ONLINE APPENDICES

Appendix A. ML Input Variables

We use an exhaustive list of 286 input variables in our ML models to predict market reactions. The variables are selected based on prior literature with potential impact on the market's assessment of a transaction and its value creation. The variables fall under five categories: 1) deal attributes (Refinitiv database), 2) characteristics and accounting performance of the acquirer and target (Compustat database), 3) prior acquisition activities and performance of the acquirer (Refinitiv & CRSP databases), 4) activeness and performance of recent acquisitions in the market (Refinitiv & CRSP databases), and 5) macroeconomic and environmental factors (FRED, CRSP, & Compustat databases).

First Category: Deal Attributes
Value of Transaction
Value of Transaction to Acquirer Assets
Ranking Value of Transaction including Net Debt of Target
Target Public Status
Number of Bidders
Percent of Share Held 6 Months Prior to Announcement
Percent of Shares Sought
Percent of Shares Sought in Tender Offer
Initial Offer Price
Percent of Cash/Stock/Other/Unknown Payment
Premium Paid 1/4 weeks Prior to Announcement
Value of Cash
Value of Common Stock
Analyst Estimated Value
Implied Deal Value
Intrastate Deal
State Distance between Acquirer and Target Headquarters
Same-industry Deal
Month/Date Announced
Form of Deal (Acquisition of Majority Interest, Acquisition of Remaining Interest, Acquisition of Certain Assets, Acquisition of Assets)
Deal Attitude (Friendly, Hostile, Neutral, or Unsolicited)
Offering Technique (Tender Offer)
Definitive Agreement Review
Fiduciary Termination Right
FTC Review
Acquirer-target Relative Size

Second Category: Characteristics and Accounting Performance of the Acquirer and Target
Acquirer Assets; Sales; Property, Plant, and Equipment (PP&E); Inventory; Capital Expenditure; Special Items; Market Capitalization; Size (Market Capitalization/Asset/Sales-based); Market-to-book Ratio; Tobin's Q; Gross Margin; Operating Margin; Net Profit Margin; Dividend Payout Ratio; Current Ratio;

Quick Ratio; Debt; Debt-to-equity Ratio; PP&E Newness; PP&E over Sales/Assets; Inventory over Sales/Assets; Capital Expenditure over Sales/Assets; R&D Expenditure over Sales/Assets; Advertising Expenses over Sales/Assets; Special Items over Sales/Assets; Sales Growth; Return-on-assets; Return-on-sales; Return-on-equity; Return-on-investment; EPS
Acquirer R&D Expenditure over Sales/Assets 3-year Moving Average
Acquirer Capital Expenditure over Sales/Assets 3-year Moving Average
Acquirer/Target EBIT
Acquirer/Target Net Income
Acquirer/Target Equal Weighted Industry Return
Acquirer/Target Value Weighted Industry Return
Acquirer/Target Industry Average Dividend Payout Ratio
Acquirer/Target Industry Average Dividend Yield
Acquirer/Target Industry Average Book-to-market Ratio
Acquirer/Target Industry Average Price-to-sales Ratio
Acquirer/Target Industry Average Price-to-book Ratio
Acquirer/Target Industry Average Gross Profit Margin
Acquirer/Target Industry Average Return-to-assets
Acquirer/Target Industry Average Return-to-equity
Acquirer/Target Industry Average Capitalization Ratio
Acquirer/Target Industry Average Cash Flow Margin
Acquirer/Target Industry Average Debt-to-equity Ratio
Acquirer/Target Industry Average Cash Ratio
Acquirer/Target Industry Average Current Ratio
Acquirer/Target Industry Average Asset Turnover
Acquirer/Target Industry Average Inventory Turnover
Acquirer/Target Industry Average Sales-to-Working Capital Ratio
Acquirer/Target Industry Average R&D over Assets
Acquirer/Target Industry Average Advertising Expenses over Sales
Acquirer/Target Industry Average Labor Expenses over Sales
Target Forecasted EBIT

Third Category: Prior Acquisition Activities and Performance of the Acquirer
Count of Prior Acquisitions
Count of Prior Acquisitions with Positive Stock Returns
Percentage of Prior Acquisitions with Positive Stock Returns
Average Stock Returns to Prior Acquisitions
Standard Deviation/Minimum/ Maximum of Stock Returns to Prior Acquisitions
Standard Deviation of Stock Returns to 3/5 Most Recent Acquisitions
Minimum Stock Returns to 3/5 Most Recent Acquisitions
Maximum Stock Returns to 3/5 Most Recent Acquisitions
Count of Prior Withdrawn Deals
Count of Prior Withdrawn Deals with Positive Stock Returns

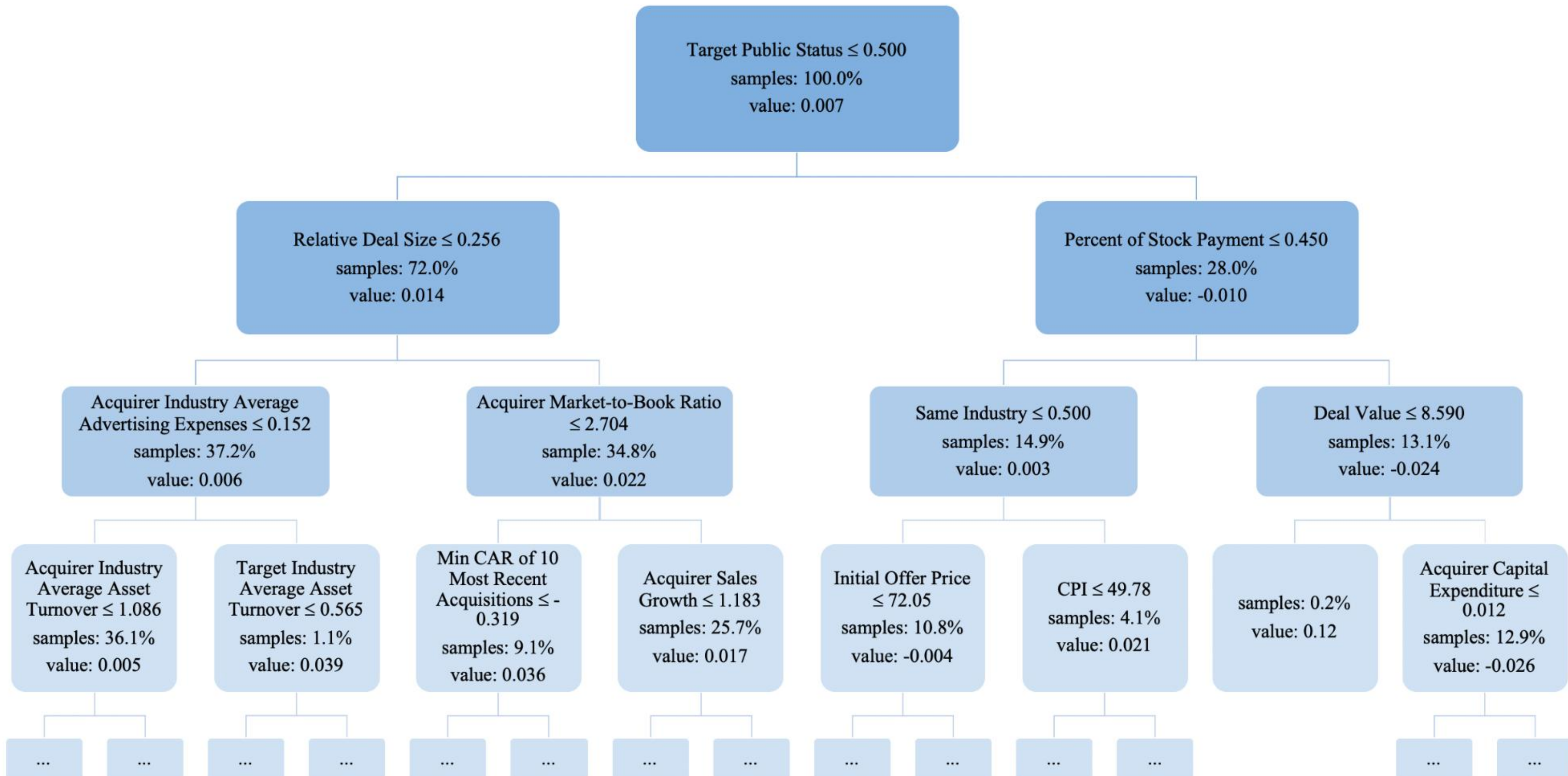
Fourth Category: Activeness and Performance of Recent Acquisitions in the Market
Count of Acquisitions over Past 1/3/6/12 Month(s)
Count of Acquisitions over Past 1/3/6/12 Month(s) with Positive Stock Returns
Percentage of Acquisitions over Past 1/3/6/12 Month(s) with Positive Stock Returns
Average Stock Returns to Acquisitions over Past 1/3/6/12 Month(s)
Standard Deviation of Stock Returns to Acquisitions over Past 1/3/6/12 Month(s)
Minimum Stock Returns to Acquisitions over Past 1/3/6/12 Month(s)
Maximum Stock Returns to Acquisitions over Past 1/3/6/12 Month(s)

Average Stock Returns to 5/10/20 Most Recent Acquisitions in the Market
Standard Deviation of Stock Returns to 5/10/20 Most Recent Acquisitions in the Market
Minimum Stock Returns to 5/10/20 Most Recent Acquisitions in the Market
Maximum Stock Returns to 5/10/20 Most Recent Acquisitions in the Market

Fifth Category: Macroeconomic and Environmental Factors
Industrial Production Index
Inflation Level
Oil Prices
Term Spread
Default Spread
Political Uncertainty Index
S&P 500 Daily/Monthly Return
FTC Transactions Reviewed
FTC Second Request Issued
FTC Second Request Ratio
FTC Early Termination Transactions Granted
FTC Early Termination Transactions Not Granted
Industry Total Number of Firms
Industry Total/Average Sales
Industry Total/Average Sales Yearly Change
Industry Total/Average Sales Standard Deviation over Past Five Years
Unpredictability of Industry Total/Average Sales (Standard Error of Year Dummy in Predicting Sales) based on 1/2/3-digit SIC Code
Unpredictability of Industry Total/Average Sales (R-squared in Predicting Sales) based on 1/2/3-digit SIC Code
Acquirer Industry Number of Firms
Acquirer Industry Total/Average Sales based on 2/3-digit SIC Code
Acquirer Industry Total/Average Sales Yearly Change based on 2/3-digit SIC Code
Acquirer Industry Total/Average Sales Standard Deviation over Past Five Years based on 2/3-digit SIC Code

Appendix B. Visualization of a Decision Tree in the Random Forest model

Below, we provide visualizations of a randomly selected decision tree generated by the Random Forest Model. Since decision trees can be dramatically different and vary (Choudhury et al. 2021), we provide the visualization primarily for illustrative purposes. In the decision tree, the factor, Target Public Status, shows up at the top of the tree, indicating that it is a very informative feature in predicting market reactions. Additionally, Relative Deal Size and Percentage of Stock Payment are also at the top in the decision tree. These results are consistent with the impurity-based and permutation-based feature importance that we report in Table 2. Other factors include characteristics of the acquirer (e.g., size, profitability), prior acquisition performance of the acquirer, and performance of recent acquisitions in the market prior to the focal transaction. In unreported analyses, we also develop Accumulated Local Effects (ALE) plots of the relationship between several variables and market reactions based on the Random Forest model to visualize patterns in the data. Overall, the interpretation of the ML models through various techniques accords well with prior research, and reaffirms that market reactions are associated with fundamentals related to an acquisition transaction.



Note: Only the top four layers of the decision tree are presented in the interest of space. Left-pointing arrows represent "True", while right-pointing arrows represent "False".

Appendix C. OLS Regression Analysis of CAR-Predicted CAR Disparity

Variables	Model 1
Public Target	0.010**
	(0.004)
Percentage of Stock Payment	0.005
	(0.006)
Deal Value to Acquirer Assets	0.013***
	(0.003)
Same Industry	–0.004
	(0.004)
Geographical Distance	–0.001+
	(0.000)
Pre-Announcement Days	0.003*
	(0.002)
Acquirer Size	0.001
	(0.003)
Acquirer ROA	–0.001
	(0.016)
Acquirer Tobin's Q	0.001
	(0.002)
Acquirer Leverage Ratio	–0.005**
	(0.002)
Acquirer Acquisition Experience	0.002
	(0.004)
Acquirer Historical Average CAR	–0.186***
	(0.049)
M&A Wave	–0.002
	(0.006)
Constant	0.135*
	(0.052)
Adjusted R-squared	0.376

Note: Dependent variable is *CAR-Predicted CAR Disparity*. N=2,647. Models are estimated with firm, industry, and year fixed effects. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.10$. Standard errors are reported in parentheses.

Appendix D. Control Variables in Regression Analyses

Variable	Description
Public Target (dummy)	Public status of the target, = 1 if the target is a public company and 0 if the target is a private company
Percentage of Stock Payment	Percentage of stock payment in the transaction
Deal Value to Acquirer Assets	Deal value over acquirer's assets
Same Industry (dummy)	Same industry indicator, =1 if the acquirer and the target are in the same industry based on their 4-digit SIC code, and 0 otherwise
Geographical Distance (mile, logged)	Geographical distance between the headquarters of the acquirer and the target, = log (Distance in miles)
FTC Enforcement (dummy)	Indicator of merger enforcement actions brought by FTC, =1 if the transaction is reviewed by the FTC and 0 otherwise
FTC Transactions Reviewed (logged)	Total number of transactions reviewed by the FTC under the Hart-Scott-Rodino Antitrust Improvements Act in the past 90 days prior to the announcement of the focal transaction, = log (Transactions)
Pre-Announcement Days (logged)	Number of days between the date when the target publicly announces its search of buyer and the announcement date of the transaction by the intended acquirer, = log(1+Days)
Acquirer ROA	Acquirer's return on assets
Acquirer Tobin's Q	Acquirer's market value over assets
Acquirer Leverage Ratio	Acquirer's debt-to-equity ratio
Acquirer Acquisition Experience (logged)	Number of acquisitions conducted by the acquirer prior to the announcement of the focal transaction, = log(1+Acquistions)
Acquirer Historical Average CAR	Historical average market reactions to acquisition announcements prior to the announcement of the focal transaction
M&A Wave (logged)	Total number of transactions conducted by all other firms in the past 90 days prior to the announcement of the focal transaction, = log(1+Acquistions)

References

Choudhury P, Allen RT, Endres MG (2021) Machine learning for pattern discovery in management research. *Strategic Management J.* 42(1):30–57.