source of variation in both the method of payment and the target's intangible intensity. Such an approach would enable clear causal identification of whether intangible intensity affects bidder announcement returns for the chosen payment method.

However, both the method of payment and target intangible intensity are inherently endogenous. The choice between stock and cash financing reflects a range of corporate considerations, including managerial strategy, capital structure constraints, tax considerations, and information asymmetry (Faccio and Masulis, 2005; Betton et al., 2008). At the same time, intangible intensity is closely related to firms' operational models and investment behavior. As documented by Peters and Taylor (2017), intangible capital has increased structurally over time and constitutes an increasingly important component of firm value. The underlying firm attributes that affect the choice of payment and intangible intensity may also independently influence bidder announcement returns, making clean causal identification infeasible in a non-experimental setting.

Given these endogeneity concerns, this study adopts an observational empirical design. Although this approach limits strict causal interpretations, it enables documentation of systematic associations between payment methods, target intangible intensity, and bidder announcement returns.

The empirical method proceeds in two main steps. First, a standard event study estimates bidder CARs around the announcement date. Second, a cross-sectional OLS regression examines whether target intangible intensity moderates the relationship between payment method and bidder returns. To strengthen the analysis, robustness checks are then conducted, followed by a Probit regression investigating how target intangible intensity affects the choice of payment method.

4.2 Event Study Specification

The study employs the standard event-study methodology outlined by MacKinlay (1997) to estimate the stock market's reaction to acquisition announcements. For each acquisition, the announcement date is defined as $t = 0$, and the abnormal return of the acquiring firm i is computed around that date. Announcements reported on non-trading days (for example, weekends or market holidays) are reassigned to the next trading day. This ensures that the market reaction is captured when trading resumes.

Expected excess returns are estimated using the Carhart four-factor model (Carhart, 1997), which extends the Fama-French three-factor model (Fama and French, 1993) by incorporating a momentum factor:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + s_iSMB_t + h_iHML_t + m_iMOM_t + \varepsilon_{i,t}$$

The model utilizes the daily excess stock return, defined as the difference between the return of acquirer i on day t , $R_{i,t}$, and the risk-free rate, $R_{f,t}$, proxied by the one-month U.S. Treasury bill rate. The factors SMB_t and HML_t represent the size and value factors, respectively, while MOM_t denotes the momentum factor. Daily factor returns (SMB_t , HML_t , MOM_t , $R_{m,t} - R_{f,t}$) are obtained from the Fama-French Data Library (Kenneth R. French Data Library)

accessed via WRDS.

The model parameters are estimated over a pre-event estimation window of [-280, -31] trading days, consistent with recent M&A literature (e.g., Filipović and Wagner, 2025). This period spans roughly one year before the announcement, supporting stable parameter estimation. The 30-day gap between the end of the estimation window and the announcement is intended to mitigate the risk of potential information leakage and price run-ups.

The announcement effect is measured over a three-day event window [-1, 1], capturing immediate market reactions while accounting for minor information leakage and timing effects. This approach aligns with previous M&A studies (Travlos, 1987; Heron and Lie, 2002; Betton et al, 2008; Officer et al., 2009).

For each day in the event window, abnormal returns are computed as the difference between the realized return and the expected return implied by the estimated factor model:

$$AR_{i,t} = R_{i,t} - (R_{f,t} + \hat{\alpha}_i + \hat{\beta}_i(R_{m,t} - R_{f,t}) + \hat{s}_i SMB_t + \hat{h}_i HML_t + \hat{m}_i MOM_t)$$

Cumulative abnormal returns (CARs) are computed by summing abnormal returns over the event window:

$$CAR_i[\tau_1, \tau_2] = \sum_{t=\tau_1}^{\tau_2} AR_{i,t}$$

4.3 OLS Regression Specification

To examine whether target intangible intensity moderates the market reaction to the payment method choice, ordinary least squares (OLS) regressions of the acquirer announcement returns are estimated. The dependent variable is the CAR for acquirer i , measured over the three-day event window [-1, 1]. A series of model specifications are estimated to facilitate interpretation and assess robustness. The fully specified regression model is given below with the full set of regression specifications in Appendix C.

$$\begin{aligned} CAR_i = & \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i \\ & + \beta_4(TargetIntangibleIntensity_i \times Stock_i) \\ & + \beta_5(TargetIntangibleIntensity_i \times Mixed_i) \\ & + \beta' Controls_i + \gamma_t + \mu_s + \varepsilon_i \end{aligned} \quad (1)$$

$Stock_i$ is a binary variable equal to 1 for acquisition announcements of stock-financed transactions and 0 otherwise. $Mixed_i$ is a binary variable equal to 1 if the payment structure is a mix of cash and stock at announcement and 0 otherwise. Payment method classification is based on the consideration structure announced at the transaction announcement date, as reported by SDC Platinum. Cash-financed acquisitions serve as the reference category and are omitted from the regression to prevent multicollinearity arising from the mutually exclusive payment method indicators.

$TargetIntangibleIntensity_i$ measures the intangible intensity for the target firm. It is defined as the ratio of intangible assets to the total assets. Intangible assets are constructed using the method introduced by Peters and Taylor (2017) and serve as a structural proxy for valuation uncertainty.⁷ The interaction terms $TargetIntangibleIntensity_i \times Stock_i$ and

⁷ Balance sheet items are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction.

$TargetIntangibleIntensity_i \times Mixed_i$ capture whether the market reaction to stock-financed and mixed-financed acquisitions varies with the level of target intangible intensity.

$\beta'Controls_i$ denotes the vector of control variables used in the analysis, while γ_t and μ_s represent year fixed effects and industry fixed effects, respectively.

4.3.1 Control Variables

A set of standard control variables is included to account for other firm- and deal-specific characteristics known to affect announcement returns and takeover outcomes, thereby mitigating omitted-variable bias. All fundamental accounting variables are measured using opening balances for the fiscal year in which the transaction occurred.

Acquirer and Target Tobin's Q

Tobin's Q is defined as the market value of equity plus total assets minus the book value of equity, all divided by total assets. This metric reflects the market's valuation of the firm relative to its asset base, thus serving as a proxy for potential mispricing. Moreover, it has been shown to affect both payment choice and bidder announcement returns (Malmendier et al., 2016).

Acquirer Leverage

Leverage is defined as the ratio of long-term and short-term debt to total assets. This variable is relevant because capital structure may constrain the acquirer's ability to use cash financing and has thus been shown to affect both payment choice and bidder announcement returns (Faccio and Masulis, 2005; Filipović and Wagner, 2025).

Acquirer Stock Run-Up

Consistent with Klitzka, He, and Schiereck (2022), the acquirer stock run-up is included as a control variable. The run-up is defined as the CAR in the window $[-30, -2]$, using the Carhart four-factor model specified above. This measure captures stock price movements prior to the acquisition announcement, reflecting broader market trends. It can serve as a proxy for potential bidder overvaluation and temporary mispricing, which may affect announcement returns.

Relative Deal Size

Relative deal size is defined as the transaction value divided by the acquirer's market value of equity. This variable captures the economic importance of the transaction and has been shown to influence both financing decisions and bidder announcement returns (Malmendier et al., 2016), as larger transactions may generate stronger valuation effects and financing constraints.

Tender Offer

Tender offer is a binary variable equal to 1 when a tender offer is launched for the target and 0 otherwise, as defined by SDC Platinum. Tender offers differ systematically from negotiated mergers in terms of deal structure, payment method, and market reaction, and are therefore included as a control variable in line with prior literature (e.g., Malmendier et al., 2016).

Target Size

Consistent with established M&A literature (Rhodes-Kropf et al., 2005; Malmendier et al., 2016; Klitzka et al., 2022), target size is included as a control variable to account for systematic size effects that may influence takeover outcomes and bidder announcement returns. The variable is measured by the natural logarithm of market capitalization to mitigate heteroskedasticity.

4.3.2 Fixed Effects and Standard Errors

Fixed effects for the year and the acquirer's industry are included to account for unobserved heterogeneity, consistent with standard M&A practice (Officer et al., 2009; Malmendier et al., 2016; Filipović and Wagner, 2025). Year fixed effects control for macroeconomic shocks and trends affecting all firms simultaneously, ensuring identification relies on cross-sectional variation. Industry fixed effects, defined at the two-digit Standard Industrial Classification (SIC) level, control for persistent structural differences across industries. One category is omitted for each set of fixed effects to avoid perfect multicollinearity. Standard errors are clustered at the two-digit SIC industry level. This approach creates heteroskedasticity-robustness while allowing residuals to be correlated within industries.

4.4 Robustness Checks

To further evaluate whether the main results are sensitive to alternative specifications, several robustness checks are conducted with slight alterations of the key definitions and assumptions.

Alternative Measures of Target Intangible Intensity

The measurement of intangible assets poses significant challenges. Many components are not fully captured by standard accounting measures due to strict capitalization restrictions on internally generated intangible assets under U.S. GAAP (Financial Accounting Standards Board, 2001a; 2001b). To address this limitation, the main model adopts the broader definition proposed by Peters and Taylor (2017). However, as robustness checks, two alternative proxies for target intangible intensity are employed: the book value of intangible assets to total assets and target R&D intensity, defined as R&D expenditure to total sales.

While target R&D intensity does not directly measure intangible assets, it captures a related dimension of intangible activity by indicating a firm's investments in internally generated knowledge and innovation. Importantly, the book value of intangible assets and R&D expenditures are both inputs in the construction of Peters and Taylor's (2017) intangible capital measure. Focusing on these components separately thus enables an assessment of whether the baseline results are primarily driven by one of these core components.

Further, to assess whether the effects are concentrated among targets with particularly high levels of intangible capital, two regressions with binary variables based on thresholds in the distribution of intangible intensity are constructed. Specifically, the binary variables equal 1 if the target's intangible intensity exceeds the sample median and the 75th percentile, respectively, and 0 otherwise.

This approach allows for a clearer distinction between targets with relatively low and high levels of intangible intensity and facilitates the identification of potential threshold effects. In particular, the impact of intangible assets may become more pronounced only at higher levels, where firms are likely to face greater valuation uncertainty and information asymmetry. However, transforming a continuous variable into a binary indicator entails a loss of information and may reduce statistical power, especially when higher percentile thresholds are used. The results from these specifications should therefore be interpreted as complementary to the baseline continuous analysis.⁸

⁸ All alternative measures (book value of target intangible intensity, target R&D intensity, and the binary variables) replace target intangible intensity in the baseline specification (Equation 1).

Alternative Model Specifications

Both the event study and OLS regression are re-estimated using the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model (FF3) to assess robustness to the choice of market model. The model is also re-estimated with wider event windows of $[-2, 2]$ and $[-5, 5]$. Compared to the baseline window of $[-1, 1]$, broader windows capture potential information leakage prior to the announcement as well as delayed market reactions. The use of multiple event windows is therefore common in M&A research (e.g., Masulis, Wang, and Xie, 2007).

Additional Robustness Checks

Additionally, the sample is restricted to the years 2004 to 2018, thereby excluding the early years when intangible assets represented a smaller share of firm value, as well as the COVID-19 period, during which intangible valuations were substantially affected (see Figure 1). Furthermore, to specifically examine whether target intangible intensity moderates the relationship between cash- and stock-financed transactions, a model specification excluding mixed deals is also estimated.

4.5 Probit Regression

To complement the main analysis, a Probit regression is estimated. While the main analysis examines how the market reacts to the choice of payment method, the Probit analysis investigates whether target intangible intensity influences this choice. This provides insight into the managerial perspective on the role of intangible assets in acquisition contexts. The model is estimated across several specifications to assess robustness. The fully specified regression is presented below with the full set of specifications in Appendix D.

$$P(\text{StockPayment}_i = 1) = \Phi(\alpha + \beta_1 \text{TargetIntangibleIntensity}_i + \beta' \text{Controls}_i + \gamma_t + \mu_s)$$

$\Phi(\cdot)$ denotes the cumulative normal distribution function. The dependent variable is a binary variable equal to 1 if the acquisition is financed with stock and 0 otherwise.⁹ The main independent variable $\text{TargetIntangibleIntensity}_i$ is measured using the approach developed by Peters and Taylor (2017). $\beta' \text{Controls}_i$ represent the set of control variables used in the baseline regression. γ_t and μ_s capture year fixed effects and industry fixed effects, respectively.

Due to the limited number of observations in several two-digit SIC industries, the inclusion of two-digit SIC industry fixed effects leads to convergence difficulties. Instead, fixed effects and standard errors are clustered at the broader industry categories presented in Table 1. Moreover, the Agriculture, Forestry, and Fishing category, which contains only a single transaction, is excluded from the estimation. The final Probit analysis is therefore based on 1,217 transactions.

5 Empirical Results

This section presents the empirical findings. Following the methodology outlined above, the main analysis proceeds in two steps. First, an event study identifies the average stock market reaction to acquisition announcements. Second, a cross-sectional OLS regression is estimated to assess whether target intangible intensity moderates the reaction to financing decisions. Several robustness tests are then conducted to ensure that the results are not driven by the chosen main

⁹ Transactions classified as cash or mixed are both treated as non-stock transactions (0).

model specification. Finally, a Probit regression is estimated to investigate whether target intangible intensity affects the choice of payment method.

5.1 Event Study Results

Table 3: **Event Study**

Table 3 presents the results from the event study examining bidder stock price reactions around acquisition announcements within the $[-1, 1]$ event window. Column 1 reports event time relative to the announcement date, measured in trading days. Columns 2 to 4 report average raw returns, average abnormal returns, and average cumulative abnormal return (CAR), respectively. Columns 5 and 6 report the corresponding Z-statistics. Column 7 shows the number of events used in the analysis. Abnormal returns are estimated using the Carhart four-factor model. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Event Day	Average Raw Return (%)	Average Abnormal Return (%)	Average CAR (%)	Z-statistic AAR	Z-statistic CAR	Number of Events
-1	0.005480	-0.014	-0.014	-0.173070	-0.173070	1218
0	-1.036502	-1.155***	-1.169***	-6.224403	-5.771307	1218
1	-0.155943	-0.31**	-1.479***	-2.043850	-5.846151	1218

Table 3 presents the results from the event study of bidder abnormal returns over the event window $[-1, 1]$. The results show that, on average, acquiring firms experience a negative abnormal return around the acquisition announcement. This reaction is concentrated on the announcement day (event day 0), where bidders earn a significant average abnormal return of -1.16%. Over the full three-day event window, acquirers experience a significant negative CAR of -1.48%.

Because the sample consists exclusively of acquisitions of publicly traded targets, the observed announcement returns are consistent with established evidence that bidder returns are typically negative at announcement. Using the same event window of $[-1, 1]$, Filipović and Wagner (2025) report an average acquirer CAR of -1.47% for publicly traded targets, while Betton et al. (2008) document an average CAR of -0.87% for their public subsample.

5.2 Main Regression Results

Table 4 presents the OLS regression results. Consistent with prior M&A literature, stock-financed acquisitions are associated with significantly lower bidder announcement returns across all specifications. In the fully specified model (6), stock payments reduce bidder CAR by approximately 4.3 percentage points compared to cash-financed transactions. Mixed payment structures show a similar, though slightly smaller, negative effect. The stability of both coefficient magnitudes and statistical significance across model specifications broadly aligns with the well-documented stock payment discount reported by, for example, Travlos (1987), Heron and Lie (2002), Betton et al. (2008), and Malmendier et al. (2016).

Target intangible intensity does not display a statistically significant relationship with acquirer CAR, suggesting that under these model specifications, target intangible intensity does not affect bidder announcement returns. Importantly, the interaction term remains statistically insignificant across all model specifications. This indicates that target intangible intensity does not systematically moderate the market's differential reaction to cash versus stock financing. The stock payment discount, therefore, appears largely independent of target intangible characteristics within the present sample.¹⁰

¹⁰ The VIF statistics presented in Appendix E indicate that most variables exhibit low values, suggesting that multicollinearity is unlikely to materially affect the result.

Table 4: OLS Regression – Main Analysis

Table 4 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.009** (0.005)	0.008 (0.005)	0.052* (0.027)	0.060 (0.036)	0.019 (0.027)	0.013 (0.032)
Target Intangible Intensity	-0.002 (0.002)	-0.001 (0.002)	0.000 (0.002)	-0.001 (0.003)	0.002 (0.002)	0.000 (0.003)
Stock	-0.052*** (0.007)	-0.050*** (0.010)	-0.049*** (0.010)	-0.047*** (0.010)	-0.045*** (0.012)	-0.043*** (0.012)
Mixed	-0.043*** (0.004)	-0.040*** (0.007)	-0.045*** (0.007)	-0.041*** (0.006)	-0.040*** (0.006)	-0.036*** (0.005)
Target Intangible Intensity × Stock		-0.002 (0.008)	-0.003 (0.007)	-0.002 (0.007)	-0.006 (0.008)	-0.005 (0.008)
Target Intangible Intensity × Mixed		-0.003 (0.005)	-0.002 (0.005)	-0.003 (0.004)	-0.006* (0.004)	-0.008** (0.003)
Acquirer Tobin's Q			-0.003*** (0.001)	-0.002* (0.001)	-0.002** (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.001 (0.002)
Acquirer Leverage			0.038*** (0.011)	0.035*** (0.011)	0.035*** (0.012)	0.033*** (0.012)
Acquirer Stock Run-Up			-0.017 (0.023)	-0.022 (0.022)	-0.012 (0.024)	-0.015 (0.022)
Relative Deal Size			0.003 (0.007)	0.004 (0.007)	-0.000 (0.007)	0.000 (0.008)
Tender Offer			-0.008** (0.003)	-0.007* (0.004)	-0.009*** (0.003)	-0.008** (0.004)
Target Size			-0.002 (0.002)	-0.004* (0.002)	-0.002 (0.002)	-0.004* (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.078	0.078	0.101	0.136	0.157	0.189
Adj. R ²	0.076	0.075	0.092	0.112	0.110	0.126
N	1218	1218	1218	1218	1218	1218

To assess whether the insignificant interaction effect is due to limited statistical power, the minimum detectable effect (MDE) is calculated. Using the standard error from specification (6), the smallest interaction effect detectable with 80% power at the 5% significance level is

about 2.1 percentage points of the CAR. The estimated interaction coefficient is substantially smaller than this threshold, suggesting that economically small moderation effects may not be detectable in our sample.

While the interaction between intangible intensity and stock financing is insignificant, the interaction term between intangible intensity and mixed consideration is negative and statistically significant in the most comprehensive model specifications (5) and (6). This suggests that acquirers using mixed payment structures may experience slightly lower announcement returns when targets are more intangible-intensive compared to cash-financed deals. However, given that the study's primary focus is the difference between cash and stock financing, this finding is not central to the main conclusion.

The inclusion of industry and year fixed effects increases the explanatory power of the regression, suggesting that both industry-specific and time-specific factors contribute to variation in announcement outcomes. Although the model exhibits relatively low R^2 and Adjusted R^2 values, this is typical in studies of bidder announcement returns.¹¹

5.3 Robustness Results

The following section presents the results from the robustness checks described above, beginning with alternative measures of target intangible intensity, followed by alternative model specifications, and finally, additional robustness tests.¹² Overall, the robustness checks confirm that the main findings are largely insensitive to alternative specifications and sample restrictions.

5.3.1 Regression on Target Book Value Intangible Intensity

Table 5 reports the results of the robustness check in which the target intangible intensity measure from the baseline model is substituted with target intangible intensity measured at book value. Despite the change in definition, the main empirical findings are largely unchanged. The stock and mixed coefficients remain negative and significant across all model specifications, with magnitudes similar to the baseline specification. Target intangible intensity is positive and slightly greater in magnitude, but remains statistically insignificant across all model specifications, consistent with the baseline results.

In contrast to the main findings, the interaction term between intangible intensity and stock payment is slightly positive yet remains insignificant across all specifications. This suggests that the direction of the interaction term is sensitive to the definition of intangible assets, despite remaining insignificant in both specifications.

The interaction term for mixed payment and intangible intensity remains negative, with a marginally larger magnitude. However, unlike in the baseline regression, it loses significance in the final two model specifications (5) and (6), rendering it insignificant throughout all specifications.

Overall, the results indicate that the stand-alone effects of stock payment and target intangible intensity are robust, whereas the interaction term is sensitive to the definition of intangible assets. However, since the interaction remains insignificant, it does not alter the main conclusion.

¹¹ Filipović and Wagner (2025) document adjusted R^2 values between 0.05 and 0.10, and Officer et al. (2009) report values ranging from 0.05 to 0.15 across specifications.

¹² Robustness specifications that require a new event study to re-estimate acquirer CAR produce CAR estimates that are broadly consistent with those obtained under the baseline specification, remaining statistically significant at the 1% level.

Table 5: OLS Regression – Target Intangible Intensity Measured at Book Value

Table 5 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target intangible intensity is defined as intangible assets divided by total assets, where intangible assets is defined as the book value of intangible assets. The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.005 (0.004)	0.004 (0.004)	0.051* (0.029)	0.054 (0.034)	0.010 (0.031)	-0.002 (0.034)
Target Intangible Intensity	0.010 (0.011)	0.014 (0.018)	0.009 (0.017)	0.009 (0.017)	0.025 (0.021)	0.024 (0.021)
Stock	-0.051*** (0.007)	-0.053*** (0.011)	-0.053*** (0.011)	-0.051*** (0.011)	-0.050*** (0.012)	-0.049*** (0.013)
Mixed	-0.042*** (0.004)	-0.037*** (0.006)	-0.041*** (0.006)	-0.038*** (0.006)	-0.039*** (0.006)	-0.036*** (0.006)
Target Intangible Intensity × Stock		0.015 (0.042)	0.012 (0.039)	0.020 (0.041)	0.005 (0.044)	0.014 (0.046)
Target Intangible Intensity × Mixed		-0.028 (0.028)	-0.028 (0.028)	-0.027 (0.025)	-0.035 (0.032)	-0.038 (0.028)
Acquirer Tobin's Q			-0.003*** (0.001)	-0.002* (0.001)	-0.002** (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.002 (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.001 (0.001)
Acquirer Leverage			0.039*** (0.011)	0.036*** (0.011)	0.035*** (0.012)	0.033*** (0.012)
Acquirer Stock Run-Up			-0.016 (0.024)	-0.021 (0.022)	-0.010 (0.024)	-0.014 (0.022)
Relative Deal Size			0.002 (0.007)	0.003 (0.007)	-0.001 (0.007)	0.000 (0.008)
Tender Offer			-0.008** (0.003)	-0.008** (0.004)	-0.009*** (0.003)	-0.009** (0.004)
Target Size			-0.002 (0.002)	-0.003* (0.002)	-0.003* (0.002)	-0.004** (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.078	0.080	0.102	0.138	0.159	0.191
Adj. R ²	0.076	0.076	0.093	0.113	0.112	0.129
N	1218	1218	1218	1218	1218	1218

5.3.2 Regression on Target R&D Intensity

Table 6: OLS Regression – Target Intangible Intensity Substituted by R&D Intensity

Table 6 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target R&D intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target R&D intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target R&D Intensity is defined as R&D expenditure over sales. The interaction terms capture how target R&D intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.004 (0.004)	0.005 (0.004)	0.014 (0.027)	0.006 (0.039)	0.094*** (0.030)	0.097** (0.040)
Target R&D Intensity	0.003 (0.003)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.001 (0.001)	0.002 (0.002)
Stock	-0.058*** (0.009)	-0.059*** (0.011)	-0.059*** (0.012)	-0.060*** (0.013)	-0.060*** (0.013)	-0.061*** (0.014)
Mixed	-0.042*** (0.008)	-0.049*** (0.009)	-0.053*** (0.009)	-0.056*** (0.009)	-0.052*** (0.010)	-0.056*** (0.009)
Target R&D Intensity × Stock		0.001 (0.006)	0.001 (0.006)	0.003 (0.007)	0.004 (0.006)	0.005 (0.008)
Target R&D Intensity × Mixed		0.010*** (0.003)	0.010*** (0.002)	0.011*** (0.003)	0.010*** (0.003)	0.011*** (0.003)
Acquirer Tobin's Q			-0.003** (0.001)	-0.002* (0.001)	-0.002** (0.001)	-0.002* (0.001)
Target Tobin's Q			-0.001 (0.001)	-0.001 (0.002)	-0.001 (0.001)	0.000 (0.002)
Acquirer Leverage			0.026* (0.014)	0.030* (0.017)	0.010 (0.019)	0.013 (0.019)
Acquirer Stock Run-Up			-0.018 (0.026)	-0.024 (0.027)	-0.016 (0.026)	-0.020 (0.027)
Relative Deal Size			0.008 (0.009)	0.011 (0.010)	-0.002 (0.010)	0.001 (0.011)
Tender Offer			-0.005 (0.004)	-0.005 (0.005)	-0.005 (0.003)	-0.005 (0.004)
Target Size			-0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.096	0.099	0.116	0.146	0.184	0.212
Adj. R ²	0.093	0.094	0.104	0.111	0.131	0.138
N	863	863	863	863	863	863

Table 6 presents the results from the robustness check replacing the target intangible intensity with target R&D intensity. A limitation of this robustness test is that the availability of R&D data reduces the sample to 863 observations. Despite the reduced sample size, the main findings remain largely unchanged. The stock payment discount persists across all specifications, with a magnitude similar to the baseline results. The mixed payment indicator also remains negative and statistically significant across all models. The target R&D intensity variable itself remains small and statistically insignificant. This suggests that target R&D intensity does not directly affect bidder announcement returns under these model specifications.

Consistent with the baseline results, the interaction between target R&D intensity and stock financing is statistically insignificant across all models. This suggests that R&D activity does not systematically moderate the market's reaction to cash versus stock financing. The interaction between target R&D intensity and mixed consideration is positive and statistically significant in the robustness specification, in contrast to the negative interaction in the main regression. This indicates that the moderating effect of mixed payment deals depends on how intangible intensity is measured.

Taken together, the results indicate that the main effects are robust to the use of target R&D intensity. These results are consistent with the robustness test using book-value-based intangible intensity.

5.3.3 Regressions Using Binary Measures of Target Intangible Intensity

The results from the regressions replacing the continuous measure of target intangible intensity with binary specifications are presented in Table 7 and 8. Overall, the findings are consistent with the baseline specification. Stock- and mixed-financed acquisitions are associated with significantly lower announcement returns, confirming the presence of a stock discount.

When using the median as the threshold, target intangible intensity does not have a statistically significant effect on announcement returns, neither independently nor through interaction with the payment method. This suggests that, when defined relative to the median, target intangible intensity does not meaningfully alter the relationship between payment method and announcement returns.

However, when applying a higher threshold based on the 75th percentile, target intangible intensity becomes positive and statistically significant in several specifications. This indicates that firms acquiring targets with particularly high levels of intangible assets experience higher announcement returns, suggesting that the effect of intangible intensity may be concentrated among targets in the upper tail of the distribution.

Despite this direct effect, the interaction terms between intangible intensity and payment method remain statistically insignificant. This implies that the impact of payment method on announcement returns does not depend on whether the target exhibits high intangible intensity or not. In other words, while high-intangible targets may be associated with different overall returns, the relative announcement effects of stock and mixed payment remain unchanged across levels of intangible intensity. These findings are therefore broadly consistent with the baseline results and suggest that the main conclusion is robust to alternative measures of intangible intensity.

Table 7: OLS Regression – Intangible Intensity Measured with Median Threshold

Table 7 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is a binary variable equal to 1 if the targets intangible intensity, defined as intangible assets divided by total assets, exceeds the sample median, and 0 otherwise. Intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.010** (0.004)	0.007 (0.005)	0.053* (0.030)	0.057 (0.037)	0.018 (0.029)	0.008 (0.035)
Target Intangible Intensity	-0.005 (0.004)	-0.001 (0.005)	0.002 (0.005)	0.001 (0.006)	0.003 (0.005)	0.003 (0.006)
Stock	-0.052*** (0.007)	-0.047*** (0.011)	-0.046*** (0.011)	-0.042*** (0.010)	-0.043*** (0.012)	-0.039*** (0.012)
Mixed	-0.043*** (0.004)	-0.040*** (0.007)	-0.044*** (0.008)	-0.039*** (0.007)	-0.040*** (0.007)	-0.036*** (0.006)
Target Intangible Intensity × Stock		-0.010 (0.018)	-0.012 (0.017)	-0.014 (0.017)	-0.015 (0.018)	-0.016 (0.018)
Target Intangible Intensity × Mixed		-0.007 (0.014)	-0.006 (0.014)	-0.010 (0.012)	-0.011 (0.013)	-0.015 (0.011)
Acquirer Tobin's Q			-0.003*** (0.001)	-0.002* (0.001)	-0.002** (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Acquirer Leverage			0.037*** (0.011)	0.034*** (0.011)	0.035*** (0.012)	0.033*** (0.012)
Acquirer Stock Run-Up			-0.017 (0.024)	-0.022 (0.023)	-0.011 (0.024)	-0.015 (0.023)
Relative Deal Size			0.003 (0.007)	0.004 (0.007)	-0.000 (0.007)	0.001 (0.007)
Tender Offer			-0.008** (0.003)	-0.008* (0.004)	-0.009** (0.003)	-0.008** (0.004)
Target Size			-0.002 (0.002)	-0.003* (0.002)	-0.002 (0.002)	-0.004* (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.079	0.079	0.102	0.138	0.158	0.190
Adj. R ²	0.076	0.076	0.093	0.113	0.111	0.128
N	1218	1218	1218	1218	1218	1218

Table 8: OLS Regression – Intangible Intensity Measured with 75th Percentile Threshold

Table 8 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the $[-1, 1]$ announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is a binary variable equal to 1 if the targets intangible intensity, defined as intangible assets divided by total assets, exceeds the 75th percentile, and 0 otherwise. Intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.005 (0.005)	0.005 (0.004)	0.036 (0.022)	0.040 (0.032)	0.007 (0.020)	-0.002 (0.026)
Target Intangible Intensity	0.006 (0.007)	0.006 (0.005)	0.009** (0.004)	0.007 (0.005)	0.012** (0.005)	0.011** (0.005)
Stock	-0.051*** (0.007)	-0.050*** (0.009)	-0.049*** (0.009)	-0.047*** (0.009)	-0.048*** (0.010)	-0.046*** (0.010)
Mixed	-0.042*** (0.004)	-0.043*** (0.004)	-0.048*** (0.005)	-0.045*** (0.005)	-0.045*** (0.005)	-0.042*** (0.005)
Target Intangible Intensity × Stock		-0.005 (0.027)	-0.004 (0.025)	-0.003 (0.025)	-0.006 (0.027)	-0.004 (0.026)
Target Intangible Intensity × Mixed		0.009 (0.010)	0.010 (0.011)	0.007 (0.012)	0.002 (0.010)	-0.001 (0.012)
Acquirer Tobin's Q			-0.003*** (0.001)	-0.002* (0.001)	-0.002** (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.003* (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Acquirer Leverage			0.040*** (0.010)	0.037*** (0.010)	0.037*** (0.011)	0.035*** (0.011)
Acquirer Stock Run-Up			-0.018 (0.023)	-0.022 (0.022)	-0.012 (0.024)	-0.015 (0.022)
Relative Deal Size			0.003 (0.007)	0.004 (0.007)	-0.000 (0.007)	0.000 (0.007)
Tender Offer			-0.008** (0.004)	-0.008* (0.004)	-0.009** (0.004)	-0.008* (0.004)
Target Size			-0.001 (0.001)	-0.002 (0.002)	-0.002 (0.001)	-0.003 (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.079	0.079	0.104	0.138	0.159	0.190
Adj. R ²	0.077	0.076	0.095	0.113	0.112	0.127
N	1218	1218	1218	1218	1218	1218

5.3.4 Additional Robustness Checks

Alternative Market Models

The regression results using CAPM and FF3 as model specifications are presented in Appendix F and G, respectively. These results are largely consistent with the baseline findings. Both the stock and mixed discounts remain statistically significant and exhibit similar magnitudes across all model specifications. The interaction terms also display comparable directions, magnitudes, and significance levels. The stock interaction term is statistically insignificant across all specifications, and the mixed interaction term is statistically significant in the two most comprehensive model specifications (5) and (6), consistent with the baseline results. The only notable deviation is that target intangible intensity becomes statistically significant under CAPM, but only in the first specification. This significance disappears once control variables are included. This pattern indicates that the initial significance is likely driven by omitted firm characteristics correlated with target intangible intensity. Thus, the main conclusion does not seem to depend on the choice of market model.

Alternative Estimation Windows

The regression results for the wider event windows of $[-2, 2]$ and $[-5, 5]$ are reported in Appendix H and I, respectively. The results are overall consistent with the baseline specification. The stock and mixed-payment discounts remain negative and statistically significant across all specifications. Target intangible intensity remains statistically insignificant, both independently and when interacted with the stock payment variable. The significant interaction between intangible intensity and mixed consideration appears only in the most comprehensive specifications under the $[-2, 2]$ event window and disappears entirely when the wider $[-5, 5]$ window is used. Overall, the results are largely robust to the choice of event window, although the mixed interaction effect is sensitive to longer event windows.

Subsample: 2004–2018 Time Period

Restricting the sample to transactions between 2004 and 2018 results in 774 observations. Regression results are presented in Appendix J. The significant stock and mixed discounts persist across all model specifications, consistent with the baseline findings, although the magnitudes vary slightly. As in the CAPM regression, target intangible intensity is statistically significant in the first specification but loses significance once control variables are included. The interaction term for mixed payment remains insignificant across all specifications, unlike in the baseline results. Notably, statistical significance emerges for the interaction between stock and intangible intensity in the two most comprehensive model specifications (5) and (6). These findings suggest that during periods characterized by high intangible intensity (as indicated in Figure 1), the most comprehensive specifications reveal a negative and significant moderating effect between intangible intensity and stock payment. However, the effect does not persist across specifications and disappears when the full sample period (2000–2022) is considered. Thus, these results suggest that the moderating effect is not robust across time periods.

Subsample: Only Cash and Stock Transactions

The results from the regression model that excludes mixed deals are reported in Appendix K. Including only cash and stock deals reduces the sample to 935 observations. The findings are broadly consistent with the baseline results. The stock payment discount remains negative and statistically significant across all specifications. Target intangible intensity is statistically insignificant in most specifications. It attains weak significance in specification (5) at the

10% level, but this effect disappears in the fully specified model (6), where year fixed effects are included. Furthermore, the interaction between target intangible intensity and the stock payment variable remains statistically insignificant across all models. Therefore, excluding mixed consideration deals does not alter the main conclusion of the analysis.

5.4 Probit Regression Results

Table 9: Probit Regression

Table 9 reports Probit regression results on whether target intangible intensity affects the acquirer's payment choice. The dependent variable *Stock* is a binary variable, equal to 1 if the acquisition is financed with stock and 0 otherwise. The main independent variable is *Target Intangible Intensity* defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). Column (1) presents the baseline specification including only target intangible intensity. Columns (2) – (5) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use a sub-sample of 1,217 transactions. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Constant	-0.644*** (0.105)	1.274*** (0.465)	0.962** (0.381)	1.720*** (0.479)	1.351*** (0.333)
Target Intangible Intensity	-0.107* (0.055)	-0.169** (0.067)	-0.071 (0.068)	-0.120** (0.056)	-0.024 (0.050)
Acquirer Tobin's Q		0.093** (0.040)	0.055 (0.035)	0.103*** (0.036)	0.065** (0.032)
Target Tobin's Q		0.093*** (0.023)	0.093*** (0.024)	0.094*** (0.023)	0.092*** (0.024)
Acquirer Leverage		-0.330 (0.236)	-0.394* (0.208)	-0.486*** (0.140)	-0.553*** (0.120)
Acquirer Stock Run-Up		0.603 (0.400)	0.527 (0.408)	0.616 (0.405)	0.552 (0.411)
Relative Deal Size		0.419* (0.226)	0.413** (0.202)	0.416* (0.222)	0.419** (0.199)
Tender Offer		-1.293*** (0.113)	-1.446*** (0.108)	-1.271*** (0.099)	-1.436*** (0.098)
Target Size		-0.113*** (0.025)	-0.076*** (0.018)	-0.120*** (0.023)	-0.082*** (0.016)
FE: Year	No	No	Yes	No	Yes
FE: Industry	No	No	No	Yes	Yes
Pseudo R ²	0.003	0.136	0.198	0.151	0.213
N	1217	1217	1217	1217	1217

Table 9 reports Probit regression results on whether target intangible intensity affects the acquirer's payment choice. The target intangible intensity coefficient is negative across all

specifications, and statistically significant in specifications (1), (2), and (4). This suggests that higher intangible intensity in targets is associated with a lower probability of stock financing.

Including year fixed effects in specifications (3) and (5) leaves the coefficient magnitude largely unchanged, but statistical significance is lost. This suggests that time-specific factors, such as market conditions or changes in the relevance of intangible assets, may influence the relationship.

Overall, the results provide tentative evidence that target intangible intensity influences the choice of payment method. However, the lack of consistent statistical significance across all specifications suggests that the relationship should be interpreted with caution.

6 Discussion

6.1 Interpretation

The empirical analysis confirms two well-established patterns in the M&A literature. First, the event study documents negative bidder announcement returns for acquisitions of publicly traded targets (Table 3), consistent with the findings of Betton et al. (2008), Officer et al. (2009), and Filipović and Wagner (2025). Furthermore, the OLS regression (Table 4) confirms the well-documented stock discount, consistent with Travlos (1987), Heron and Lie (2002), Betton et al. (2008), and Malmendier et al. (2016).

The main objective of this study was to examine whether this stock-payment discount varies systematically with the target's intangible intensity. This was motivated by the possibility that stock payment could serve as a risk-sharing mechanism under valuation uncertainty. The main OLS regression (Table 4) does not find evidence that target intangible intensity affects bidder announcement returns, either independently or through interaction with the method of payment. This suggests that although intangible assets are often difficult to value, their intensity does not appear to systematically influence bidder announcement returns in the context studied.

Moreover, the proposed risk-sharing mechanism would be expected to be most pronounced in transactions characterized by high target intangible intensity, given the greater valuation uncertainty. However, the analysis using the 75th percentile dummy variable still reveals no significant moderating effect, despite the presence of some significant stand-alone effects. This finding indicates that although elevated target intangible intensity may affect bidder announcement returns directly, it does not appear to generate sufficient valuation uncertainty for stock consideration to function as a value-enhancing risk-sharing tool.

Taken together, these findings suggest that the risk-sharing mechanism proposed by Hansen (1987) and empirically explored by Officer et al. (2009) may be less relevant in acquisitions of publicly traded targets. Although valuation uncertainty may still exist for public firms, disclosure requirements, regulatory oversight, and analyst coverage likely reduce information asymmetries. In addition, public firms must satisfy several listing requirements to become publicly traded, including demonstrating a history of operations and meeting financial and governance standards (see, for example, New York Stock Exchange, 2026; Nasdaq, 2026). As a result, publicly listed firms are typically more mature and transparent, which may further reduce uncertainty surrounding their valuation. Investors could therefore perceive less need for stock payment as a risk-sharing tool. Instead, other bidder, target, or deal-specific characteristics may play a more prominent role in shaping market reactions to announcements. Factors such as tender offer status or acquirer leverage, which are significant in the regression analyses, may be more salient to investors and therefore overshadow the potential role of target intangible

intensity in explaining announcement returns.

Comparing the results with previous studies, Officer et al. (2009) document significantly higher announcement returns on stock-financed transactions when the target is difficult to value. However, they capture a somewhat different dimension of valuation uncertainty, focusing on proxies such as volatility and the target's development stage. Although their findings apply to both public and private targets, the effect is most pronounced among private firms. Taken together, these differences could further help explain why a similar relationship is not observed in the present study.

Similarly, while Filipović and Wagner (2025) do not examine the cash-versus-stock gap at announcement, they document a strong negative market reaction to intangibles talk in takeover announcements. However, in their public subsample, they find no significant relationship between intangibles talk and actual intangible intensity. This suggests that textual emphasis on intangibles captures a different dimension of uncertainty than accounting-based measures.

Although the main regression does not identify a moderating effect for target intangible intensity, the Probit analysis provides additional insight. The results indicate that acquisitions of targets with higher intangible intensity are more likely to be financed with cash. One possible interpretation is that managers may primarily see intangible assets as potential growth opportunities or synergies rather than pure valuation uncertainty. Consistent with this, Filipović and Wagner (2025) find that greater intangibles talk in takeover announcements increases the likelihood of cash financing. They attribute the choice to managers' unwillingness to share this potential upside with target shareholders. While the Probit regression captures only the managerial perspective on intangibles, investors may also hold differing interpretations of their value. In such a case, intangible assets could simultaneously reflect both valuation uncertainty and future growth opportunities. Stock payment may therefore be viewed either as a risk-sharing tool under valuation uncertainty or as a potential diluter of future gains. These opposing effects could therefore offset one another, providing an additional explanation for the absence of a significant moderating effect in the OLS regressions. However, this interpretation remains speculative, and further research is needed to establish whether and how these competing mechanisms influence bidder announcement returns in M&A transactions.

6.2 Limitations and Future Studies

While the results provide useful insights, they should be interpreted with caution. Given the non-experimental setting, the analysis identifies associations rather than causal relationships, and several limitations may influence the interpretation of the findings.

First, measurement challenges related to intangible assets represent an important limitation. Intangible assets are inherently difficult to quantify, and accounting-based measures may only imperfectly capture their underlying economic value. Although this study employs three distinct proxies for target intangible intensity, each remains an imperfect representation. The Peters and Taylor (2017) measure arguably better reflects the underlying economic value of firms' intangible capital but may not correspond directly to the information observed by financial markets at the time of acquisition announcements. Conversely, the book-value-based and R&D measures are more transparent and readily observable to investors but are less likely to accurately reflect the true underlying economic value. Measurement errors in these proxies may therefore weaken the regressions' ability to detect a moderating effect.

Second, the statistical power of the analysis may limit the ability to detect small effects. The estimated MDE under specification (6) of the main OLS regression is approximately 2.1 percentage points of CAR at 80% power and a 5% significance level. The estimated interaction

coefficient is substantially smaller than this threshold, suggesting that economically meaningful but small moderating effects may remain undetected. The limited statistical power potentially reflects the relatively small sample size compared to earlier M&A studies (Malmendier et al., 2016; Filipović and Wagner, 2025).

Third, the distribution of transactions over time may influence the results. A large share of acquisitions occurs in the early part of the sample period, particularly around 2000 (see Appendix L). At the same time, the importance of intangible assets has increased substantially over time. As shown in Figure 1, the median target intangible intensity is considerably higher in the latter part of the sample period. Consequently, the analysis may primarily reflect the acquisition dynamics of the earlier economic environment, in which intangible assets played a less dominant role in firm value. A potential relationship between target intangible intensity, payment method, and announcement returns may therefore be attenuated in the observed data.

Consistent with this interpretation, restricting the analysis to the period from 2004 to 2018 (Appendix J) indicates that target intangible intensity does moderate the difference in announcement returns between payment methods under the most comprehensive specifications. However, the restricted sample substantially reduces the number of observations, further lowering statistical power and increasing estimation uncertainty. Thus, while the sample may reflect a later economic environment in which intangible assets play a greater role in firm value, the results should be treated as suggestive rather than conclusive.

Lastly, the analysis is constrained by SDC Platinum's categorical classification of payment method. The results reveal a notable pattern in mixed payment structures. Transactions involving mixed consideration exhibit a discount similar to stock-financed deals, though less pronounced. The interaction term for mixed payment is also significant in several specifications. This suggests that the benefits of a risk-sharing mechanism may depend on the proportion of stock used in the transaction rather than a simple stock-versus-cash distinction. This relationship cannot be examined in this study because, to our knowledge, SDC Platinum only reports the percentages of cash and stock used in the completed transaction, not at the announcement date. Consequently, the analysis relies on SDC's categorical classifications of cash, stock, and mixed consideration at the announcement date, requiring the use of dummy variables rather than a continuous measure. Future studies could therefore examine payment structures using continuous measures of the equity component to determine whether the announcement returns vary systematically with the proportion of stock used.

Taken together, the analysis highlights several directions for future research. Future studies could further investigate the relationship studied using alternative measures of intangible assets, more detailed classifications of payment structures, and larger samples. Such approaches could help determine whether the absence of a significant effect reflects a true lack of moderation or limitations in the current empirical specification.

7 Conclusion

This paper investigates whether the well-documented difference in bidder announcement returns between stock- and cash-financed acquisitions of publicly traded targets varies with the target's intangible intensity. Using a sample of U.S. public M&A transactions from 2000 to 2022, the results confirm the persistence of a stock-payment discount. However, no robust evidence is found that announcement returns vary systematically with the target's intangible intensity, either directly or through interaction with the payment method.

These findings contribute to the M&A literature by demonstrating that, despite the growing

importance of intangible assets, target intangible intensity does not appear to materially influence how investors interpret the choice of payment method in acquisitions of publicly traded targets. This suggests that the risk-sharing mechanism proposed in earlier literature (Hansen, 1987; Officer et al., 2009) may be less relevant in this context, potentially because public firms are subject to greater transparency and lower information asymmetries surrounding the value of their intangible assets.

Complementary evidence from the Probit analysis suggests that acquisitions of intangible-intensive targets are more likely to be financed with cash. This indicates that managers may not primarily interpret intangible assets as a source of valuation uncertainty. Instead, they are seen as indicators of growth opportunities, increasing incentives to retain future upside rather than diluting it through equity financing. At the same time, investors may also interpret stock financing ambiguously, either as a risk-sharing mechanism under valuation uncertainty or as a signal of dilution of future gains associated with intangible assets. These potentially opposing interpretations could also help explain the absence of a robust moderating effect in the empirical analysis.

Overall, while the stock-payment discount among public targets remains a robust empirical pattern, target intangible intensity does not appear to be a key factor in explaining variation in bidder announcement returns across payment methods in this setting. These findings should nevertheless be interpreted in light of the study's limitations. In particular, measurement challenges related to intangible assets and the observational nature of the analysis should be considered.

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Appendix

Appendix A

Table 10: **Sample Construction**

Table 10 shows the screening criteria applied using the SDC Platinum Mergers and Acquisitions database. Starting from all deals announced between January 1, 2000, and December 31, 2022, the sample is restricted to transactions in which both the acquirer and the target are U.S. firms. The acquirer is required to be publicly listed, and repurchases, exchange offers, self-tenders, and recapitalizations are excluded. A minimum deal value of USD 10 million is imposed. To focus on transactions in which the acquirer is not already a controlling shareholder prior to the acquisition, the acquirer must hold no more than 15% of the target's shares six months prior to the announcement and must own at least 80% of the target's shares following completion. The sample is further restricted to completed transactions, and the target is required to be publicly listed. Only transactions with a clearly identified consideration structure are included, and the sample is restricted to cash-only, stock-only, and mixed cash-and-stock deals. Regulated utilities (SIC 4900–4999) and financial firms (SIC 6000–6999) are excluded. Applying all screening criteria results in a final sample of 1,676 transactions.

Sample Filters	# of deals
Date Announced: January 1, 2000 – December 31, 2022	1,221,864
Acquirer Nation: United States	303,043
Target Nation: United States	249,036
Acquirer Public Status: Public	82,520
Exclude: Repurchases, Exchange Offers, Self-Tenders, Recapitalizations	64,993
Deal Value (USD millions) ≥ 10	24,442
% of Shares Held by Acquirer $\leq 15\%$ (6 months prior)	23,683
% of Shares Owned After Transaction $\geq 80\%$	20,002
Deal Status: Completed	20,002
Target Public Status: Public	8,229
Consideration: Cash only, Stock only, or Hybrid	5,017
Exclude Regulated Utilities (SIC 4900–4999) & Financial Firms (SIC 6000–6999)	1,676

Appendix B

Table 11: **Skewness and Kurtosis Before and After Winsorization**

Table 11 reports the skewness and kurtosis statistics for all continuous variables in the regression, except Target Size, before and after winsorization. CAR is the acquirer cumulative abnormal return (CAR) measured over the $[-1, 1]$ announcement window, estimated using the Carhart four-factor model. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). Other continuous variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, and Relative Deal Size. All variables are winsorized at the 1st and 99th percentiles.

Variable	Skewness (Raw)	Skewness (Wins.)	Kurtosis (Raw)	Kurtosis (Wins.)
CAR $[-1,1]$	-0.148	-0.231	3.261	1.600
Acquirer Stock Run-Up	0.252	0.432	4.408	1.802
Target Intangible Intensity	7.805	2.362	108.582	7.979
Acquirer Tobin's Q	9.750	2.826	134.034	10.009
Target Tobin's Q	7.559	2.752	80.850	9.449
Acquirer Leverage	2.108	0.941	11.695	0.747
Relative Deal Size	15.064	2.193	356.184	5.350

Appendix C

Specification 1: Model Without Interaction Terms

$$CAR_i = \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i + \varepsilon_i$$

Specification 2: Model Including Interaction Terms

$$\begin{aligned}
 CAR_i = & \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i \\
 & + \beta_4 (TargetIntangibleIntensity_i \times Stock_i) \\
 & + \beta_5 (TargetIntangibleIntensity_i \times Mixed_i) + \varepsilon_i
 \end{aligned}$$

Specification 3: Model Including Interaction Terms & Full Set of Control Variables

$$\begin{aligned}
 CAR_i = & \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i \\
 & + \beta_4 (TargetIntangibleIntensity_i \times Stock_i) \\
 & + \beta_5 (TargetIntangibleIntensity_i \times Mixed_i) \\
 & + \beta_6 AcquirerTobin'sQ_i + \beta_7 TargetTobin'sQ_i \\
 & + \beta_8 AcquirerLeverage_i + \beta_9 AcquirerStockRunUp_i \\
 & + \beta_{10} RelativeDealSize_i + \beta_{11} TenderOffer_i + \beta_{12} TargetSize_i + \varepsilon_i
 \end{aligned}$$

Specification 4: Model Including Interaction Terms, Full Set of Control Variables, & Year Fixed Effects

$$\begin{aligned}
CAR_i = & \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i \\
& + \beta_4(TargetIntangibleIntensity_i \times Stock_i) \\
& + \beta_5(TargetIntangibleIntensity_i \times Mixed_i) \\
& + \beta_6AcquirerTobin'sQ_i + \beta_7TargetTobin'sQ_i \\
& + \beta_8AcquirerLeverage_i + \beta_9AcquirerStockRunUp_i \\
& + \beta_{10}RelativeDealSize_i + \beta_{11}TenderOffer_i + \beta_{12}TargetSize_i \\
& + \gamma_t + \varepsilon_i
\end{aligned}$$

Specification 5: Model Including Interaction Terms, Full Set of Control Variables, & Industry Fixed Effects

$$\begin{aligned}
CAR_i = & \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i \\
& + \beta_4(TargetIntangibleIntensity_i \times Stock_i) \\
& + \beta_5(TargetIntangibleIntensity_i \times Mixed_i) \\
& + \beta_6AcquirerTobin'sQ_i + \beta_7TargetTobin'sQ_i \\
& + \beta_8AcquirerLeverage_i + \beta_9AcquirerStockRunUp_i \\
& + \beta_{10}RelativeDealSize_i + \beta_{11}TenderOffer_i + \beta_{12}TargetSize_i \\
& + \mu_s + \varepsilon_i
\end{aligned}$$

Specification 6: Model Including Interaction Terms, Full Set of Control Variables, Year Fixed Effects, & Industry Fixed Effects

$$\begin{aligned}
CAR_i = & \alpha + \beta_1 TargetIntangibleIntensity_i + \beta_2 Stock_i + \beta_3 Mixed_i \\
& + \beta_4(TargetIntangibleIntensity_i \times Stock_i) \\
& + \beta_5(TargetIntangibleIntensity_i \times Mixed_i) \\
& + \beta_6AcquirerTobin'sQ_i + \beta_7TargetTobin'sQ_i \\
& + \beta_8AcquirerLeverage_i + \beta_9AcquirerStockRunUp_i \\
& + \beta_{10}RelativeDealSize_i + \beta_{11}TenderOffer_i + \beta_{12}TargetSize_i \\
& + \gamma_t + \mu_s + \varepsilon_i
\end{aligned}$$

Appendix D

Specification 1: Model Without Control Variables

$$P(\text{StockPayment}_i = 1) = \Phi(\alpha + \beta_1 \text{TargetIntangibleIntensity}_i)$$

Specification 2: Model Including Full Set of Control Variables

$$\begin{aligned} P(\text{StockPayment}_i = 1) = & \Phi(\alpha + \beta_1 \text{TargetIntangibleIntensity}_i \\ & + \beta_2 \text{AcquirerTobin's}Q_i + \beta_3 \text{TargetTobin's}Q_i \\ & + \beta_4 \text{AcquirerLeverage}_i + \beta_5 \text{AcquirerStockRunUp}_i + \\ & + \beta_6 \text{RelativeDealSize}_i + \beta_7 \text{TenderOffer}_i + \beta_8 \text{TargetSize}_i) \end{aligned}$$

Specification 3: Model Including Full Set of Control Variables & Year Fixed Effects

$$\begin{aligned} P(\text{StockPayment}_i = 1) = & \Phi(\alpha + \beta_1 \text{TargetIntangibleIntensity}_i \\ & + \beta_2 \text{AcquirerTobin's}Q_i + \beta_3 \text{TargetTobin's}Q_i \\ & + \beta_4 \text{AcquirerLeverage}_i + \beta_5 \text{AcquirerStockRunUp}_i + \\ & + \beta_6 \text{RelativeDealSize}_i + \beta_7 \text{TenderOffer}_i + \beta_8 \text{TargetSize}_i \\ & + \gamma_t) \end{aligned}$$

Specification 4: Model Including Full Set of Control Variables & Industry Fixed Effects

$$\begin{aligned} P(\text{StockPayment}_i = 1) = & \Phi(\alpha + \beta_1 \text{TargetIntangibleIntensity}_i \\ & + \beta_2 \text{AcquirerTobin's}Q_i + \beta_3 \text{TargetTobin's}Q_i \\ & + \beta_4 \text{AcquirerLeverage}_i + \beta_5 \text{AcquirerStockRunUp}_i + \\ & + \beta_6 \text{RelativeDealSize}_i + \beta_7 \text{TenderOffer}_i + \beta_8 \text{TargetSize}_i \\ & + \mu_s) \end{aligned}$$

Specification 5: Model Including Full Set of Control Variables, Year Fixed Effects, & Industry Fixed Effects

$$\begin{aligned} P(\text{StockPayment}_i = 1) = & \Phi(\alpha + \beta_1 \text{TargetIntangibleIntensity}_i \\ & + \beta_2 \text{AcquirerTobin's}Q_i + \beta_3 \text{TargetTobin's}Q_i \\ & + \beta_4 \text{AcquirerLeverage}_i + \beta_5 \text{AcquirerStockRunUp}_i + \\ & + \beta_6 \text{RelativeDealSize}_i + \beta_7 \text{TenderOffer}_i + \beta_8 \text{TargetSize}_i \\ & + \gamma_t + \mu_s) \end{aligned}$$

Appendix E

Table 12: Variance Inflation Factors

Table 12 reports the Variance Inflation Factors (VIFs) for the explanatory variables used in the main regression. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Other variables include Acquirer and Target Tobin's Q, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size.

Variable	VIF
Target Size	10.718
Target Intangible Intensity	4.385
Acquirer Tobin's Q	3.683
Mixed	3.631
Target Tobin's Q	3.514
Stock	3.316
Target Intangible Intensity $\times$ Stock	3.043
Target Intangible Intensity $\times$ Mixed	2.931
Acquirer Leverage	2.678
Relative Deal Size	2.071
Tender Offer	1.555
Acquirer Stock Run-Up	1.022

Appendix F

Table 13: OLS Regression – CAPM as Model Specification

Table 13 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Capital Asset Pricing Model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.011** (0.004)	0.009** (0.005)	0.052* (0.027)	0.060* (0.035)	0.022 (0.027)	0.014 (0.033)
Target Intangible Intensity	-0.004* (0.002)	-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.003)	0.001 (0.002)	-0.000 (0.003)
Stock	-0.055*** (0.008)	-0.052*** (0.010)	-0.051*** (0.010)	-0.048*** (0.010)	-0.048*** (0.012)	-0.045*** (0.012)
Mixed	-0.042*** (0.004)	-0.038*** (0.006)	-0.041*** (0.007)	-0.038*** (0.006)	-0.038*** (0.006)	-0.034*** (0.006)
Target Intangible Intensity × Stock		-0.003 (0.008)	-0.004 (0.007)	-0.003 (0.007)	-0.007 (0.008)	-0.006 (0.008)
Target Intangible Intensity × Mixed		-0.005 (0.004)	-0.004 (0.005)	-0.005 (0.004)	-0.008*** (0.003)	-0.009*** (0.003)
Acquirer Tobin's Q			-0.003** (0.001)	-0.002 (0.001)	-0.002* (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.001 (0.002)
Acquirer Leverage			0.033*** (0.011)	0.032*** (0.012)	0.030** (0.012)	0.029** (0.013)
Acquirer Stock Run-Up			-0.014 (0.022)	-0.015 (0.021)	-0.007 (0.022)	-0.007 (0.020)
Relative Deal Size			0.001 (0.007)	0.002 (0.008)	-0.001 (0.007)	-0.001 (0.008)
Tender Offer			-0.007* (0.004)	-0.006 (0.005)	-0.008** (0.004)	-0.007* (0.004)
Target Size			-0.002 (0.002)	-0.003* (0.002)	-0.002 (0.002)	-0.003* (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.082	0.082	0.099	0.133	0.158	0.187
Adj. R ²	0.079	0.078	0.090	0.108	0.110	0.125
N	1218	1218	1218	1218	1218	1218

Appendix G

Table 14: OLS Regression – Fama-French Three-Factor as Model Specification

Table 14 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Fama-French three-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.010** (0.004)	0.008* (0.005)	0.050* (0.028)	0.059 (0.038)	0.017 (0.028)	0.012 (0.034)
Target Intangible Intensity	-0.003 (0.002)	-0.001 (0.002)	0.000 (0.002)	-0.001 (0.003)	0.002 (0.002)	0.000 (0.003)
Stock	-0.053*** (0.007)	-0.050*** (0.010)	-0.049*** (0.010)	-0.047*** (0.010)	-0.046*** (0.012)	-0.043*** (0.012)
Mixed	-0.042*** (0.004)	-0.038*** (0.006)	-0.042*** (0.007)	-0.039*** (0.007)	-0.038*** (0.006)	-0.034*** (0.006)
Target Intangible Intensity × Stock		-0.003 (0.008)	-0.004 (0.007)	-0.003 (0.007)	-0.007 (0.008)	-0.006 (0.008)
Target Intangible Intensity × Mixed		-0.004 (0.004)	-0.004 (0.005)	-0.004 (0.004)	-0.008*** (0.003)	-0.009*** (0.003)
Acquirer Tobin's Q			-0.002** (0.001)	-0.001 (0.001)	-0.002* (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.001 (0.002)
Acquirer Leverage			0.036*** (0.011)	0.033*** (0.012)	0.033*** (0.012)	0.031** (0.013)
Acquirer Stock Run-Up			-0.011 (0.022)	-0.016 (0.021)	-0.006 (0.022)	-0.009 (0.021)
Relative Deal Size			0.002 (0.007)	0.003 (0.008)	-0.001 (0.008)	-0.001 (0.008)
Tender Offer			-0.008** (0.003)	-0.007* (0.004)	-0.009*** (0.003)	-0.008** (0.004)
Target Size			-0.002 (0.002)	-0.003* (0.002)	-0.002 (0.002)	-0.004 (0.002)
FE: Industry	No	No	No	No	Yes	Yes
FE: Year	No	No	No	Yes	No	Yes
R ²	0.081	0.081	0.101	0.136	0.159	0.190
Adj. R ²	0.079	0.077	0.092	0.111	0.111	0.127
N	1218	1218	1218	1218	1218	1218

Appendix H

Table 15: OLS Regression – [-2, 2] Event Window

Table 15 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-2, 2] announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.008 (0.005)	0.008 (0.005)	0.053 (0.035)	0.058 (0.043)	0.042 (0.034)	0.036 (0.039)
Target Intangible Intensity	-0.002 (0.003)	-0.002 (0.003)	-0.001 (0.002)	-0.002 (0.003)	0.002 (0.003)	0.000 (0.003)
Stock	-0.047*** (0.007)	-0.048*** (0.009)	-0.047*** (0.009)	-0.044*** (0.008)	-0.044*** (0.010)	-0.041*** (0.010)
Mixed	-0.046*** (0.005)	-0.046*** (0.008)	-0.049*** (0.008)	-0.045*** (0.007)	-0.046*** (0.006)	-0.041*** (0.006)
Target Intangible Intensity × Stock		0.000 (0.008)	0.000 (0.007)	0.000 (0.007)	-0.003 (0.007)	-0.002 (0.007)
Target Intangible Intensity × Mixed		-0.000 (0.005)	0.000 (0.005)	-0.001 (0.005)	-0.004 (0.004)	-0.006* (0.004)
Acquirer Tobin's Q			-0.003*** (0.001)	-0.002* (0.001)	-0.002*** (0.001)	-0.001 (0.001)
Target Tobin's Q			-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.001 (0.002)
Acquirer Leverage			0.044*** (0.011)	0.042*** (0.012)	0.038*** (0.013)	0.037*** (0.014)
Acquirer Stock Run-Up			0.034 (0.021)	0.028 (0.020)	0.041** (0.021)	0.036* (0.019)
Relative Deal Size			0.001 (0.008)	0.002 (0.009)	-0.001 (0.009)	-0.000 (0.009)
Tender Offer			-0.007* (0.004)	-0.005 (0.004)	-0.009*** (0.003)	-0.008** (0.004)
Target Size			-0.002 (0.002)	-0.004 (0.003)	-0.003 (0.002)	-0.004 (0.003)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.067	0.067	0.093	0.128	0.148	0.178
Adj. R ²	0.064	0.063	0.084	0.103	0.099	0.115
N	1218	1218	1218	1218	1218	1218

Appendix I

Table 16: OLS Regression – [-5, 5] Event Window

Table 16 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-5, 5] announcement window and is estimated using the Carhart four-factor model. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. All specifications use the full sample of 1,218 observations. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.010 (0.007)	0.010 (0.007)	0.098** (0.041)	0.106** (0.051)	0.104*** (0.038)	0.113** (0.047)
Target Intangible Intensity	-0.004 (0.004)	-0.005 (0.005)	-0.005 (0.004)	-0.003 (0.006)	-0.002 (0.005)	-0.001 (0.006)
Stock	-0.039*** (0.007)	-0.035*** (0.011)	-0.033*** (0.011)	-0.038*** (0.011)	-0.031** (0.012)	-0.037*** (0.013)
Mixed	-0.037*** (0.007)	-0.044*** (0.010)	-0.042*** (0.010)	-0.044*** (0.011)	-0.039*** (0.010)	-0.041*** (0.012)
Target Intangible Intensity × Stock		-0.005 (0.013)	-0.004 (0.012)	-0.002 (0.014)	-0.006 (0.013)	-0.004 (0.014)
Target Intangible Intensity × Mixed		0.010 (0.010)	0.008 (0.010)	0.008 (0.010)	0.005 (0.010)	0.005 (0.011)
Acquirer Tobin's Q			-0.006*** (0.001)	-0.007*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)
Target Tobin's Q			-0.000 (0.002)	-0.001 (0.002)	0.000 (0.002)	-0.000 (0.002)
Acquirer Leverage			0.038** (0.016)	0.035** (0.016)	0.041** (0.020)	0.039* (0.020)
Acquirer Stock Run-Up			0.103*** (0.023)	0.100*** (0.024)	0.105*** (0.024)	0.103*** (0.025)
Relative Deal Size			-0.005 (0.010)	-0.004 (0.010)	-0.006 (0.011)	-0.006 (0.011)
Tender Offer			-0.004 (0.005)	-0.006 (0.004)	-0.007 (0.005)	-0.009** (0.004)
Target Size			-0.004* (0.002)	-0.004 (0.003)	-0.004* (0.003)	-0.004 (0.003)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.031	0.032	0.074	0.096	0.112	0.132
Adj. R ²	0.029	0.028	0.065	0.070	0.062	0.065
N	1218	1218	1218	1218	1218	1218

Appendix J

Table 17: OLS Regression – Time Period 2004–2018

Table 17 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Carhart four-factor model. The sub-sample is restricted to transactions occurring between 2004 and 2018, resulting in a smaller sample of 774 observations. Columns (1) – (2) include payment method indicators, target intangible intensity, and their interaction terms. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. Stock and Mixed are binary variables equal to 1 if the acquisition is financed with stock or mixed consideration, respectively, and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction terms capture how target intangible intensity moderates announcement returns across payment methods relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.014*** (0.005)	0.012** (0.006)	0.022 (0.050)	0.001 (0.050)	-0.016 (0.043)	-0.051 (0.041)
Target Intangible Intensity	-0.006** (0.003)	-0.005 (0.003)	-0.001 (0.003)	-0.000 (0.004)	-0.001 (0.004)	-0.000 (0.004)
Stock	-0.034*** (0.007)	-0.027*** (0.009)	-0.034*** (0.009)	-0.034*** (0.008)	-0.021* (0.012)	-0.020* (0.011)
Mixed	-0.048*** (0.005)	-0.050*** (0.007)	-0.059*** (0.009)	-0.059*** (0.009)	-0.051*** (0.008)	-0.048*** (0.008)
Target Intangible Intensity × Stock		-0.008 (0.005)	-0.007 (0.005)	-0.006 (0.005)	-0.013** (0.006)	-0.012* (0.006)
Target Intangible Intensity × Mixed		0.003 (0.006)	0.006 (0.006)	0.005 (0.006)	-0.003 (0.003)	-0.005 (0.004)
Acquirer Tobin's Q			-0.003*** (0.001)	-0.002* (0.001)	-0.003*** (0.001)	-0.002** (0.001)
Target Tobin's Q			-0.004 (0.002)	-0.003 (0.002)	-0.004* (0.002)	-0.003 (0.002)
Acquirer Leverage			0.047*** (0.012)	0.046*** (0.012)	0.044*** (0.011)	0.044*** (0.012)
Acquirer Stock Run-Up			-0.029 (0.032)	-0.032 (0.032)	-0.018 (0.034)	-0.018 (0.033)
Relative Deal Size			0.011 (0.009)	0.011 (0.010)	0.006 (0.009)	0.006 (0.009)
Tender Offer			-0.002 (0.004)	-0.004 (0.005)	-0.004 (0.004)	-0.007 (0.005)
Target Size			-0.000 (0.003)	-0.001 (0.003)	0.000 (0.003)	-0.000 (0.003)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.074	0.076	0.111	0.161	0.214	0.259
Adj. R ²	0.070	0.070	0.097	0.132	0.144	0.178
N	774	774	774	774	774	774

Appendix K

Table 18: OLS Regression – Only Cash and Stock Deals

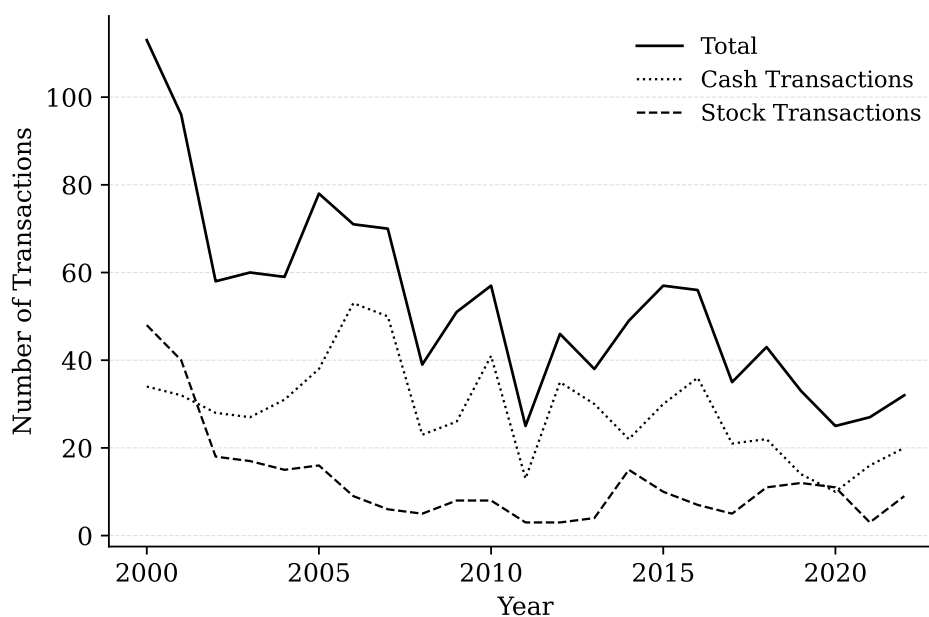
Table 18 reports ordinary least squares (OLS) regression results examining the relation between acquisition payment method, target intangible intensity, and acquirer announcement returns. The dependent variable is the acquirer cumulative abnormal return (CAR) measured over the [-1, 1] announcement window and is estimated using the Carhart four-factor model. The sub-sample is restricted to transactions consisting of only cash and stock transactions, resulting in a smaller sample of 935 observations. Columns (1) – (2) include a payment method indicator, target intangible intensity, and the interaction term. Columns (3) – (6) progressively add control variables as well as acquirer industry and year fixed effects. Stock is a binary variable equal to 1 if the acquisition is financed with stock and 0 otherwise. Cash-financed acquisitions serve as the omitted reference category. Target Intangible Intensity is defined as the ratio of intangible assets to total assets, where intangible assets are measured using the replacement cost of a firm's intangible capital, including both the book value of intangible assets, R&D expenditure and a fraction of SG&A expenditure (Peters and Taylor, 2017). The interaction term captures how target intangible intensity moderates announcement returns relative to cash deals. Control variables include Acquirer and Target Tobin's Q, Acquirer Leverage, Acquirer Stock Run-Up, Relative Deal Size, Tender Offer, and Target Size. All continuous variables are winsorized at the 1st and 99th percentiles, except Target Size, which is measured as the natural logarithm of market capitalization. Balance sheet variables are measured using opening balances for the fiscal year in which the transaction occurred. Income statement variables are measured using data from the fiscal year preceding the transaction. Standard errors clustered at the two-digit SIC industry level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.009 (0.005)	0.008 (0.005)	0.017 (0.034)	0.014 (0.041)	-0.014 (0.032)	-0.035 (0.035)
Target Intangible Intensity	-0.002 (0.003)	-0.001 (0.002)	0.002 (0.002)	-0.001 (0.003)	0.005* (0.003)	0.002 (0.003)
Stock	-0.052*** (0.007)	-0.050*** (0.010)	-0.049*** (0.010)	-0.047*** (0.009)	-0.047*** (0.011)	-0.044*** (0.011)
Target Intangible Intensity × Stock		-0.002 (0.008)	-0.003 (0.007)	-0.002 (0.007)	-0.004 (0.007)	-0.003 (0.007)
Acquirer Tobin's Q			-0.003* (0.001)	-0.001 (0.002)	-0.002 (0.002)	-0.000 (0.002)
Target Tobin's Q			-0.003** (0.001)	-0.002 (0.002)	-0.003* (0.002)	-0.002 (0.002)
Acquirer Leverage			0.039*** (0.010)	0.036*** (0.013)	0.026** (0.010)	0.025* (0.013)
Acquirer Stock Run-Up			-0.004 (0.020)	-0.008 (0.019)	0.005 (0.020)	0.001 (0.019)
Relative Deal Size			0.004 (0.010)	0.006 (0.010)	-0.002 (0.010)	-0.000 (0.011)
Tender Offer			-0.008* (0.004)	-0.008 (0.005)	-0.006 (0.004)	-0.006 (0.005)
Target Size			-0.000 (0.002)	-0.002 (0.002)	-0.000 (0.002)	-0.002 (0.002)
FE: Year	No	No	No	Yes	No	Yes
FE: Industry	No	No	No	No	Yes	Yes
R ²	0.086	0.086	0.116	0.157	0.186	0.224
Adj. R ²	0.084	0.083	0.106	0.127	0.128	0.147
N	935	935	935	935	935	935

Appendix L

Figure 2: **Transactions Over Time**

Figure 2 illustrates the yearly number of M&A transactions between 2000 and 2022. Cash transactions are defined as transactions in which the only consideration offered is cash, earnout or assumption of liabilities, or any combination of the three. Stock transactions are transactions in which the only consideration is a form of stock. Both categories are based on the description of the consideration provided by the acquirer in its initial announcement offer for the target, as defined by SDC Platinum.



AI Appendix

In this paper, we have utilized AI tools to assist with Python coding, preparing the README script, translation between programming languages, formatting in LaTeX, grammar, and general language improvements. All AI-generated content has been closely monitored, and no code or text produced by AI has been included without thorough revision, editing, and consideration. The AI tools that have been used are ChatGPT (OpenAI), Claude (Anthropic), and Grammarly.