

Managerial compensation incentives and merger waves

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Abstract

This paper examines the relation between executive compensation incentives and the nature of merger transactions inside and outside of merger waves. We find that the sensitivity of CEO wealth to firm risk, vega, increases the likelihood of merger transactions outside of waves, but is unrelated to merger frequency inside wave periods. CEOs whose compensation is more closely tied to firm risk make better performing acquisitions when they acquire outside of merger waves, but this is not the case for in-wave deals, suggesting that underperformance of acquiring firms during waves can be attributed in part to ineffective compensation incentives. We also find that the cross-sectional dispersion of acquirers' returns is higher for in-wave acquisitions relative to acquisitions made outside a wave, suggesting that out-wave acquisitions are characterized by lower uncertainty of future stock price returns. This is again restricted to high vega CEOs during out-wave periods.

JEL Classification: G31, G34, M12.

Keywords: Incentive Compensation, Vega, Merger Waves, Deal Performance.

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We thank Helen Bollaert, Jens Hagendorff, Andrew Marshall, and seminar participants at the 2015 IAFDS Symposium (Ljubljana) for helpful comments on earlier drafts of this paper. We also thank Martin Kemmitt for helpful research assistance. All errors remain our own.

1. Introduction

Merger activity historically clusters in ‘waves’ across time and industries, and waves are of significant magnitude in economic terms (Moeller et al., 2005). For the general population of mergers with deal value greater than \$1million in Compustat we identify 58 merger waves, with an average of 225 acquisitions per wave, between 1991 and 2010. Mitchell and Mulherin (1996) propose that waves are driven by shocks to the cost and revenue structure of industries, such as changes in technology and government regulations whereas Shleifer and Vishny (2003) argue that waves are driven by relative mis-valuation of acquiring and target firms. Acquiring firms have also been shown to significantly underperform for several years following mergers during a wave period (Moeller et al., 2005; Bouwman et al., 2009).

In this study we extend research on agency cost theories that seek to explain differences in the quality of merger decisions inside and outside of merger waves. For a sample of 7,689 mergers initiated by publicly traded firms between 1993 and 2010, we examine how merger waves affect the relation between ex-ante CEO remuneration incentives and both the likelihood of firms engaging in merger activity and the quality of these decisions. We propose that differences in compensation incentives affecting the relation between CEO wealth and both stockholder wealth (delta) and risk (vega) are an important channel through which merger decisions vary inside and outside of merger waves.

Following Duchin and Schmidt (2013), we expect that acquiring firm managers can more easily ‘get away’ with bad merger decisions during waves. This can arise due to higher adverse selection costs that reduce the ability of analysts and investors to identify low quality targets, weak corporate governance at acquiring firms, and the resulting difficulty in monitoring the actions of acquiring firm CEOs. We therefore expect that during wave periods there is no

relation between incentive compensation and propensity to acquire. In contrast, when monitoring is stronger during out-wave periods, highly incentivized managers should acquire only when it is optimal to do so for firm stockholders and CEOs will respond positively to compensation incentives that reward managers for taking on risky investment projects (Coles et al., 2006).

Our results show that compensation incentives for acquiring firm CEOs are weaker during merger waves. Cash compensation is higher and pay-risk sensitivity is lower for acquiring firm managers during in-wave periods relative to out-wave periods. Moreover, we find a positive relation between vega and the likelihood of making an acquisition outside of merger waves only. Since acquisitions are a risky class of investment, this is in line with the expectations that higher pay-risk sensitivity reduces managerial risk aversion, mitigating agency costs (Coles et al., 2006; Billett et al., 2010). Conversely, CEO compensation incentives are unrelated to acquisition activity during merger waves. These results indicate that the decision to acquire during merger waves is unrelated to compensation incentives, suggesting sub-optimal compensation design.

Our study also re-examines the documented underperformance of acquisitions initiated during merger waves relative to out-wave deals (e.g. Moeller et al., 2005). If in-wave acquisitions consistently destroy value for acquiring firm stockholders, they should not be among the investment choices of CEOs whose interests are sufficiently aligned to those of stockholders. Therefore, superior performance of out-wave deals is likely to be explained by stronger compensation incentives provided to acquiring managers outside of merger waves.

We find that the documented underperformance of acquisitions initiated during merger waves can be explained, in part, by weak compensation incentives. While vega is positively related to short- and long-term stock price returns for out-wave acquisitions, no such relation is found for mergers initiated during a wave. We expect that ex-ante compensation incentives are

ineffective during in-wave periods given reduced monitoring and the ex-post increase in CEO compensation following even low quality mergers (Goel and Thakor, 2010; Fu et al., 2013).

Finally, we examine the standard deviation of post-acquisition abnormal returns for acquiring firms as a direct test of how adverse selection costs vary conditional on merger waves. During periods of high adverse selection costs, we expect higher dispersion of post-acquisition returns as new information is released to the market, over time, on the underlying quality of acquiring and target firms (Yung et al., 2008). We propose that compensation incentives lead managers to perform greater due diligence on target firms, which leads to lower dispersion in post-acquisition abnormal returns. However, we expect that compensation incentives are effective only outside of merger waves. During in-wave periods, firm managers who make low quality acquisitions can more easily pool within a greater number of acquiring firms and ‘get away’ with low quality merger decisions (Duchin and Schmidt, 2013).

Our results show that in-wave acquisitions are subject to greater adverse selection costs. Firms engaging in merger activity during in-wave periods experience a higher dispersion of abnormal returns in the post-acquisition period relative to firms acquiring outside of merger waves. Moreover, during out-wave periods high vega CEOs make acquisition decisions that are characterized by greater certainty of post-acquisition returns. This supports our proposition that CEO compensation during out-wave periods incentivizes acquiring firm CEOs to conduct greater due diligence of target firms. In contrast, the compensation incentives of in-wave acquiring CEOs are ineffective in mitigating such concerns and we observe no difference in the dispersion of post-acquisition returns between high and low incentive compensation CEOs.

Our paper makes a number of contributions to the literature. We extend the findings of Duchin and Schmidt (2013) who show that adverse selection costs and inefficient monitoring of

firm management can explain the underperformance of acquiring firms during merger waves. We show, in part, this is driven by weaker compensation incentives provided to acquiring firm CEOs. Outside of merger waves managers respond to pay-risk compensation incentives by making more acquisitions, better performing acquisitions, and have greater consistency in post-acquisition performance. During merger waves, compensation incentives are unrelated to deal performance and propensity to acquire, given weaker corporate governance, higher adverse selection costs, and expected increases in ex-post CEO compensation (Fu et al., 2013).

Our results also have implications for the optimal design of CEO compensation contracts, highlighting the need to consider external market conditions, as well as the firm's investment opportunity set in the design of managerial incentives. We show that the importance of providing managers with risk-seeking compensation incentives (see Datta et al., 2001; Coles et al., 2006) is contingent on the level of takeover market activity. We show that outside of merger waves, CEO risk-taking incentives increase the likelihood of managers undertaking mergers and the performance of acquiring firms, whereas such incentives are redundant during merger waves.

The rest of this paper is organized as follows. Section 2 surveys literature on merger waves, executive compensation and merger performance, and develops our empirical hypotheses. Section 3 outlines the construction of the sample and the identification of merger waves. Section 4 presents our empirical results and Section 5 concludes.

2. Literature review and hypotheses development

2.1. The determinants of merger waves and acquiring firm long-run performance

Evidence on the drivers of merger waves and the underperformance of acquiring firms during wave periods is mixed (Rau and Stouraitis, 2011). Lambrecht (2004) argues that firms tend to

merge in periods of economic expansion and Garfinkel and Hankins (2011) find that merger activity is positively related to uncertainty surrounding future cash flows. The two theories that find the strongest support in the literature explain merger waves on the basis of stock market mis-valuation (Shleifer and Vishny, 2003; Rhodes-Kropf and Viswanatham, 2004) and industry shocks (Mitchell and Mulherin, 1996; Harford, 2005).

Mitchell and Mulherin (1996) argue that takeover waves are caused by industry-wide phenomena, or industry shocks, rather than due to target-specific characteristics. Andrade et al. (2001) find that mergers occur in waves and cluster by industry, which is supportive of the theory that mergers occur as a reaction to unexpected industry shocks. Harford (2005) argues that industry merger waves are caused by economic, regulatory and technological shocks under the condition that sufficient capital liquidity is available to accommodate the transactions. Mergers can also occur in waves following deregulation of poorly performing industries (Ovtchinnikov, 2013).

Alternatively, Shleifer and Vishny (2003) attribute merger clustering to stock market mis-valuation, arguing that firms with overvalued equity are more likely to become acquirers while undervalued and relatively less overvalued firms are more likely to become takeover targets. Rhodes-Kropf and Viswanathan (2004) also show that merger waves are more likely to occur during periods of stock market overvaluation. Rhodes-Kropf et al. (2005) provide empirical evidence to support these earlier propositions.

In addition to examining the determinants of merger waves, prior research also examines differences in acquiring firm performance in the short- and long-term. The evidence on short-run acquiring firm performance inside and outside of merger waves is, at best, mixed. Moeller et al. (2005) find higher short-term returns to acquiring firms during the merger wave between 1998

and 2001. Ovtchinnikov (2013) finds that bidders' announcement returns are actually lower during merger waves that follow industry deregulation relative to mergers in unregulated industries, which do not usually occur during wave periods. Duchin and Schmidt (2013) find no difference in short-term announcement returns between in-wave and out-wave acquiring firms.

Examining the largest merger wave in U.S. history, between 1998 and 2001, Moeller et al. (2005) document significant long-run underperformance for acquiring-firm stockholders, which is driven by a small number of acquisitions made by high valuation bidders. In contrast, mergers earlier in the 1990s are found to increase value for the acquiring firm. Bouwman et al. (2009) find that acquirers in hot markets experience significantly lower long-term abnormal stock returns and operating performance than acquirers in depressed markets. These findings are consistent with recent evidence that corporate decisions are affected by stock market valuations and the authors attribute their results to managerial herding that leads to lower quality investment decisions during wave periods. Goel and Thakor (2010) find that acquirers' underperformance is concentrated in mergers initiated later in the wave. Duchin and Schmidt (2013) find significant long-term underperformance for acquisitions initiated during merger waves. They attribute this to higher adverse selection costs in identification of low quality targets, which leads to weaker monitoring and higher agency costs at acquiring firms during wave periods. If managers are likely to mimic the investment decisions of other managers (Scharfstein and Stein, 1990), they argue that in-wave deals are agency-driven. They show that, during merger waves managers can 'get away' with bad acquisitions because they are evaluated more favorably when they make decisions similar to those of their peers. The reduced monitoring and increased uncertainty during merger waves makes it easier for managers to share the blame of unsuccessful acquisitions with other managers.

2.2.Executive compensation and mergers

Prior research shows that mergers lead to an increase in the level of managerial compensation subsequent to completion of the deal. Since CEO compensation increases after an acquisition even if the transaction destroys value for acquiring firm stockholders, executives may engage in merger activity to increase the size of their firms and their level of compensation (Bliss and Rosen, 2001; Sharma and Hsieh, 2011). The post-acquisition increase in executive compensation is often unrelated to deal performance (Kroll et al., 1990; Bliss and Rosen, 2001), is likely to be driven in part by CEO envy of their peer group (Goel and Thakor, 2010), and can take the form of either higher cash compensation (Schmidt and Fowler, 1990) or greater stock and option grants (Harford and Li, 2007). Fu et al. (2013) find that mergers driven by bidding firm overvaluation, which can itself be a cause of waves, lead to significant increases in awards of new restricted stock and option grants despite poor post-acquisition performance.

The ex-ante structure of executive compensation contracts can also play an important role in managers' decision to acquire. Being risky investment decisions, compensation incentives linked to stockholder wealth and risk are expected to increase the incentive for risk-averse CEOs to initiate mergers. Specifically, higher pay-risk sensitivity, vega, is expected to mitigate risk aversion, increasing the propensity to acquire (Crocchi and Petmezas, 2015). Sharma and Hsieh (2011) argue that acquiring managers receive higher proportions of equity-based compensation and lower proportions of cash compensation than the managers of non-acquiring firms.

In addition to an increased propensity to acquire, incentive compensation can also improve the quality of managerial decisions. Mehran (1995) finds that firms whose managers receive higher proportions of equity-related compensation have higher Tobin's Q. Datta et al.

(2001) and Minnick et al. (2011) find that incentive compensation makes managers less risk-averse when they acquire, which leads to better-performing merger decisions.

2.3.Hypotheses development

Duchin and Schmidt (2013) show that long-run acquiring firm underperformance during wave periods is driven, in part, by reducing monitoring of firm management. We extend this finding and provide new evidence on how ex-ante incentives provided through managerial compensation contracts affect the likelihood of undertaking acquisitions inside and outside of merger waves and the quality of these acquisitions. In doing so, we consider whether the documented superior performance of out-wave acquisitions is related to the incentives acquiring firm managers are provided with via their compensation contracts.

We expect a positive relation between incentive compensation and the propensity to engage in risk investment decisions, including mergers (Datta et al., 2001; Croci and Petmezas, 2015). We propose that this relation will differ conditional on merger waves. Outside of wave periods, we expect that risk-averse acquiring firm managers respond to greater compensation incentives in the manner proposed by Smith and Stulz (1985) and Edmans and Gabaix (2011). Subsequently, we expect that the propensity to acquire outside of merger waves is positively related to managers' incentive compensation.

During wave periods merger decisions can arise from managerial herding, which increases information asymmetry and reduces the ability of monitors to differentiate between poor post-acquisition performance caused by bad managerial decision making or general market trends (Duchin and Schmidt, 2013). Given this environment, the ability to pool within a larger group of acquiring managers reduces the inherent risk aversion of acquiring firm managers

because they are less likely to be held accountable for any low quality merger decisions (Ross, 2004; Duchin and Schmidt, 2013). Managers motivated by the increased ex-post compensation benefits from mergers will be more willing to engage in merger transactions during wave periods. Therefore, during wave periods managers are less likely to require ex-ante compensation incentives to engage in risky merger transactions. We therefore expect no relation between compensation incentives and the propensity to acquire during merger waves.

Should these predictions be correct, we expect to reject the following null hypothesis:

H₁: The difference in the likelihood of acquiring a firm between in-wave and out-wave time periods is unrelated to incentive compensation.

Prior studies shows that firm performance is positively associated with equity-based compensation (Mehran, 1995) but negatively with excessive cash compensation (Brick et al., 2006). Moreover, incentive compensation is associated with value-increasing acquisitions (Datta et al., 2001; Minnick et al., 2011). At the same time, mergers initiated during wave time periods significantly underperform their benchmark index in the long-term (Bouwman et al., 2009; Goel and Thakor, 2010), while evidence on short-term returns for in-wave and out-wave transactions is mixed (Moeller et al., 2005; Ovtchinnikov, 2013).

We propose here that the previously documented relation between managers' compensation incentives and post-acquisition performance will vary inside and outside of merger waves. Given the reduced monitoring during merger waves proposed by Duchin and Schmidt (2013), managers are more likely to engage in low quality acquisitions that are associated with subsequent underperformance. Given this environment, we expect that equity based

compensation is ineffective in encouraging managers to undertake value maximizing investment decisions and therefore we expect no relation between incentive compensation and acquiring firm performance during wave periods. We expect the previously documented positive relation between incentive compensation and deal performance to be restricted to out-wave time periods where incentive compensation can be used to overcome managerial risk aversion and reward managers for making value maximizing decisions.

To measure merger performance, we examine the immediate stock price response to merger announcements, and long-run stock price and operating performance following the transaction. Performance measures surrounding in-wave and out-wave mergers are compared to verify prior evidence on differences in deal performance across in-wave and out-wave time periods. Should the empirical findings confirm that differences in performance between in-wave and out-wave deals can be explained by managerial incentives, the following null hypothesis will be rejected:

H₂: The difference in short- and long-term acquiring firm performance between in-wave and out-wave time periods is unrelated to incentive compensation.

Finally, we expect that acquisitions initiated during merger waves are subject to greater information asymmetry and adverse selection concerns for acquiring firm stockholders relative to out-wave acquisitions. In the context of IPOs, Yung et al. (2008) propose that this valuation uncertainty is resolved over time as private information on firm quality is released to the market. Applying this theory to merger transactions, we expect higher cross-sectional variation of post-acquisition stock price returns for in-wave relative to out-wave mergers.

We also extend this analysis to examine the relation between CEO incentive compensation and the cross-sectional variation of post-acquisition stock price returns. We propose that better incentivized managers will have a greater incentive to overcome adverse selection concerns by performing sufficient due diligence of target firms. Incentive compensation is expected to be more effective in encouraging effective due diligence during out-wave time periods because acquisitions are less concentrated in short periods of time, giving managers more time to carry out this activity. Outside of merger waves, a higher level of incentive compensation is expected to be more effective in mitigating adverse selection costs, leading managers to make fewer low quality acquisitions. We expect that during wave periods, the increased managerial euphoria, ex-post increases in compensation following completed deals, reduced monitoring and weaker corporate governance will moderate the positive relation between incentive compensation and merger quality (Duchin and Schmidt, 2013; Fu et al., 2013).

Following this, we propose the following null hypothesis:

H₃: The dispersion of cross-sectional post-acquisition abnormal returns between in-wave and out-wave time periods is unrelated to incentive compensation.

3. Sample data

3.1. Sample construction

We use three primary data samples to conduct empirical analysis and construct merger and executive compensation variables. For our *matched sample* the SDC Platinum database is used to collect all completed domestic¹ mergers and acquisitions between January 1, 1993 and December 31, 2010. Both the announcement and effective day should be within our sample

¹ Both the bidder and the target are US firms.

period. We follow Aktas et al. (2013) and select only those transactions that have been classified as mergers, acquisitions, acquisitions of majority interest, acquisitions of assets, acquisitions of certain assets, acquisitions of remaining interest, and exchange offers. In order to be included in the sample, the transactions should also fulfil the following criteria: the disclosed deal value should be at least \$1 million² and the bidding firm³ should be a publicly listed company owning less than 50 percent of the target firm's stock six months prior to the acquisition announcement and holding at least 50 percent of the target's stock after the transaction, such that an explicit change of control can be ensured. The number of transactions that meet these criteria is 28,751. We match our sample of mergers to CEO compensation data from ExecuComp for the year preceding the merger. The starting year of our merger sample is 1993 since ExecuComp does not provide executive compensation data prior to 1992. We require acquiring firms to have sufficient stock price data available in CRSP for the calculation of announcement returns and accounting data available in Compustat at the time of the acquisition announcement. These criteria results in a sample of 7,859 transactions made by 1,926 firms with available accounting, stock price and executive compensation data. From this sample, we drop a small number of transactions for acquiring firms where we cannot clearly identify the CEO of the company in Execucomp. This filter results in a final sample of 7,689 transactions made by 1,843 firms.

To avoid selection bias in our findings from examining only completed acquisitions, we also construct an *ExecuComp sample* to examine the relation between incentive compensation and the likelihood of a firm making an acquisition. We collect all ExecuComp firms with available CEO compensation data for the period 1992-2009. This produces a sample of 30,995

² SDC Platinum does not report method of payment for those transactions without a disclosed deal value. All dollar values in the analysis are adjusted for inflation using the consumer price index and expressed in 2010 USD.

³ Since all transactions in our sample are completed acquisitions, the terms acquirer and bidder or acquiring and bidding firm are used interchangeably.

firm-year observations for 2,430 unique firms with CEO compensation data available. We then match firm-year observations in ExecuComp with data on merger transactions made by each firm during each year of our sample period from SDC Platinum. For the larger *ExecuComp sample* we have the same sample of 7,689 transactions made by 1,843 firms.

Lastly, we construct a *merger wave sample* following the process of Duchin and Schmidt (2013) in order to classify merger transactions in the *matched* and *ExecuComp samples* as occurring during in-wave or out-wave time periods. We collect merger data for an extended sample of 35,829 completed US mergers and acquisitions with an announcement and effective date within the period January 1, 1981 to December 31, 2010 using SDC Platinum and using the Aktas et al. (2013) sample selection criteria described previously. In the *merger wave sample* we do not require data availability in ExecuComp and CRSP/Compustat. The sample is extended back to 1981 to avoid bias in the identification of merger wave patterns due to the unusually high merger activity in the US in the 1990s relative to preceding and subsequent periods. 5,394 (15%) of these 35,829 transactions occurred in 1981-1990, 18,645 (52%) occurred in 1991-2000 and 11,790 (33%) occurred in 2001-2010. This pattern is comparable to the distribution of mergers documented by Duchin and Schmidt (2013).⁴

3.2. Identification of merger waves

Since mergers are found to cluster by industry (Mitchell and Mulherin, 1996; Andrade et al., 2001) we follow Harford (2005) to identify merger waves that occurred in the 48 industry groups

⁴ Duchin and Schmidt (2013) report a final sample of 9,854 acquisitions of which 1,677 (17%) occurred in the first decade of their sample (1980-1989), 4,869 (49%) occurred in the second decade (1990-1999) and 3,308 (34%) occurred in the third decade (2000-2009). The smaller size of their sample is due to more restrictions imposed in their selection criteria. Duchin and Schmidt select only those transactions identified by SDC as mergers, transactions with a reported deal value of at least \$10 million, and that represent at least 5% of the market value of the bidding firm at the time of the announcement. The remaining sample selection criteria are identical to our own.

classified by Fama and French (1997). Ahern and Harford (2014) show that apart from occurring within industries, merger waves also propagate across industries through customer-supplier links. In particular, they find that cross-industry merger activity is more intense when product market connections are stronger and shocks travel across the economy through supplier links. Therefore, in the methodology followed in this section, both intra- and inter-industry deals are taken into consideration to characterize a transaction as in-wave or out-wave. Similar to Harford (2005), if both the acquirer and the target are from the same industry the transaction is counted only once towards the merger total for this industry. If the firms are from different industries, the transaction will count towards merger activity both for the industry of the bidder and the target.

Following Harford (2005) and Duchin and Schmidt (2013) we split the *merger wave sample* into three decades: 1981-1990, 1991-2000 and 2001-2010. For each industry, we identify the 24-month period with the highest number of bids in each decade. These periods are classified as potential waves. We define an actual wave where the concentration of bids in the 24-month period is higher than the 95% percentile of the distribution of a simulated uniform distribution of all mergers that took place in that industry over the decade. Therefore, there can be up to one wave per industry-decade. Following Duchin and Schmidt (2013) potential waves consisting of fewer than 10 transactions are not considered as actual waves.

Following the identification of merger waves, transactions are classified as in-wave or out-wave following the method developed by Harford (2005). For the *merged sample* of acquisitions we define *In-Wave* as a dummy variable that takes the value of one if the acquirer or the target firm's industry is experiencing a merger wave at the point where the acquisition is announced. For the *ExecuComp sample* that examines the propensity of firms to acquire we

define *In-Wave_Year* as a dummy variable that takes the value of one if the firm operates in an industry that experiences a merger wave during the calendar year, and zero otherwise.⁵

3.3. Merger waves descriptive statistics

The method outlined in the previous section identifies 74 waves across 40 industries, which are presented in Table 1. 40 industries are identified with at least one wave, 23 industries with waves in at least two decades and 11 industries with waves in all three decades.^{6,7} For each wave, Table 1 reports the month that the 24-month wave period started and the number of mergers during the wave. The largest wave identified is in the business services industry, began in September 1998 and includes 1,491 completed deals. Harford (2005) identifies a similar wave for this industry at the same starting point. In general, most of the starting points identified in the *merger wave sample* differ to those reported by Harford (2005) only by a few months. For the *merged sample* of 7,689 acquisitions, 2,437 transactions (32% of the sample) are characterized as in-wave deals and the remaining 5,252 (68%) transactions are classified as out-wave transactions. These proportions are identical to those reported in Duchin and Schmidt (2013) who also follow the wave identification strategy of Harford (2005). This shows that, despite the large size of firms covered in ExecuComp, sample firms engage in merger activity at a rate comparable to the general population of firms during in-wave and out-wave time periods.

⁵ Note that *In-Wave* is a transaction variable where conditional on a merger taking place, the transaction is classified as occurring inside or outside of a wave period if either of the bidding and target firm operate in an industry experiencing a wave. *In-Wave_Year* is a firm-year variable and classifies ExecuComp firms according to whether their industry is experiencing a wave during their financial year.

⁶ The *Alcoholic Beverages* and *Tobacco Products* industries do not have 10 or more acquisitions in any 24-month period and the remaining six industries without a merger wave fail to fulfil the wave identification criteria following our simulation tests.

⁷ This is comparable to the findings of Duchin and Schmidt (2013) who report 77 merger waves in their sample period with 38 industries having at least one wave, 28 industries having two waves or more and 11 industries having waves in all three decades.

3.4. Variable definitions and summary statistics for the merged sample

Table 2 reports summary statistics for all compensation and control variables used in the analysis for the *merged sample*. All variables are defined in Appendix A.

3.4.1. CEO compensation

CEO compensation (*Total_Comp_CEO*) is the sum of salary, bonus, the fair value of new stock and option grants and other components of executive pay.⁸ Core and Guay (2002) and Coles et al. (2006) argue that simplified measures equity-based pay used in early studies are only noisy proxies for managerial incentives that are captured by the sensitivity of managers' wealth to stock price changes, delta, and stock return volatility, vega. They show that delta and vega can better explain the compensation characteristics that theoretical models identify as important.

The calculation of *Delta_CEO* and *Vega_CEO* for our sample follows the method developed by Core and Guay (2002) and Coles et al. (2006).⁹ The mean (median) delta value is \$1,524,000 (\$222,000), and the mean (median) value of vega is \$171,000 (\$44,000). The values of compensation variables are generally higher than Cohen et al. (2013) and Croci and Petmezas (2015), which most likely reflects the expected positive relation between managerial incentives and corporate investment documented in these studies.

3.4.2. Post-acquisition performance

Three measures of acquiring firm performance are examined. *CARs(0,1)* measure the short-term market reaction to acquisition announcements and is equal to the acquirer's cumulative abnormal

⁸ These may include severance payments, imputed interest, tax reimbursements, perquisites and other personal payments, contributions to pension plans, life insurance premiums, payment for unused vacation, etc.

⁹ We are grateful to Coles et al., (2006) for making their data on delta and vega publicly available. The data provides estimated values of vega and delta for each executive who appears in the ExecuComp database for the period 1992-2010.

return over a two-day window surrounding the acquisition announcement date, where 0 is the day of the announcement, using the market model. Market model returns are calculated using the CRSP value-weighted index. The estimation period is from 200 days to 60 days before the acquisition announcement. Moreover, in order to maintain independence of observations, when a company has made more than one acquisition announcement at the same date only the transaction with the highest deal value is included in the analysis. We also exclude outliers at the 1% and 99% percentiles of the $CARs(0,1)$ distribution.

$3yABHR$ measures acquirer's 3-year post-acquisition stock price performance. It is calculated as the 3-year daily buy-and-hold return of the acquiring firm beginning one day following the acquisition effective date minus the 3-year daily buy-and-hold return of the matched firm over the same period.¹⁰ All companies with available stock price and accounting data in the CRSP/Compustat database are used as potential matches. Our matched criteria are as follows: the acquiring and matched firms should operate in the same industry;¹¹ the matched firm should have not been involved in any acquisition activity either as acquirer or target for a period of 3 years preceding the acquisition effective date to 3 years following the acquisition effective date; the sum of the absolute difference of the market capitalization value and book-to-market ratio between the acquiring and the matched firm should be minimised. Each acquiring firm is matched to a firm from the pool of the potential matches that best meet these criteria. Matched firms that are delisted before the completion of the 3-year post-acquisition period are substituted with the next closest match on the day of the delisting.¹² Similar to the approach followed for the

¹⁰ One year is defined as 252 trading days.

¹¹ Industries are again defined using the Fama and French (1997) 48 industry classification.

¹² 30 acquirers of our final sample of 7,689 deals do not have available data on market capitalization and book-to-market value in the year end before the announcement and are therefore excluded from the analysis. 747 out of the remaining 7,659 transactions are matched with two firms as the first matched firm is delisted before the passage of three years from the acquisition effective date. 81 acquirers are matched with three firms and 14 acquirers are

calculation of announcement returns, we exclude overlapping observations and outliers at the 1% and 99% percentiles of the $3yABHR$ distribution.

$\Delta IROA$ measures the change in bidder's operating performance over a 3-year period surrounding the acquisition effective date. It is defined as the ratio of acquirer's return on assets (ROA) at the end of the second year following the year of the transaction (t+2) to the acquirer's ROA at the end of the year preceding the year of the transaction (t-1). ROA is defined as operating income before depreciation divided by book value of total assets. Similar to our stock-price performance measures, overlapping observations and outliers at the 1% and 99% percentiles of the distribution are excluded from the analysis without any effect on the results.¹³

3.4.3. Control variables

In subsequent analysis we control for a number of factors that have been identified by previous studies as important determinants of the decision to merger and merging firm's post-acquisition financial and operating performance. As with compensation variables, firm characteristics are measured at the financial year-end prior to the acquisition announcement, unless otherwise specified.

Size is defined as the natural logarithm of the acquiring firm's market value 4 weeks before the announcement date. Moeller et al. (2004) find a negative relation between the size of the acquiring firm and announcement period returns and Gorton et al., (2009) show that merger waves are more likely to occur in industries with more medium-size firms. We define *Relative_Size* as the ratio of the deal value reported in SDC Platinum to the market value of the

matched with four firms that best meet the matching criteria. In 5 cases where no match is possible after the delisting of the first two best matched firms, the industry criterion is dropped.

¹³ Our results remain unchanged across all measures of post-acquisition performance when the treatment of outliers and overlapping observations are dropped.

acquiring firm 4 weeks before the acquisition announcement. Both a positive (Asquith et al., 1983) and a negative (Travlos, 1987) relation between deal size and announcement period abnormal returns has been documented.

Acquisition performance can also be affected by past stock-price performance, cash holdings and growth opportunities of the acquiring firm. Past stock-price performance (*Runup*) is measured as the acquirer's buy-and-hold return between 205 days and 6 days preceding the acquisition announcement minus the buy-and-hold return of the matched firm described previously over the same time period. Rosen (2006) finds that past-performance is negatively related to long-run post-acquisition returns. We define *Cash* as the acquirer's balance of cash and equivalents divided by book value of total assets. Under Jensen's (1988) free cash flow theory, managers of strong performing firms can be driven by hubris and destroy value in acquisitions by overpaying for targets. Harford (1999) also shows that managerial hubris increases in the presence of excess cash. *B/M* is the ratio of the bidder's book value of equity to market value of equity. Rau and Vermaelen (1998) show that acquirers with low book-to-market ratio experience poor post-acquisition performance. Dong et al. (2006) find a positive relation between the book-to-market ratio of the acquiring firm and the market reaction to acquisition announcements.

Following Harford (1999), acquirer's return on assets, sales growth, leverage, price-to-earnings ratio, non-cash working capital, capital expenditures and research and development (R&D) expenditures are used as additional explanatory variables in the M&A selection models. *ROA* is defined previously. *Sales_Growth* is a forward measure of growth opportunities and is defined as the natural logarithm of the ratio of revenues at year t+1 divided by revenues in year t. *P/E* is the stock price of the acquiring firm divided by earnings per share. *Leverage* is acquirer's book value of total debt divided by book value of total assets. *Leverage* is also used as a control

variable when we examine the relation between incentive compensation and deal performance, as Moeller et al. (2004) show that leverage is negatively correlated with announcement returns. *NC_Working_Cap* is equal to acquirer's current assets net of cash and equivalents minus current liabilities, divided by book value of total assets. *CAPEX* is capital expenditures divided by book value of total assets. *R&D* is defined as research and development expenses divided by book value of total assets.¹⁴

Finally, in models examining long-run performance following merger completion we also control for selection bias since not all acquiring firms are expected to have survived for 3 years following the transaction. The model requires the use of an instrumental variable in the first-stage model predicting firm survival over the post-acquisition period that does not appear in the second-stage regression to explain long-run post-acquisition performance. We define *Months_Surv.* as the number of months between the first acquisition made by the acquiring firms during the *merger wave sample* period January 1, 1981, to December 31, 2010 and the most recent deal that we evaluate long-run performance surrounding. If the company has not made a previous acquisition during the 1981 to 2010 period this variable takes the value of zero.

4. Empirical findings

4.1. Executive compensation and the propensity to acquire

Table 3 presents differences in compensation characteristics between CEOs that initiate acquisitions during merger waves and CEOs that acquire outside a wave for the *merged sample*. Panel A presents dollar values for delta, vega and cash compensation.

The wealth of managers who initiate in-wave acquisitions appears to be less sensitive to changes in stock price and stock return volatility in comparison to the wealth of out-wave

¹⁴ When the value of research and development expenditure is missing from Compustat we set it equal to zero.

acquiring managers. The wealth of out-wave acquiring CEOs changes by \$1,605,730 for a 1% change in the stock price compared to a \$1,348,980 change in the wealth of in-wave acquiring CEOs, but the difference in is not statistically significant. The average change in the wealth of CEOs for in-wave deals for a 1% change in the standard deviation of stock returns is \$157,750 compared to \$177,620 for out-wave acquiring CEOs and the difference in vega is statistically significant at the 5 percent level. A significantly lower vega during in-wave time periods suggests that managerial wealth is less sensitive to risk during active takeover markets. We interpret this as evidence of sub-optimal contracting where managers are less sensitive to stock price risk when making investment decisions during in-wave time periods. Weaker compensation incentives can dampen risk-inducing incentives from executive compensation during active takeover markets, and reduce the quality of merger decisions. Panel A also shows that the average dollar value of cash compensation for in-wave acquiring CEOs is higher relative to that of out-wave acquiring CEOs. This can further result in value-decreasing decisions since a high proportion of cash compensation can increase managerial entrenchment and negatively affect firm performance (Berger et al., 1997; Brick et al., 2006).

Since dollar differences in incentive compensation can stem from differences in firm size and the total value of the compensation package, Panel B presents differences in compensation variables standardized by CEO total compensation. The difference in pay-performance sensitivity between in-wave and out-wave acquiring CEOs remains statistically insignificant. In contrast, the difference in the sensitivity of CEO's wealth to stock return volatility remains important economically and statistically. After scaling by total compensation, vega incentives during out-wave periods are 1.68 times higher relative to in-wave periods. The difference in cash compensation also remains statistically important at the 1 percent level. In-wave acquiring CEOs

receive 2.1% more of their total compensation through salary and cash bonus payments than out-wave acquiring CEOs. The results suggest that the findings in Panel A are robust to controlling for firm size.

These findings provide preliminary evidence allowing the rejection of H_1 , showing that managers who make out-wave acquisitions are better incentivized than those who acquire during merger waves. This can provide a partial explanation for the documented underperformance of in-wave acquisitions (Bouwman et al., 2009; Goel and Thakor, 2010), in as much as the wealth of acquiring CEOs making acquisitions during in-wave periods is less sensitive to stock price risk relative to acquiring CEOs undertaking mergers during out-wave time periods.

We extend these univariate results, and control for selection bias in focusing only on acquiring firms, by examining whether the propensity to acquire is affected by CEO incentives, and whether this varies conditional on merger waves. To avoid selection bias, we conduct this testing using the *ExecuComp sample* of 30,995 firm-year observations. Since corporate acquisitions are investment decisions that increase firm risk, a positive relation is expected between the sensitivity of CEO's wealth to stock return volatility and the propensity to acquire (Coles et al., 2006; Croci and Petmezas, 2015).

Following Harford (1999), we construct a probit model that predicts acquiring firms based on a number of explanatory variables at the year-end prior to the acquisition announcement. The dependent variable, *Acquisition*, equals one if a firm makes an acquisition announcement in a given year and zero otherwise. In addition to our compensation variables, the propensity to acquire is also related to firm characteristics including acquirer's size, past performance, cash holdings, growth prospects, leverage, and non-cash working capital.

Table 4 presents the results. Model 1 confirms our base predictions, showing that higher vega increases the propensity to acquire. On the other hand, pay-performance sensitivity, delta, is unrelated to the likelihood of making an acquisition. The relation between the likelihood to acquire and cash compensation is positive and statistically strong. While inconsistent with incentive compensation predictions (Datta et al., 2001) the finding is in line with Croci and Petmezas (2015) and Cohen et al. (2013) who find that cash compensation is positively associated with investment in risky projects. By construction, the *In-Wave_Year* dummy is positively related to the likelihood of acquisitions.

The remaining control variables are also according to expectations. Large and cash-rich firms are more likely to acquire (Harford, 1999) and so are firms with good past stock-price performance, indicating that acquisition decisions may be driven by managerial hubris (Roll, 1986). On the other hand, highly leveraged firms tend to avoid the increased risk associated with acquisitions. The propensity to acquire is also positively related to growth opportunities, as measured by recent sales growth and the bidder's book-to-market ratio.

In Model 2 we introduce interaction terms between incentive compensation variables and the *In-Wave_Year* dummy to examine whether the positive impact of incentive compensation on the propensity to acquire varies across merger wave conditions. We find that the coefficient of *Delta_CEO*In-Wave_Year* is insignificant, which is unsurprising given the findings in Model 1 and the statistically insignificant difference in *Delta_CEO* between in-wave and out-wave acquiring managers in Table 3.

We find that the coefficient of *Vega_CEO*In-Wave_Year* is negative and statistically significant at the 5 percent level, offsetting the positive impact of *Vega_CEO* on the propensity to initiate acquisitions. The (unreported) p-value of the joint coefficient *Vega_CEO + Vega*In-*

Wave_Year is 0.963 showing that the joint coefficient is statistically insignificant. The positive coefficient for *Vega_CEO* implies that sensitivity to stockholder risk increases the likelihood of managers making merger decisions. The significant and negative coefficient on the interaction term though indicates that offering risk-taking incentives to managers during wave periods does not increase acquisition investments. The signs and significance of the remaining control variables are identical to those in Model 1.

Partitioning the sample into in-wave and out-wave years in Models 3 and 4 respectively confirms the results of Model 2. While both measures of incentive compensation are unrelated to the propensity to acquire during in-wave years, *Vega_CEO* is positive and statistically significant at the 1 percent level in Model 4, which examines the propensity to acquire for out-wave firm-years. The results show that incentive compensation induces acquisition activity only outside of merger waves, which allows us to reject the null H_1 . If in-wave acquisitions destroy stockholder value, as shown in prior literature, our findings are consistent with the incentive-alignment hypothesis.¹⁵

4.2. Deal performance across in-wave and out-wave periods

Prior to examining the relation between incentive compensation and firm performance, we first confirm the long-run underperformance of merger transactions inside and outside of merger waves. Table 5 presents the output of multivariate regressions that examine the relation between merger waves and both short- and long-run performance for the *merged sample*. The key explanatory variable of interest in Table 5 is *In-Wave*. If in-wave acquirers underperform relative

¹⁵ Our core results on the relation between vega, merger waves and the propensity to acquire are consistent when we re-estimate our regression models using deal values for all acquisitions during the financial year as the dependent variable. We replace the *Acquisition* dummy variable with *Acquisition_Spending*, which is the sum of all deal values for completed mergers meeting our sample selection criteria during the firm's financial year scaled by total revenues at the previous year-end. We estimate these models using Tobit regressions.

to their out-wave counterparts, the coefficient of *In-Wave* should take a negative and statistically significant value.

In Model 1 we examine difference in short-run stock price returns surrounding the announcement date. The coefficient of *In-Wave* is statistically insignificant showing that short-term announcement returns do not vary between in-wave and out-wave periods for our sample, confirming the findings of Duchin and Schmidt (2013). The coefficients of our control variables are according to expectations. Acquisition announcement returns are negatively related to the size of the acquiring firm (Moeller et al., 2004) and the relative size of the transaction (Travlos, 1987). The market reacts more positively to acquisitions financed by cash relative to stock deals (Rhodes-Kropf and Viswanathan, 2004; Travlos, 1987) and the value destruction in public deals (Fuller et al., 2002, Officer 2007) is confirmed by the negative coefficient of the *Public* variable. The results also indicate that the decision to acquire can be driven by managerial hubris as both bidders' past stock-price performance and cash holdings are negatively related to the market reaction, confirming Jensen's (1988) free cash flows theory and the findings of Rosen (2006). The negative impact of managerial hubris on firm value highlights the potential importance of compensation-related managerial incentives in acquisition decisions.

The next two sets of models (Models 2-3 and 4-5) test whether long-term post-acquisition stock price and operating performance respectively differs between in-wave and out-wave acquirers. Since not all acquiring firms survive for three years following the acquisition, we control for selection bias using Heckman (1979) two-step selection model. The dependent variable for the probit regressions (Models 2 and 4) is a dummy variable that takes the value of one if the acquirer survives for three years following the acquisition effective date, and zero otherwise. The instrumental variable explaining survival following the first acquisition by the

acquiring firm during our sample period, *Months_Surv.*, is positively related to the likelihood of surviving for three years following the transaction. The difference between the number of total and uncensored observations indicate that the bidders of 1,139 transactions in the *merged sample* don't survive as independent entities for three years post acquisition.

Our results show that regardless of whether long-run performance is measured by acquirer's 3-year abnormal buy-and-hold return or the change in ROA of the acquiring firm, deals initiated during merger waves underperform relative to out-wave deals. The coefficient of *In-Wave* is negative and statistical significant at the 5 percent level (1 percent level) when long-run performance is measured by *3yABHR* ($\Delta IROA$). The findings are consistent with previous studies that document financial and operating long-run underperformance for acquisitions initiated during hot markets (Bouwman et al., 2009; Goel and Thakor, 2010).

Examining our control variables, larger firms and firms that finance the merger with cash have a higher possibility to survive for three years following the transaction whereas the likelihood of surviving is considerably lower for undervalued firms (Models 2 and 4). The latter is according to expectations given that undervalued firms are potential targets for relatively overvalued acquirers (Shleifer and Vishny, 2003; Rhodes-Kropf et al., 2005).

The coefficient of the inverse Mills ratio is statistically significant only at the 10 percent level in Model 3, indicating that certain unobservable characteristics that increase the likelihood of the acquirer to survive post-acquisition are positively related to acquirer's long-run stock-price performance. However, the inverse Mills ratio is insignificant in Model 5, showing that selection bias is not an important driver of long-run operating performance post-acquisition.

4.3.CEO compensation, merger waves and acquisition performance

Having confirmed that in-wave acquisitions underperform in the long-term relative to out-wave acquisitions, we extend this analysis to consider how incentive compensation impacts subsequent merger performance across in-wave and out-wave periods. Table 6 examines the relation between CEO compensation and short-term acquisition announcement returns for the *merged sample*.

In Model 1 we find that vega is positively related with the market reaction to the announcement. This is consistent with previous research findings that acquisitions made by managers with higher proportions of option-based compensation experience better announcement returns (Datta et al., 2001; Minnick et al., 2011). In-contrast, delta is unrelated to merger announcement returns. Cash compensation is also positively related to the market reaction to acquisition announcements.

The remaining control variables are according to expectations. Large firms experience lower announcement returns when they acquire (Moeller et al., 2004); acquisitions financed by cash have a more positive stock price response (Travlos, 1987; Rhodes-Kropf and Viswanathan, 2004); and firms with strong past performance and higher levels of cash appear to destroy value in corporate takeovers (Jensen, 1988). Acquisition announcement returns are also lower when the size of the deal is large relative to the size of the acquiring firm (Travlos, 1987) and when the target is a publicly listed firm (Fuller et al., 2002; Officer, 2007).

Models 2 and 3 partition acquisitions into those initiated inside and outside of merger waves respectively. We find that delta is unrelated to announcement returns in both cases. We do find that vega is positively related to announcement returns only outside of merger waves. We interpret this finding as suggesting that although risk-based incentive compensation is positively

correlated with short-term returns outside of merger waves, the managerial euphoria and hubris that characterize periods of merger waves override the positive impact of incentive pay on decision making. In addition, as shown in Table 3, in-wave acquiring managers are provided with weaker incentives regarding the sensitivity of their wealth to firm risk relative to out-wave acquiring managers, suggesting that weaker compensation incentives are ineffective in motivating stockholder value-maximizing decisions during in-wave periods.

Turning to long-run post-acquisition performance, Table 5 shows that in-wave acquirers experience lower abnormal buy-and-hold abnormal returns in the three years following the merger than firms that acquire during out-wave periods. Table 7 examines whether this difference in long-run stock-price performance can be attributed to differences in the structure of CEO compensation. Similar to section 4.2, issues of selection bias are addressed using the two-step selection method developed by Heckman (1979). Models 1, 3 and 5 present the output of probit regressions where the dependent variable equals one if the acquiring firm survives 3 years after the transaction, and zero otherwise. Models 2, 4 and 6 present second-stage OLS regressions that examine the impact of CEO compensation, firm and deal characteristics on acquirer's 3-year post-acquisition abnormal buy-and-hold return. The second-stage OLS regressions include surviving firms only.

Models 1 and 2 present the results for the full *merged sample*. Model 1 shows that delta is positively related to the likelihood of surviving three years following the acquisition. Both vega and delta are also positively related to acquirer's *3yABHR* in Model 2 showing that when CEO compensation is more closely linked to stock price performance and volatility respectively, managers make acquisitions that increase value for acquiring firm stockholders in the long-run. Datta et al., (2001) also report a significant and positive relation between equity-based

compensation and post-acquisition stock price performance. Cash compensation has a strong, negative relation with the probability of firm survival and is weakly positively associated with long-run acquisition performance. The Mills ratio is insignificant in Model 2.

Models 4 and 6 present results for the relation between incentive compensation and long-run post acquisition performance separately for in-wave and out-wave acquisitions respectively. Model 4 shows that both delta and vega are unrelated to long-run stock-price performance when acquisitions for in-wave mergers. On the other hand, we find in Model 6 that delta and vega are statistically significant and positively related to acquirer's long-run financial performance when acquisitions are initiated outside of merger waves.

Combined with our univariate comparison of incentive compensation in Table 3 the results presented here indicate that the long-run underperformance of in-wave mergers can, at least partially, be attributed to weak compensation incentives provided to in-wave acquiring CEOs. The results are similar to those for short-run acquiring firm performance; *Vega_CEO* in Model 4 is statistically insignificant while *Vega_CEO* in Model 6 is positively related to long-run stock performance post-merger. We propose that increased information asymmetry and resulting weak monitoring of acquiring firm managers during merger waves reduces the penalties for making bad acquisitions (Duchin and Schmidt, 2013). Moreover, during in-wave periods managers are able to benefit from greater increases in ex-post compensation following even poorly performing mergers (Goel and Thakor, 2010), which outweighs the ex-ante compensation benefits from their existing compensation package. These effects offset the positive impact of ex-ante pay incentives on the quality of acquisition decisions during in-wave periods.

Other firm and deal characteristics in Table 7 also favor out-wave acquisitions. Cash acquirers experience higher long-run stock-price returns only when they acquire outside of

merger waves. A positive relation between diversifying acquisitions and long-term performance is also documented only for out-wave deals. In addition, the negative relation between cash holdings and acquisition performance is restricted to in-wave transactions. Jointly, the findings from Tables 5 to 7 lead to the rejection of the null H_2 .

The final test in this section examines the relation between executive compensation and long-run operating performance. Table 8 presents the results for the full *merged sample*. We control for selection bias using the same method outlined previously. The coefficient of *Delta_CEO* in all three first stage probit regressions (Models 1, 3 and 5) is positive and significant, showing that the higher sensitivity of CEO's wealth to stock price changes increases the acquirer's likelihood of surviving three years following the acquisition. However, in contrast to our findings for long-run stock-price performance, both vega and delta are unrelated to post-acquisition operating performance in Models 2, 4 and 6.

For our control variables, cash compensation is negatively related to the likelihood of the acquiring firm surviving for three years following the merger. The coefficient of the inverse Mills ratio is not statistically significant in any model indicating that bidder's operating performance is not driven by unobservable characteristics related to surviving firms. The book-to-market ratio is positively related to long-run changes in operating performance post-acquisition, which is consistent with superior performance for value relative to glamour acquiring firms (Rau and Vermaelen, 1998).

4.4. Merger waves and dispersion of acquisition returns

Our results so far show that in-wave bidders experience lower post-acquisition returns relative to out-wave bidders and that this difference can, at least partially, be attributed to weaker incentives

provided to out-wave acquiring managers via their compensation contracts. In this section, we examine whether the dispersion of post-acquisition abnormal returns varies between high and low incentive compensation managers and across in-wave and out-wave acquiring firms in order to test hypothesis H_3 . If the decision to acquire during a merger wave is associated with higher adverse selection costs, we expect higher dispersion of cross-sectional post-acquisition returns for in-wave acquirers relative to out-wave acquiring firms. During waves, adverse selection costs are higher, target firm quality is more difficult to determine and therefore acquiring firms are more likely to over-pay for target firms. Initiating acquisitions during periods of high adverse selection costs is expected to lead to greater variation in the quality of merger decisions and result in a high dispersion of the potential outcomes.

Following Yung et al. (2008) we calculate the cross-sectional standard deviation of acquirer's daily cumulative abnormal returns and abnormal buy-and-hold returns for four different time intervals: 3 months, 6 months, 9 months and 12 months. CARs and ABHRs are calculated as described previously using the returns on the market value-weighted index and control matched firms respectively as benchmarks. This approach assumes that private information on acquirer and target firm quality is released to the market following completion of the acquisition, which contributes to the dispersion of post-acquisition returns.

Table 9 presents the results of this testing. We confirm that the cross-sectional dispersion of post-acquisition returns is significantly higher for in-wave deals relative to out-wave deals using all eight measures and post-acquisition time periods. Taking the 6-month CARs (ABHRs), the cross-sectional standard deviation of returns is 0.2700 (0.3675) for in-wave acquirers and 0.2309 (0.3262) for out-wave acquiring firms. All differences are significant at the 1 percent level based on an F-test comparison of sample variances. The cross-sectional dispersion of

ABHRs is higher than for CARs in any given time period. This arises because the returns of control firms are more volatile than returns on the market index, which increases the variance of the difference between the acquiring firm's return and that of the benchmark (Yung et al., 2008). We propose that the higher dispersion of post-acquisition returns for wave periods is driven by higher adverse selection costs during wave periods and the reduced ability to monitor the actions of acquiring managers. This leads to an increase in the number of low quality acquisitions during wave periods.

Our previous findings show that incentive compensation leads to higher quality merger decisions, on average, based on short- and long-term stock price performance. We now extend this analysis to examine how incentive compensation affects the cross-sectional dispersion of abnormal returns. This provides a measure of the relation between incentive compensation and consistency in the quality of merger decisions. These results are presented in Table 10. The sample is partitioned into *High* and *Low* incentives based on the level of incentive compensation provided to bidder's CEO. Bidding firms with *Delta_CEO* above the sample median are classified as *High Delta* and bidding firms with *Delta_CEO* equal to or lower than the sample median are classified as *Low Delta*. Similarly, acquirers with *Vega_CEO* above the sample median are classified as *High Vega* and the remaining ones as *Low Vega*.

Panel A presents differences in the standard deviation of cross-sectional acquisition returns based on different levels of incentive compensation for the full sample of acquiring firms. *High Vega* firms experience significantly lower cross-sectional dispersion of returns than *Low Vega* acquirers over each time period and measure of abnormal returns. All differences are significant at the 1 percent level. Our findings for delta are somewhat weaker. Differences in delta cannot explain any difference in the cross-sectional standard deviation of CARs, but the

dispersion of buy-and-hold returns is lower for high delta managers for up to 9 months following mergers. The findings are in line with expectations given that vega measures CEO's risk-seeking compensation incentives and can therefore explain changes in risk-related parameters better than delta (Coles et al., 2006; Cohen et al., 2013).

Panels B and C present the dispersion of cross-sectional returns for in-wave and out-wave acquirers respectively. We find in Panel B that compensation incentives provided to in-wave acquiring managers cannot explain differences in the post-acquisition cross-sectional standard deviation of returns in this group of firms.¹⁶ On the other hand, the findings in Panel C show that higher sensitivity of out-wave acquiring CEOs' wealth to stock returns volatility can explain cross-sectional dispersion in post-acquisition abnormal returns. Out-wave acquiring managers with higher vega make more consistent acquisition decisions based on the dispersion of post-acquisition abnormal returns. The results are again stronger for vega than for delta, which is in line with the findings in the previous section. Collectively, the results in this section provide strong support to reject the null H_3 .

5. Conclusions

We present new evidence to show that the underperformance of acquisitions initiated during merger waves can be explained, in part, by differences in the compensation incentives of acquiring firm managers. We find that CEOs who make acquisitions outside of merger waves are better incentivized than their counterparts who initiate in-wave acquisitions. The wealth of out-wave acquiring managers is more sensitive to the volatility of stock price returns while in-wave acquiring managers receive a higher proportion of cash compensation.

¹⁶ With the exception of the difference in 12-month CARs between *High Vega* and *Low Vega* acquirers.

In line with the efficient contracting hypothesis we find that pay-risk sensitivity is positively associated with the propensity to acquire. However, this relation is observed only outside of merger wave periods. In-wave acquisitions are subject to greater adverse selection concerns for acquiring firm stockholders. Better incentivized out-wave acquiring managers can overcome such concerns but this is not the case for in-wave acquiring CEOs in the presence of weaker ex-ante compensation incentives and reduced monitoring during in-wave periods.

These differences in the structure of executive compensation have direct implications for the performance of the acquiring firms. We find that pay-risk sensitivity is positively associated with both short-term and long-term stock price performance of acquiring firms only when an acquisition is initiated outside a merger wave. In contrast, the weaker incentives provided to in-wave acquiring CEOs, along with higher adverse selection costs and managerial hubris surrounding periods of merger waves offset the positive impact of incentive compensation on firm performance. As a result, in-wave deals also experience greater dispersion of cross-sectional acquisition returns.

Our findings show that offering equity-related incentives to managers who acquire during merger waves fails to increase value for acquiring firm stockholders. Since this form of compensation can be costly for the firm, awarding restricted stock and option grants when it is inefficient to do so can result in further value destruction for stockholders. More generally, our findings show that remuneration committees should consider external market conditions in setting appropriate ex-ante incentives for CEOs to engage in risky investment decisions.

Our findings also add to the body of literature that focuses on the long-run underperformance of mergers during waves. We extend the analysis of Duchin and Schmidt (2013) who show that higher adverse selection costs and resulting weak monitoring incentives

for acquiring firm managers can partially explain the low quality of these decisions on average. Our findings show that part of the explanation for this poor post-acquisition performance lie in the weak compensation incentives provided to acquiring firm managers during in-wave relative to out-wave periods.

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Table 1: Distribution of merger waves across industries and time

The table presents the distribution of 74 merger waves for the Fama and French (1997) 48 industry classifications across time. Merger waves last for two years and are identified based on the method developed by Harford (2005) for a sample of 35,829 completed U.S. acquisitions from SDC Platinum over the period January 1, 1981 to December 31, 2010.

Industry	1981-1990		1991-2000		2001-2010	
	Start of Wave	No of bids	Start of Wave	No of bids	Start of Wave	No of bids
Agriculture			Feb-96	28		
Aircraft	Jul-83	25	Sep-97	37		
Alcoholic Beverages						
Apparel					Nov-04	43
Automobiles and Trucks			Jun-96	77		
Banking	Apr-82	356	Nov-96	676	Jul-03	339
Business Services	Jan-89	165	Sep-98	1,491	Jan-01	812
Business Supplies			Jul-97	54		
Candy and Soda						
Chemicals			Aug-97	88		
Coal					Jul-04	27
Computers			Apr-98	331	Jan-01	181
Construction	Oct-82	27	Dec-96	110		
Construction Materials	Feb-83	67	Aug-96	109	Feb-03	62
Consumer Goods			Jan-97	85		
Defense			Dec-96	19		
Electrical Equipment			Mar-95	63		
Electronic Equipment	Nov-82	76	Jan-99	431	Feb-01	251
Entertainment			Oct-96	155		
Fabricated Products			Apr-96	36		
Food Products			Jul-97	63	Dec-05	42
Healthcare	Jan-83	81	Jan-96	324	Dec-04	136
Insurance			Jun-96	157	Oct-01	86
Machinery			Sep-96	214	Jan-06	109
Measuring & Control Equip	Jan-83	48	Dec-95	108		
Medical Equipment			May-95	158	Feb-05	133
Miscellaneous						
Nonmetallic Mining						
Personal Services			Jan-97	102		
Petroleum and Natural Gas	Jan-83	117	Jun-96	291	Jan-06	238
Pharmaceutical Products			Jun-98	124		
Precious Metals						
Printing and Publishing			Jun-97	61		
Real Estate	Mar-83	42	Feb-97	693	Jan-05	195
Recreational Products			Nov-96	53		
Restaurants, Hotel, Motel	Feb-83	46	Jul-96	366	Feb-05	118
Retail			Sep-96	276	May-05	119
Rubber and Plastic Products			Aug-97	53		
Shipbuilding, Railroad Eq			Jul-97	16		
Shipping Containers						
Steel Works, Etc.	Apr-82	33	May-96	81		
Telecommunications	Apr-82	97	Jan-99	414	Jan-01	186
Textiles						
Tobacco Products						
Trading	Feb-82	252	Nov-96	1,107	Apr-05	584
Transportation			Sep-96	166	Dec-05	92
Utilities	Jan-89	59	Dec-96	135		
Wholesale	Jun-83	82	Dec-96	407	Jun-05	145

Table 2: Summary statistics

The table presents summary statistics for the sample of 7,859 completed U.S. acquisitions from SDC Platinum over the period January 1, 1993, to December 31, 2010. Data on executive compensation are from ExecuComp, stock price data from CRSP and accounting data from Compustat. Definitions of all variables are as described in the appendix.

Variable	Mean	Standard Deviation	25th Percentile	Median	75th Percentile	Number of Observations
<i>Compensation Variables</i>						
Delta_CEO (\$000s)	1,524	15,877	68	222	681	7,689
Vega_CEO (\$000s)	171	427	11	44	146	7,689
Cash_Comp_CEO (\$000s)	1,737	2,432	720	1,169	1,946	7,689
Total_Comp_CEO (\$000s)	7,196	16,126	1,550	3,147	7,317	7,689
<i>Deal & Firm Characteristics</i>						
Size	14.884	1.645	13.670	14.670	15.910	7,859
Relative_Size	0.120	0.248	0.012	0.039	0.113	7,859
Runup	0.043	0.823	-0.218	0.036	0.310	7,829
Cash	0.154	0.179	0.026	0.076	0.225	7,821
B/M	0.592	0.282	0.370	0.590	0.820	7,799
ROA	0.132	0.105	0.064	0.131	0.191	7,854
Sales_Growth	0.065	0.124	0.004	0.045	0.106	7,708
Leverage	0.228	0.168	0.096	0.211	0.331	6,937
R&D	0.034	0.063	0.000	0.000	0.049	7,859
CAPEX	0.046	0.058	0.010	0.030	0.060	7,713
P/E	25.318	165.185	12.794	19.160	30.729	7,813
NC_Working_Cap	0.130	0.165	0.011	0.111	0.227	6,244
Months_Surv.	91	79	24	74	144	7,859

Table 3: Difference in CEO compensation between in-wave and out-wave acquirers

The table presents differences in CEO compensation incentives between in-wave and out-wave acquiring firms. The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Data on executive compensation are from ExecuComp. *Delta_CEO* is the dollar change in CEO's wealth for a 1 percent change in firm's stock price. *Vega_CEO* is the dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns. *Cash_Comp_CEO* is the sum of CEO's salary and bonus. *Total_Comp_CEO* is the sum of CEO's salary, bonus, new stock and option grants and other forms of compensation. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). t-statistics are from the t-test for difference in means. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Panel A: Compensation Characteristics (dollar value)				
	In-Wave	Out-Wave	Difference	<i>t statistic</i>
Delta_CEO	1,348.98	1,605.73	-256.75	-0.75
Observations	2,437	5,252		
Vega_CEO	157.75	177.62	-19.88**	-2.08
Observations	2,437	5,252		
Cash_Comp_CEO	1,875.77	1,672.06	203.71***	3.02
Observations	2,437	5,252		
Panel B: Compensation Characteristics scaled by Total Compensation				
	In-Wave	Out-Wave	Difference	t statistic
Delta_CEO / Total_Comp_CEO	0.7338	1.0466	-0.3128	-0.74
Observations	2,437	5,252		
Vega_CEO / Total_Comp_CEO	0.0203	0.0342	-0.0139***	-2.85
Observations	2,437	5,252		
Cash_Comp_CEO / Total_Comp_CEO	0.4828	0.4619	0.0209***	2.81
Observations	2,437	5,252		

Table 4: Compensation incentives and the propensity to acquire

The table presents the results of probit regressions for the extended ExecuComp sample of 30,995 firm-year observations over the period 1992-2009. Executive compensation data are from ExecuComp, stock price data from CRSP and accounting data from Compustat. The dependent variable, *Acquisition*, takes the value of one if a firm makes an acquisition announcement in a given year and zero otherwise. *In-Wave_Year* is a dummy variable that takes the value of one if the industry experiences a merger wave during the calendar year and zero otherwise. Merger waves are identified based on the method developed by Harford (2005). *Delta_CEO* is the dollar change in CEO's wealth for a 1 percent change in firm's stock price. *Vega_CEO* is the dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns. *Cash_Comp_CEO* is the sum of CEO's salary and bonus. Definitions of control variables are described in the Appendix. t-statistics, based on robust standard errors, are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Variable	(1) All	(2) All	(3) In-Wave Year	(4) Out-Wave Year
Intercept	-2.8026*** (-16.68)	-2.0756*** (-16.62)	-2.1635*** (-8.98)	-1.9261*** (-13.15)
Delta_CEO	0.0012 (1.28)	0.0009 (0.48)	0.0011 (1.05)	0.0011 (0.56)
Vega_CEO	0.1003** (2.51)	0.1500*** (3.11)	-0.0232 (-0.37)	0.1645*** (3.21)
Cash_Comp_CEO	0.0222*** (3.19)	0.0222*** (3.20)	0.0321*** (2.95)	0.0173** (2.11)
In-Wave_Year	0.2120*** (9.87)	0.2290*** (9.96)		
Delta_CEO * In-Wave_Year		0.0005 (0.22)		
Vega_CEO * In-Wave_Year		-0.1473** (-2.07)		
Size	0.0766*** (9.38)	0.0756*** (9.24)	0.0900*** (5.83)	0.0684*** (7.08)
Past_ABHR	0.0220* (1.85)	0.0224* (1.88)	0.0771*** (3.56)	-0.0139 (-0.83)
Cash	0.1868*** (2.92)	0.1867*** (2.92)	0.1385 (1.16)	0.1883** (2.47)
B/M	-0.1909*** (-5.51)	-0.1902*** (-5.50)	-0.1752* (-1.96)	-0.1994*** (-5.50)
ROA	0.0167 (0.19)	0.0182 (0.21)	0.1769 (1.03)	-0.0401 (-0.39)
Sales_Growth	0.7381*** (8.52)	0.7432*** (8.59)	0.6675*** (4.25)	0.7744*** (7.36)
Leverage	-0.1862*** (-2.70)	-0.1863*** (-2.70)	-0.0383 (-0.29)	-0.2338*** (-2.89)
P/E	0.0000 (0.00)	0.0003 (0.05)	-0.0012 (-0.13)	0.0011 (0.15)
NC_Working_Cap	0.1310** (2.17)	0.1323** (2.19)	0.4326*** (3.74)	0.0114 (0.16)
Number of Observations	24,844	24,844	6,041	18,803
Wald Chi-Square	689.56***	694.52***	204.91***	381.64***
Pseudo R-Square	0.033	0.033	0.033	0.026

Table 5: Merger waves and deal performance

The table presents the results of multivariate analysis and sample selection models following Heckman (1979) of acquisition performance on deal and firm characteristics. The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Stock price data are from CRSP and accounting data from Compustat. The dependent variable for the first-stage regression in Heckman selection models is a dummy variable that equals one if the acquiring firm survives for three years after the acquisition effective date and zero otherwise. $CARs(0.1)$ is the bidder's cumulative abnormal returns over a two-day event window (0, +1) where 0 is the announcement date using the market model. The estimation period is from 200 days to 60 days before the acquisition announcement. $3yABHR$ is the bidder's 3-year buy-and-hold daily returns following the acquisition effective date minus the 3-year buy-and-hold daily returns of the matching firm for the same period. $\Delta IROA$ is the difference between the acquirer's return on assets (ROA) at the end of the second year following the transaction (t+2) and the acquirer's ROA at the end of the year preceding the transaction (t-1) adjusted for the industry median. ROA is defined as Operating Income before Depreciation divided by total assets. The $Months_Surv.$ variable measures the number of months the acquiring firm has survived since its first acquisition during the period January 1, 1981, to December 31, 2010. $In-Wave$ is a dummy variable that takes the value of one if the acquisition has been initiated during a merger wave and zero otherwise. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). Definitions of control variables are described in the Appendix. t-statistics, based on robust standard errors, are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Variable	(1) CARs(0.1)	(2) Selection	(3) 3yABHR	(4) Selection	(5) $\Delta IROA$
Intercept	3.9841*** (6.77)	0.0780 (0.36)	0.1870 (0.59)	0.3035 (1.30)	-0.0499** (-2.28)
In-Wave	-0.0993 (-0.31)		-0.0636** (-2.41)		-0.0103*** (-4.69)
Months_Surv.		0.0011*** (4.25)		0.0011*** (4.00)	
Size	-0.2107*** (-6.21)	0.0717*** (5.40)	-0.0196 (-1.28)	0.0444*** (3.09)	0.0011 (1.13)
Payment_Cash	0.4019*** (3.75)	0.1287*** (3.29)	0.0903** (2.52)	0.1527*** (3.67)	-0.0039 (-1.30)
Diversifying	-0.0560 (-0.55)	0.0962** (2.56)	0.0880*** (2.84)	0.0982** (2.46)	0.0005 (0.21)
Runup	-0.2349*** (-3.13)	0.0215 (1.03)	-0.0245 (-1.49)	0.0091 (0.42)	0.0019 (1.53)
Cash	-0.8225** (-2.29)	-0.5520*** (-5.10)	-0.1824 (-1.42)	-0.5457*** (-4.75)	-0.0056 (-0.57)
Public	-1.2771*** (-8.66)	-0.0113 (-0.21)	-0.0103 (-0.27)	0.0042 (0.07)	-0.0030 (-1.05)
Private	-0.1344 (-1.15)	-0.0156 (-0.35)	-0.0169 (-0.54)	-0.0670 (-1.43)	-0.0010 (-0.38)
Relative_Size	-0.6388* (-1.88)	0.0196 (0.25)	0.0217 (0.36)	0.1210 (1.51)	-0.0055 (-1.28)
B/M	-0.4200** (-1.97)	-0.3541*** (-4.84)	-0.1548** (-2.07)	-0.3500*** (-4.58)	0.0462*** (8.05)
Inverse_Mills			0.7163* (1.66)		-0.0035 (-0.11)
Total Observations	7,376	7,416		5,741	
Uncensored Observ.	-		6,277		4,602
F-statistic	22.95***	-		-	
Wald Chi-Square	-	40.56***		193.02***	

Table 6: Bidder's announcement returns, merger waves and CEO compensation

The table presents multivariate regression results of bidder's two-day CARs (0.1) on CEO compensation and other firm and deal characteristics. The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Data on executive compensation are from ExecuComp, stock price data from CRSP and accounting data from Compustat. The dependent variable is $CARs(0.1)$ and it is defined as the bidder's cumulative abnormal returns over a two-day event window (0, +1) where 0 is the announcement date using the market model. The estimation period is from 200 days to 60 days before the acquisition announcement. Δ_{CEO} is the dollar change in CEO's wealth for a 1 percent change in firm's stock price. $Vega_{CEO}$ is the dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns. $Cash_Comp_CEO$ is the sum of CEO's salary and bonus. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). Definitions of control variables are described in the Appendix. t-statistics, based on robust standard errors, are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Variable	(1) Full Sample	(2) In-Waves	(3) Out-Waves
Intercept	5.3065*** (8.08)	4.8863*** (3.94)	5.3910*** (6.95)
Delta_CEO	0.0055 (1.14)	0.0039 (0.17)	0.0059 (0.91)
Vega_CEO	0.4167*** (3.02)	0.2670 (1.05)	0.4558*** (2.78)
Cash_Comp_CEO	0.0523*** (2.77)	0.0477* (1.75)	0.0570** (2.01)
Size	-0.3073*** (-7.68)	-0.2924*** (-3.93)	-0.3095*** (-6.46)
Payment_Cash	0.3845*** (3.59)	0.6076*** (2.98)	0.2821** (2.22)
Diversifying	-0.0633 (-0.62)	0.1829 (0.98)	-0.1726 (-1.40)
Runup	-0.2252*** (-2.99)	-0.2222** (-2.34)	-0.2325* (-1.82)
Cash	-0.9201** (-2.55)	-0.5965 (-0.92)	-1.0334** (-2.36)
Public	-1.2639*** (-8.58)	-1.1301*** (-4.02)	-1.3225*** (-7.61)
Private	-0.1486 (-1.27)	-0.2826 (-1.27)	-0.0758 (-0.55)
Relative_Size	-0.6845** (-2.02)	-0.1924 (-0.29)	-0.8593** (-2.20)
B/M	-0.4711** (-2.22)	-0.6245 (-1.63)	-0.3815 (-1.48)
Number of Observations	7,376	2,321	5,055
F-Statistic	20.92***	7.23***	14.49***
R-Squared	0.037	0.036	0.039

Table 7: Bidder's long-run financial performance, merger waves and CEO compensation

The table presents the results of sample selection models following Heckman (1979) of acquisition long-run financial performance on CEO compensation and other firm and deal characteristics. The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Data on executive compensation are from ExecuComp, stock price data from CRSP and accounting data from Compustat. The dependent variable for the first-stage regression in Heckman selection models is a dummy variable that equals one if the acquiring firm survives for three years after the acquisition effective date and zero otherwise. The dependent variable for the second-stage regression is *3yABHR* which is the bidder's 3-year buy-and-hold daily returns following the acquisition effective date minus the 3-year buy-and-hold daily returns of the matching firm for the same period. *Delta_CEO* is the dollar change in CEO's wealth for a 1 percent change in firm's stock price. *Vega_CEO* is the dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns. *Cash_Comp_CEO* is the sum of CEO's salary and bonus. The *Months_Surv.* variable measures the number of months the acquiring firm has survived since its first acquisition during the period January 1, 1981, to December 31, 2010. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). Definitions of control variables are described in the Appendix. t-statistics, based on robust standard errors, are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Variable	Full Sample		In-Wave Acquisitions		Out-Wave Acquisitions	
	(1) Selection	(2) 3yABHR	(3) Selection	(4) 3yABHR	(5) Selection	(6) 3yABHR
Intercept	0.1220 (0.50)	0.7002** (2.51)	0.2358 (0.56)	0.5460 (1.56)	0.0164 (0.05)	0.8065* (1.96)
Delta_CEO	0.0426*** (3.05)	0.0020*** (2.64)	0.0470* (1.90)	0.0020 (1.26)	0.0421** (2.39)	0.0018** (2.12)
Vega_CEO	0.0892 (1.24)	0.0836** (2.57)	0.1342 (0.93)	-0.0108 (-0.17)	0.0649 (0.78)	0.1031*** (2.69)
Cash_Comp_CEO	-0.0348*** (-4.58)	0.0136* (1.88)	-0.0247** (-2.32)	0.0131 (1.61)	-0.0447*** (-4.01)	0.0205* (1.74)
Months_Surv.	0.0010*** (4.16)		0.0020*** (4.24)		0.0006** (2.05)	
Size	0.0680*** (4.32)	-0.0525*** (-3.56)	0.0581** (2.17)	-0.0394** (-2.04)	0.0781*** (3.91)	-0.0603*** (-2.82)
Payment_Cash	0.1275*** (3.24)	0.0717** (2.28)	0.1299* (1.83)	-0.0258 (-0.53)	0.1293*** (2.71)	0.1079** (2.58)
Diversifying	0.1027*** (2.72)	0.0684** (2.45)	0.0611 (0.95)	0.0581 (1.38)	0.1377*** (2.89)	0.0847** (2.12)
Runup	0.0190 (0.91)	-0.0254 (-1.62)	0.0568** (2.20)	-0.0329 (-1.60)	-0.0446 (-1.29)	-0.0034 (-0.13)
Cash	-0.6027*** (-5.54)	-0.1326 (-1.19)	-0.5301*** (-2.77)	-0.2674* (-1.73)	-0.6813*** (-5.11)	-0.0817 (-0.49)
Public	-0.0128 (-0.24)	-0.0113 (-0.31)	-0.0124 (-0.13)	-0.0447 (-0.73)	-0.0079 (-0.12)	-0.0011 (-0.02)
Private	-0.0246 (-0.56)	-0.0190 (-0.63)	0.0734 (0.92)	-0.0374 (-0.73)	-0.0689 (-1.29)	-0.0068 (-0.17)
Relative_Size	0.0200 (0.25)	0.0144 (0.25)	-0.1754 (-1.28)	0.0092 (0.08)	0.1202 (1.19)	0.0127 (0.18)
B/M	-0.2923*** (-3.93)	-0.1143* (-1.84)	-0.5606*** (-4.25)	-0.2077* (-1.88)	-0.1950** (-2.13)	-0.1047 (-1.39)
Inverse_Mills		0.3690 (1.11)		0.5989* (1.73)		0.2618 (0.50)
Total Observations	7,416		2,363		5,053	
Uncensored Observ.		6,277		1,966		4,311
Wald Chi-Square	59.18***		19.92*		48.43***	

Table 8: Bidder's long-run operating performance, merger waves and CEO compensation

The table presents the results of sample selection models following Heckman (1979) of acquisition long-run operating performance on CEO compensation and other firm and deal characteristics. The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Data on executive compensation are from ExecuComp, stock price data from CRSP and accounting data from Compustat. The dependent variable for the first-stage regression in Heckman selection models is a dummy variable that equals one if the acquiring firm survives for three years after the acquisition effective date and zero otherwise. The dependent variable for the second-stage regression is $\Delta IROA$ which is the difference between the acquirer's return on assets (ROA) at the end of the second year following the transaction (t+2) and the acquirer's ROA at the end of the year preceding the transaction (t-1) adjusted for the industry median. ROA is defined as Operating Income before Depreciation divided by total assets. ΔCEO is the dollar change in CEO's wealth for a 1 percent change in firm's stock price. $\Delta Vega_{CEO}$ is the dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns. $Cash_Comp_CEO$ is the sum of CEO's salary and bonus. The $Months_Surv.$ variable measures the number of months the acquiring firm has survived since its first acquisition during the period January 1, 1981, to December 31, 2010. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). Definitions of control variables are described in the Appendix. t-statistics, based on robust standard errors, are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Variable	Full Sample		In-Wave Acquisitions		Out-Wave Acquisitions	
	(1) Selection	(2) $\Delta IROA$	(3) Selection	(4) $\Delta IROA$	(5) Selection	(6) $\Delta IROA$
Intercept	0.2771 (1.05)	-0.0687*** (-3.35)	0.4534 (0.97)	-0.1059*** (-3.11)	0.1298 (0.40)	-0.0432 (-1.64)
Delta_CEO	0.0473*** (3.10)	-0.0001 (-1.14)	0.0462* (1.73)	-0.0001 (-0.39)	0.0490** (2.53)	-0.0001 (-1.49)
Vega_CEO	0.0713 (0.85)	-0.0042 (-1.28)	0.1858 (1.12)	-0.0090 (-1.21)	0.0119 (0.12)	-0.0032 (-0.92)
Cash_Comp_CEO	-0.0410*** (-4.70)	-0.0001 (-0.08)	-0.0338** (-2.59)	-0.0005 (-0.47)	-0.0484*** (-3.89)	0.0008 (0.92)
Months_Surv.	0.0010*** (3.91)		0.0020*** (4.02)		0.0006* (1.81)	
Size	0.0458*** (2.68)	0.0020* (1.83)	0.0287 (0.96)	0.0037** (1.98)	0.0603*** (2.83)	0.0008 (0.63)
Payment_Cash	0.1542*** (3.69)	-0.0026 (-1.01)	0.1658** (2.17)	-0.0047 (-0.93)	0.1487*** (2.95)	-0.0035 (-1.17)
Diversifying	0.1076*** (2.68)	-0.0002 (-0.09)	0.0711 (1.02)	0.0055 (1.28)	0.1450*** (2.88)	-0.0019 (-0.66)
Runup	0.0065 (0.30)	0.0017 (1.38)	0.0486* (1.82)	-0.0015 (-0.79)	-0.0646* (-1.76)	0.0073*** (3.77)
Cash	-0.6038*** (-5.22)	-0.0056 (-0.64)	-0.5400*** (-2.61)	-0.0262* (-1.66)	-0.6746*** (-4.79)	0.0093 (0.83)
Public	0.0001 (0.00)	-0.0030 (-1.08)	0.0007 (0.01)	-0.0056 (-0.92)	0.0035 (0.05)	-0.0028 (-0.91)
Private	-0.0767 (-1.63)	-0.0013 (-0.51)	0.0216 (0.25)	-0.0062 (-1.21)	-0.1190** (-2.09)	0.0007 (0.24)
Relative_Size	0.1273 (1.58)	-0.0045 (-1.06)	-0.0985 (-0.70)	-0.0044 (-0.44)	0.2410** (2.32)	-0.0054 (-1.06)
B/M	-0.2799*** (-3.59)	0.0473*** (9.76)	-0.5369*** (-3.89)	0.0621*** (5.60)	-0.1976** (-2.06)	0.0385*** (7.28)
Inverse_Mills		0.0058 (0.26)		0.0079 (0.26)		-0.0060 (-0.19)
Total Observations	5,741		1,744		3,997	
Uncensored Observ.	4,602		1,347		3,255	
Wald Chi-Square	172.76***		91.61***		88.52***	

Table 9: Standard deviation of cross sectional bidder's returns and merger waves

The table presents the number of acquisitions initiated inside and outside merger waves and standard deviations of cross-sectional acquisition returns (CARs and BHARs). The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Stock price data are from CRSP. Cross-sectional standard deviations are calculated for 3-month (63 trading days), 6-month (126 trading days), 9-month (189 trading days) and 12-month (252 trading days) daily returns. *CARs* is the bidder's cumulative abnormal daily returns over the respective time period using the market model. The estimation period is from 200 days to 60 days before the acquisition announcement. *ABHRs* is the bidder's buy-and-hold daily returns following the acquisition effective date minus the buy-and-hold daily returns of the matching firm for the respective time period. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). The reported probability statistics [$2*Pr(F < f)$] are from the F-test for difference in variances.

	In-Waves	Out-Waves	Difference	F-test
SD_3m_CARs	0.1824	0.1641	0.0183	0.0000
Observations	2,350	5,184		
SD_6m_CARs	0.2700	0.2309	0.0390	0.0000
Observations	2,356	5,181		
SD_9m_CARs	0.3390	0.2865	0.0525	0.0000
Observations	2,352	5,183		
SD_12m_CARs	0.3880	0.3329	0.0551	0.0000
Observations	2,352	5,187		
SD_3m_ABHRs	0.2587	0.2220	0.0367	0.0000
Observations	2,328	5,126		
SD_6m_ABHRs	0.3675	0.3262	0.0414	0.0000
Observations	2,303	5,099		
SD_9m_ABHRs	0.4724	0.4139	0.0585	0.0000
Observations	2,278	5,047		
SD_12m_ABHRs	0.5361	0.4888	0.0473	0.0000
Observations	2,242	4,998		

Table 10: Standard deviation of cross sectional bidder's returns, merger waves and CEO incentive compensation

The table presents the number of acquisitions initiated inside and outside merger waves and standard deviations of cross-sectional acquisition returns (CARs and BHARs). The sample is 7,859 completed U.S. acquisitions over the period January 1, 1993, to December 31, 2010 from SDC Platinum. Data on executive compensation are from ExecuComp and stock price data from CRSP. Cross-sectional standard deviations are calculated for 3-month (63 trading days), 6-month (126 trading days), 9-month (189 trading days) and 12-month (252 trading days) daily returns. *CARs* is the bidder's cumulative abnormal daily returns over the respective time period using the market model. The estimation period is from 200 days to 60 days before the acquisition announcement. *ABHRs* is the bidder's buy-and-hold daily returns following the acquisition effective date minus the buy-and-hold daily returns of the matching firm for the respective time period. *Delta_CEO* is the dollar change in CEO's wealth for a 1 percent change in firm's stock price. Firms with *Delta_CEO* higher than the sample median are characterized as *High Delta*, otherwise they are characterized as *Low Delta*. *Vega_CEO* is the dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns. Firms with *Vega_CEO* higher than the sample median are characterized as *High Vega*, otherwise they are characterized as *Low Vega*. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005). The reported probability statistics [$2*\Pr(F < f)$] are from the F-test for difference in variances.

Panel A: Full Sample									
	Observations	High Delta	Low Delta	Difference	<i>F-test</i>	High Vega	Low Vega	Difference	<i>F-test</i>
SD_3m_CARs	7,534	0.1684	0.1715	-0.0031	<i>0.2677</i>	0.1637	0.1760	-0.0123	<i>0.0000</i>
SD_6m_CARs	7,537	0.2419	0.2458	-0.0039	<i>0.3260</i>	0.2349	0.2526	-0.0177	<i>0.0000</i>
SD_9m_CARs	7,535	0.3021	0.3059	-0.0038	<i>0.4439</i>	0.2914	0.3165	-0.0251	<i>0.0000</i>
SD_12m_CARs	7,539	0.3500	0.3525	-0.0026	<i>0.6564</i>	0.3317	0.3704	-0.0387	<i>0.0000</i>
SD_3m_ABHRs	7,454	0.2274	0.2406	-0.0132	<i>0.0006</i>	0.2197	0.2476	-0.0279	<i>0.0000</i>
SD_6m_ABHRs	7,402	0.3308	0.3480	-0.0173	<i>0.0020</i>	0.3246	0.3537	-0.0292	<i>0.0000</i>
SD_9m_ABHRs	7,325	0.4226	0.4427	-0.0202	<i>0.0048</i>	0.4134	0.4515	-0.0381	<i>0.0000</i>
SD_12m_ABHRs	7,240	0.5001	0.5070	-0.0069	<i>0.4104</i>	0.4819	0.5249	-0.0430	<i>0.0000</i>
Panel B: In-Wave Acquisitions									
	Observations	High Delta	Low Delta	Difference	<i>F-test</i>	High Vega	Low Vega	Difference	<i>F-test</i>
SD_3m_CARs	2,350	0.1824	0.1825	-0.0001	<i>0.9814</i>	0.1842	0.1808	0.0034	<i>0.5230</i>
SD_6m_CARs	2,356	0.2687	0.2715	-0.0028	<i>0.7214</i>	0.2714	0.2688	0.0027	<i>0.7347</i>
SD_9m_CARs	2,352	0.3379	0.3405	-0.0026	<i>0.7930</i>	0.3364	0.3410	-0.0046	<i>0.6451</i>
SD_12m_CARs	2,352	0.3883	0.3879	0.0003	<i>0.9772</i>	0.3762	0.3986	-0.0225	<i>0.0475</i>
SD_3m_ABHRs	2,328	0.2565	0.2613	-0.0049	<i>0.5204</i>	0.2543	0.2627	-0.0084	<i>0.2701</i>
SD_6m_ABHRs	2,303	0.3638	0.3715	-0.0077	<i>0.4805</i>	0.3675	0.3669	0.0006	<i>0.9522</i>
SD_9m_ABHRs	2,278	0.4768	0.4656	0.0112	<i>0.4250</i>	0.4728	0.4718	0.0010	<i>0.9418</i>
SD_12m_ABHRs	2,242	0.5399	0.5302	0.0097	<i>0.5478</i>	0.5242	0.5462	-0.0219	<i>0.1714</i>

(The table is continued on the next page.)

Table 10 (Continued)

Panel C: Out-Wave Acquisitions									
	Observations	High Delta	Low Delta	Difference	<i>F-test</i>	High Vega	Low Vega	Difference	<i>F-test</i>
SD_3m_CARs	5,184	0.1607	0.1670	-0.0063	<i>0.0524</i>	0.1542	0.1736	-0.0194	<i>0.0000</i>
SD_6m_CARs	5,181	0.2266	0.2347	-0.0081	<i>0.0748</i>	0.2174	0.2443	-0.0268	<i>0.0000</i>
SD_9m_CARs	5,183	0.2818	0.2904	-0.0087	<i>0.1235</i>	0.2701	0.3026	-0.0326	<i>0.0000</i>
SD_12m_CARs	5,187	0.3284	0.3361	-0.0077	<i>0.2401</i>	0.3105	0.3546	-0.0440	<i>0.0000</i>
SD_3m_ABHRs	5,126	0.2108	0.2319	-0.0212	<i>0.0000</i>	0.2033	0.2400	-0.0368	<i>0.0000</i>
SD_6m_ABHRs	5,099	0.3125	0.3383	-0.0257	<i>0.0001</i>	0.3046	0.3472	-0.0426	<i>0.0000</i>
SD_9m_ABHRs	5,047	0.3918	0.4334	-0.0415	<i>0.0000</i>	0.3855	0.4415	-0.0560	<i>0.0000</i>
SD_12m_ABHRs	4,998	0.4787	0.4977	-0.0190	<i>0.0521</i>	0.4629	0.5146	-0.0517	<i>0.0000</i>

Appendix A: Variable definitions

<i>Compensation Variables</i>	
<i>Delta_CEO</i>	The dollar change in CEO's wealth for a 1 percent change in firm's stock price in the year preceding the acquisition announcement from ExecuComp.
<i>Vega_CEO</i>	The dollar change in CEO's wealth for a 1 percent change in the standard deviation of firm's stock returns in the year preceding the acquisition announcement from ExecuComp.
<i>Cash_Comp_CEO</i>	The sum of salary and bonus payments to the CEO in the year preceding the acquisition announcement from ExecuComp.
<i>Total_Comp_CEO</i>	The sum of CEO's salary, bonus, new stock and option grants and other forms of compensation in the year preceding the acquisition announcement from ExecuComp.
<i>Firm Characteristics</i>	
<i>Size</i>	The natural logarithm of bidder's market value of equity 4 weeks before the acquisition announcement date from CRSP.
<i>Runup</i>	The acquirer's buy-and-hold daily returns between 205 days and 6 days before the acquisition announcement date minus the buy-and-hold daily returns of the matched firm for the same time period from CRSP.
<i>Past_ABHR</i>	The market-adjusted buy-and-hold daily returns of the firm for the calendar year from CRSP. Market returns are from the CRSP value-weighted index.
<i>Cash</i>	The acquirer's cash and cash equivalents to book value of total assets at the end of the year preceding the acquisition announcement from Compustat.
<i>B/M</i>	The book value of equity of the acquiring firm from Compustat divided by its market value from CRSP at the end of the year preceding the acquisition announcement.
<i>ROA</i>	The operating income of the acquiring firm before depreciation divided by book value of total assets at the end of the year preceding the acquisition announcement from Compustat.
<i>Sales_Growth</i>	The natural logarithm of the ratio of bidder's sales in the year preceding the acquisition announcement (t-1) to sales in the previous year (t-2) from Compustat.
<i>Leverage</i>	The acquirer's total debt to total assets at the end of the year before the acquisition announcement from Compustat.
<i>P/E</i>	The ratio of the stock price of the acquiring firm to earnings per share at the end of the year preceding the acquisition announcement.
<i>NC_Working_Cap</i>	The acquiring firm's current assets minus current liabilities minus cash and cash equivalents standardized by book value of total assets from Compustat at the end of the year before the acquisition announcement.
<i>Months_Surv.</i>	The number of months the acquiring firm has survived since its first acquisition in the period January 1, 1981, to December 31, 2010. If the company has not made another acquisition in the past, the variable takes the value of zero.
<i>Merger Performance Measures</i>	
<i>CARs(0,1)</i>	The bidder's cumulative abnormal returns over a two-day event window (0, +1) where 0 is the acquisition announcement date using the market model. The estimation period is from 200 days to 60 days before the acquisition announcement. Market returns are based on the CRSP value-weighted index.
<i>3yABHR</i>	The bidder's 3-year buy-and-hold daily returns following the acquisition effective date minus the 3-year buy-and-hold daily returns of the matching firm for the same time period from CRSP.
<i>ΔIROA</i>	The difference between the acquirer's return on assets (ROA) at the end of the second year following the effective date (t+2) minus the industry median for the same year and the acquirer's ROA at the end of the year preceding the transaction (t-1) minus the industry median for the same year from Compustat.
<i>Cross-Sectional Volatility Measures</i>	
<i>SD_3m_CARs</i>	The cross-sectional standard deviation of acquirers' cumulative abnormal daily returns for a 3-month window (63 trading days) beginning one day after the acquisition announcement date. The variable is repeated over 6-month, 9-month and 12-month windows following the announcement date.
<i>SD_3m_ABHRs</i>	The cross-sectional standard deviation of acquirers' abnormal buy-and-hold daily returns for a 3-month period (63 trading days) beginning one day after the acquisition announcement date. The variable is repeated over 6-month, 9-month and 12-month windows following the announcement date.

Deal Characteristics

<i>In-Wave</i>	A dummy variable that takes the value of one if the acquisition has been initiated during a merger wave and zero otherwise. Transactions are classified as in-wave or out-wave following the method developed by Harford (2005).
<i>In-Wave_Year</i>	A dummy variable that takes the value of one if the industry experiences a merger wave during the calendar year and zero otherwise.
<i>Acquisition</i>	A dummy variable that takes the value of one if a firm has made an acquisition announcement in a given year and zero otherwise.
<i>Payment_Cash</i>	A dummy variable that takes the value of one if the transaction is financed only with cash and zero otherwise.
<i>Diversifying</i>	A dummy variable that takes the value of one if the acquiring firm and the target operate in different industries and zero otherwise based on the Fama and French (1997) classification of 48 industries.
<i>Public</i>	A dummy variable that takes the value of one if the target is a publicly listed firm and zero otherwise.
<i>Private</i>	A dummy variable that takes the value of one if the target is a privately held firm and zero otherwise.
<i>Relative_Size</i>	The ratio of the deal value reported in SDC Platinum to the market value of the acquiring firm 4 weeks before the acquisition announcement from CRSP.
