Does CEO learning improve takeover success?

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ABSTRACT

CEOs learn from previous completed acquisitions and improve target selection skills. Learning theory predicts that CEOs, who complete more takeover bids, have higher probability of succeeding in prospective bids. This paper tests the theoretical relation between the accumulated learning experience of CEOs and the success likelihood of acquisition transactions. Probit regressions reveal a positive and significant positive relation between learning and transaction outcome. It also distinguishes between the effect of learning and competence by decomposing the first transaction's outcome into two parts: the one is the part that is explained by the observable attributes of deal-firm characteristics, and the other is the residuals that are plausibly attributable to unobservable CEOs' competence. Empirical results indicate that CEOs' learning effect causes the persistence of success in acquisition programs, and declines across levels of experience.

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1. Introduction

Academic literature frequently discusses the central role of Chief Executive Officers (CEOs) in merger and acquisition (M&A) decision process. CEOs' personal characteristics have been recognized as important determinants of firms' management style (Bertrand & Schoar, 2003; Kaplan, Klebanov, & Sorensen, 2012), especially in the management of large investments such as M&As (Bao & Edmans, 2011; Custodio & Metzger, 2013; Park, 2003; Yim, 2013). CEOs are believed to learn during the process of making multiple takeover transactions (Aktas, de Bodt, & Roll, 2009, 2011, 2013; Kau, Linck, & Rubin, 2008; Luo, 2005). Intuitively, they draw more accurate inferences about takeover targets based on experience gained from previous completed acquisitions, and as a result complete potential bids successfully and profitably.

In fact, CEOs gain different sources of benefits when takeover bids succeed, such as fame (Avery, Chevalier, & Schaefer, 1998), empire building or compensations (Grinstein & Hribar, 2004). They also face threats of being disciplined for undertaking poor quality bids (Lehn & Zhao, 2012) and failing to complete desired takeover bids. For example, Ed Krell, who has been the CEO of Destination Maternity for over a decade, will be stepping down as the CEO of the maternity and kid's wear retailer after a sequence of failed attempts to take over Mothercare.[2] Zurich Insurance's chief, Martin Senn, has resigned under pressure of the failed takeover of Britain's RSA and stumbling performance in its core business.[3] Electrolux reports that its Chief Executive Keith McLoughlin will be forced to step down after the Swedish company's bid to take over the appliance

[2] Strydom, Martin "Ed Krell quits as Destination Maternity chief after failed Mothercare approach and profits warning." *The Telegraph*, August 11, 2014, Business.
[3] Armstrong, Ashley. "Zurich Insurance chief executive Martin Senn steps down". *The Telegraph*, December 1, 2015, Business.

division of General Electric failed.[4] Strict penalties and appealing compensation packages urge CEOs to learn and complete potential takeover bids.

Empirical investigation of CEOs' learning in the acquisition process is challenging because its associated acquisition influence is not directly observable; it is latent variables in econometric modelling. To overcome this problem, I utilize a theoretical model of CEOs learning (Aktas et al., 2009) that relates CEO's number of past completed deals to the takeover likelihood of success. The model assumes that financial market reflects investor reactions in stock price during the announcement date of takeover bids. CEOs receive such feedback and revise their own predictions about potential synergies with other targets. Provided that CEOs learn from completed bids, their model directly indicates that the number of completed deals, which represents CEO's accumulated learning experience (ALE), has a positive relation with the outcome of the prospective deal.

To capture the effects of CEOs' learning on the outcome of takeover bids, I examine CEOs who announce multiple bids to answer whether ALE support to complete potential transactions. Studying serial M&A transactions enables us to hold acquiring firms' characteristics constant while examining the bidding strategies of CEOs from deal to deal. We, therefore, can infer the relation between the transaction outcome, ALE and deal characteristics without being affected by the new information from acquirers.

I collect a sample of 6677 M&A transactions during the period 1992-2012 which includes two subsamples: one consists 1507 acquisition programs and the other contains 1186 transactions announced by single bidders. Probit regression provides strong and robust evidence that ALE positively affects transaction outcome. CEOs, who completed more deals, have higher probability

[4] Chopping, Dominic and Zander, Christina. "Electrolux CEO Keith McLoughlin Quits A Month After Collapse of GE Deal." *The Wall Street Journal*, January 11, 2016, Business.

to complete the prospective deal. Specifically, the takeover probability of success increases by 14.6% when ALE increases from zero to five, holding all other factors at mean**.** In addition, I decompose the outcome of the first transaction in acquisition programs into predicted success and CEOs' unobservable competence. Empirical evidence suggests that the conclusion of the learning effect is not affected by adding CEOs' competence. However, CEOs who have better inherent abilities are less like to learn and increase takeover probability of success. The learning effect is also robust to controls for various CEO-specific characteristics and compensation-related factors. It remains positive and economically significant to alternative definitions of acquisition programs, and the adjustments of CEOs towards market reaction.

I contribute to the literature of M&A in two aspects. Firstly, I identify the effect of CEOs' learning from past experience on the likelihood of success. I distinguish between the learning during the transaction period of Luo (2005) and Kau et al. (2008) by controlling for the cumulative abnormal returns (CAR) around the announcement date. Secondly, my paper separates the effect of unobservable CEOs' competence which might also cause the persistence of success in acquisitions programs.

The remainder of this paper is organized as follows. The review of literature is provided in Section 2. Section 3 explains econometric modeling and sample selection process. Section 4 provides main empirical results. Section 5 conducts various robustness checks. Section 6 concludes the paper.

2. Literature review

2.1 Determinants of takeover likelihood of success

Following literature examining the determinants of acquisition outcome, I identify a set of target characteristics consistently affecting the outcome of an M&A transaction including target

size (Ambrose & Megginson, 1992; Baker, Pan, & Wurgler, 2012; Comment & Schwert, 1995; Luo, 2005; Palepu, 1986), return on total assets (Daines, 2001; Flanagan, D'Mello, & O'Shaughnessy, 1998; Schwert, 2000), sales growth rate (Comment & Schwert, 1995; Field & Karpoff, 2002; Schwert, 2000; Sokolyk, 2011), leverage (Daines, 2001; Heron & Lie, 2006; Schwert, 2000; Sokolyk, 2011).

Deal characteristics of targets are also known to affect the transaction outcome. Specifically, deterrence of takeover defense tactic are consistently identified (Ambrose & Megginson, 1992; Field & Karpoff, 2002; Heron & Lie, 2006, 2015; Sokolyk, 2011). In addition, tender offer strategy effectively increases the takeover probability of success (Baker et al., 2012; Bates & Lemmon, 2003; Betton, Eckbo, Thompson, & Thorburn, 2014; Kau et al., 2008). Other deal characteristics that effectively influence the transaction outcome include public status (Kau et al., 2008), financing structure (Baker et al., 2012; Jennings & Mazzeo, 1993; Luo, 2005; Sokolyk, 2011), similar industry class (Flanagan et al., 1998; Henry, 2004; Nguyen, 2016), and competition (Flanagan et al., 1998; Holl & Kyriazis, 1997; Walkling, 1985) effectively. Recent literature adds that market reactions around the announcement date of takeover bids positively influence the outcome (Kau et al., 2008; Luo, 2005) and this is so called managers' learning during acquisitions. To my knowledge, the effect of ALE on the outcome of takeover transactions remains unexplored.

2.2 Review of CEO learning in M&A context

The learning-by-doing terminology refers to the hypothesis that accumulated work experience, especially repetition of the same type of action, improves workers' productivity and adds to technical knowledge. According to the management literature, acquirer CEOs have abilities to learn from past experience (Harding & Rovit, 2004; Hayward, 2002), especially in programs of repetitive acquisitions. Learning assists CEOs to forecast synergistic effects more precisely, and

targets turn to be less risky. Deighton (2006) finds that CEOs bid more precisely with experience, and the cross-sectional variation of CAR decreases from deal to deal.

Researchers provide alternative hypotheses and empirical evidence about CEOs' learning from repetitive acquisitions. Particularly, Hayward (2002) supposes that the relationship between the current acquisition performance and similarities with the businesses of the prior acquisitions shows an inverted U-shape. According to the hypothetical U-shape curve of Hayward (2002), Aktas et al. (2013) derive a theoretical model predicting that under experience building curve, the time between deals strictly decreases with deal order while under memory loss effect, elapses between consecutive deals increase significantly. Using a massive data set of more than 300,000 transactions, they show evidence of learning effects through repetitive acquisitions, especially when successive deals have significant similarities. In addition, Aktas et al. (2009) theoretically show that CEOs' past experience has a correlation with their current experience. Aktas et al. (2011) then prove that there is an auto-correlation pattern in offer premiums. Specifically, deal premiums of the previous deal have a positive correlation with the cumulative abnormal returns of the current deal.

Another classification of CEOs' learning is learning during acquisitions. This type of learning refers to CEOs who listen to outsiders' reactions and decide whether firms should consummate M&A deals. Luo (2005) confirms that CEOs make M&A decisions based on how stock market reacts with the deal announcement. If CEOs act on the interests of shareholders, when aggregate stock returns are positive, they will decide to complete the transaction. Luo (2005)'s model well excludes the probability-feedback that comes from investors' forecasts about the completion likelihood of a takeover bid. He then uses aggregate stock returns of both target and acquirer instead of the acquirer's returns to explain the success likelihood. Kau et al. (2008) confirm the

finding of Luo (2005) in that managers make major investment decisions according to the feedback of financial market, although they use only bidders' returns. They further indicate that manager's propensity to learn is high when their interests are aligned with stockholders, i.e. pay-performance sensitivity.

This paper is different from Aktas et al. (2011) in the sense that it concentrates on the takeover likelihood of success to test the learning theory of Aktas et al. (2009) rather than examining the serial correlation between deal premiums in acquisition programs. In addition, it focuses on the past accumulated learning experience rather than the learning during acquisitions identified by Luo (2005) and Kau et al. (2008).

2.3 CEO learning model

The CEO learning model of Aktas et al. (2009) presumes that financial market reflects investor reactions in stock price during the announcement date of takeover bids. CEOs receive such feedback and revise their predictions about the synergistic value with other takeover targets. CEOs gain experience from market signals and subsequently update their bidding strategy with other targets. I define z_t, the number of completed deals in the past (from time 0 to time $t-1$), as accumulated learning experience. CEOs predict more accurately about the synergy in prospective acquisitions after completing more deals, asymptotically, the variance of synergy, $\hat{\sigma}_{s,t}^2$, decreases when z_t increases.

I define:

$$\hat{\sigma}_{s,t}^2 = \left(\frac{1}{\hat{\sigma}_{s,0}^2} + z_t \frac{1}{\hat{\sigma}_{\eta}^2} \right)^{-1} \tag{1}$$

Taking derivation of $\hat{\sigma}_{s,t}^2$ with respect to z_t, we have:

$$\frac{\partial \hat{\sigma}_{s,t}^2}{\partial z_t} = \frac{\partial \left(\frac{1}{\hat{\sigma}_{s,0}^2} + z_t \frac{1}{\hat{\sigma}_{\eta}^2}\right)^{-1}}{\partial z_t} = -\left(\frac{1}{\hat{\sigma}_{s,0}^2} + z_t \frac{1}{\hat{\sigma}_{\eta}^2}\right)^{-2} \frac{1}{\hat{\sigma}_{\eta}^2} < 0 \quad (2)$$

Probability (CEO_i wining a bid) = $\Pr\left(CEO_i \text{ valuation} > CEO_j \text{ valuation}\right) = F_{v_j^*}(v_i^* | v_i^*)$, where $F_{v_j^*}(v_i^* | v_i^*)$ is the the distribution of CEO j reservation value, v_j^*, conditional on CEO i reservation value. $f_{v_j}(v_i^* | v_i^*)$ is corresponding density function.

The effect of learning on the probability of wining the competition is:

$$\frac{\partial F_{v_j^*}(v_i^* | v_i^*)}{\partial z_t} = \frac{\partial F_{v_j^*}(v_i^* | v_i^*)}{\partial v_i^*} \frac{\partial v_i^*}{\partial \hat{\sigma}_{s,t}^2} \frac{\partial \hat{\sigma}_{s,t}^2}{\partial z_t}$$

$$= f_{v_j}(v_i^* | v_i^*) \frac{\partial v_i^*}{\partial \hat{\sigma}_{s,t}^2} \frac{\partial \hat{\sigma}_{s,t}^2}{\partial z_t} \quad (3)$$

One direct result from the optimal v_i^*:

$$\frac{\partial v_i^*}{\partial \hat{\sigma}_{s,t}^2} < 0 \quad (4)$$

The intuition behind Equation 4 is that for risk averse CEOs, when the perceived variance of their expected bonus increases, their reservation value will decrease. In other words, CEOs pay higher price for a takeover bid when the valuation risk of the bid is low.

From (2), (4) and $f_{v_j}(v_i^* | v_i^*) > 0$, Equation 3 implies

$$\frac{\partial F_{v_j^*}(v_i^* | v_i^*)}{\partial z_t} > 0 \quad (5)$$

Equation 5 indicates that the number of completed bids in the past (ALE) positively influences the likelihood of success of the prospective bid.

3 Methodology and sample selection

3.1 Econometric modelling

This study employs a binary bivariate probit model to specify the functional relationship between bidders' learning experience, target and deal characteristics and the success likelihood of a takeover bid. I model the underlying bid outcome as a linear function of the bidder's learning experience and other explanatory variables:

$$Complete_{it}^{*} = \boldsymbol{\delta} z_{it} + X_{it}\beta + \varepsilon_{it} \quad (6)$$

, where z_{it} represents CEOs' accumulated learning experience. X_{it} is a vector of target and deal characteristics. ε_{it} is assumed to have a standard normal distribution.

Although $Complete_{it}^{*}$ is unobservable, the bidding outcome is fully observed. I define $Complete_{it}$ as

$$Complete_{it} = \begin{cases} 1 \; if \; Complete_{it}^{*} > 0 \\ 0, \; otherwise \end{cases}$$

I use the binary probit model to estimate the success likelihood of a takeover bid

$$Prob_{it} = Pro(Complete_{it}) = \phi(\delta z_{it} + X_{it}\beta) \quad (7)$$

in that δ reflects the significance of ALE effects on the takeover probability of success,

3.2 Sample selection

I follow Fuller, Netter, and Stegemoller (2002), Conn, Cosh, Guest, and Hughes (2006), Billett and Qian (2008), and Antonio, Rau, and Aris (2013) to collect a sample of acquisition programs. I search Thomson SDC M&A database for M&A transactions announced by U.S. public acquirers during 1990-2014. Takeover targets can be public, private or subsidiary firms. I drop all financial and utility targets and acquirers, then excluding all deal duplications identified by deal number in

the SDC database.[5] In order to identify acquisition programs at firm-CEO level, I match the acquisition database with the ExecuComp database using company identifier, CUSIP. I first merge the acquisition database with CRSP daily database using announcement dates and historical CUSIP, i.e., NCUSIP to identify CUSIP and PERMNO identifier. Subsequently, I match the dataset with ExecuComp database using CUSIP and latest fiscal year end which is identified by merging CRSP-COMPUSTAT dataset with CRSP monthly.

I define an acquisition programs as CEOs announce at least two transactions within five years, starting from the first deal. To observe complete programs, I exclude programs that belong to the period 1992-2012 and have transactions between periods 1990-1992 and 2012-2014 from my sample. I then drop all transactions announced before 1992 and after 2012. After cleaning data, I obtain a comprehensive sample of 6677 observations which consists 1507 programs (5491 transactions) and a subsample sample of 1186 single transactions. The definitions and instructions to generate all variables are shown in Appendix 1. I winsorize all continuous variables representing target characteristics at 1% and 99% to minimize the impact of outliners.

Insert Table 1 here

Table 1 describes the sample distribution of 6677 M&A transactions across announcement year and acquirers' industry classifications. It also provides distributive description of a subsample of single transactions and a subsample of serial transactions. As shown, the intense period of M&A activities is between 1996 and 2000 in which each calendar year observes more than 400 announcements. Also, most of these transactions are announced by serial acquirers. In addition, I

[5]According to 4-digit SIC codes obtained from the SDC M&A database, bidders and targets are classified into 48 industries defined by Fama and French (1997). Definition of the industry groups can be retrieved from: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_48_ind_port.html

show details of ten industries that have highest number of transactions including business services, retail, electronic equipment, insurance, pharmaceutical products, computers, trading, machinery, medical equipment and wholesale. The business industry has highest density with 867 transactions, accounting for 13% of all M&A activities. Moreover, 82% of 6677 announced transactions belongs to acquisition programs, suggesting the popularity of serial bidders in the U.S. M&A market.

Insert Table 2 here

Table 2 shows descriptive statistics of 6677 M&A transactions announced during the period 1992-2012 and two subsamples of single transactions and acquisition programs. About target characteristics, single transactions have deal size, on average, of 555.9 million dollars (1880.5) while transactions conducted by serial acquires have almost double size of 1067.2 million on average, but they also have a substantially higher standard deviation of 4951.6 million. Both subsamples show roughly equal ROA, SALEGR, and LEVERAGE. In terms of deal characteristics, serial transactions are highly likely to be consummated compared to the subsample of single transactions. On average, 38.4%(48.7%) of deals announced by serial bidders is closed, while only 30.4%(46%) of single transactions are completed. The vast majority of targets are publicly listed firms, and more than 80 percent is finance by cash on average. The popularity of within industry mergers and acquisition is observed in both subsamples with more than 90% of all transactions showing similar industry class between acquirer and target. Other target characteristics including TENDER, DEFENSE, and COMPETE are almost equal between subsamples. Overall, 8.1% of targets in the whole sample receives a tender offer from acquirers. 3.2% of targets adopts at least one defensive mechanism against the acquirer, while 1.9% of transactions has more than one bidder.

Insert table 3 here

Table 3 shows a breakdown of the unconditional probability of M&A transactions according to different levels of ALE. It appears that the more deals CEOs completed, the higher the unconditional probability of completing the prospective bid is, excluding a slight drop in completion proportion from 44.97% to 44.81% when ALE increases from 2 to 3. On overall, CEOs with no experience have unconditional probability of success of 29.74% to complete their desired transactions. However, CEOs, who complete equal or more than five transactions, have a substantially higher success likelihood of 60%.

4. Results

4.1 CEOs' learning and takeover success

Table 4 provides probit regressions of transaction outcome on CEOs' accumulated learning experience and other control variables representing firm deal characteristics. The key explanatory variable, ALE, is the number of transactions CEOs previously complete in acquisition programs. The dependent variable, SUCC, equals one if the transaction is consummated and zero otherwise. Control variables are defined and constructed as in Appendix 1. My hypothesis predicts that ALE positively affects the success probability of an M&A transaction, i.e., the more transactions CEOs consummate, the more experience they gain, and the more likely that they will complete prospective bids. I, therefore, predict a positive coefficient of ALE.

Model 1 does not control for year and industry. Model 2 controls for year. Model 3 controls for industry. Model 4 controls for both year and industry. The coefficient of ALE in Model 1 is 0.068 (0.014), statistically significant at 1%. This positive and significant effect of ALE coheres with the changes in unconditional probability shown in Table 3. Controlling for year and industry slightly reduces the coefficient of ALE but the overall statistical significance is not affected. To understand roughly about the economic significance of ALE on the success likelihood of a

takeover, I keep all other control variables at mean and change ALE from zero to five, to see how the estimated takeover probability varies. I find that the takeover likelihood of success increases by almost 14.6%. Although, it is difficult to tell how addition of 14.6% likelihood of success transfers into actual completion outcome, one still can say that ALE does increase the completion likelihood of M&A transactions.

Insert table 4 here

Table 4 also indicates that takeover targets with larger size are likely to be completed. Specifically, the coefficient of SIZE is statistically significant at 1% after controlling for year and industry. Acquirers bidding for targets with high ROA has lower probability of success, suggesting that the management team of targets that experience poor performance should be replaced (Flanagan et al., 1998). SALEGR, however, does not affect the transaction outcome. LEVERAGE is only significant in Model 2 where only year dummies are included. Its negative sign is consistent with the hypothesis that targets add debts to avoid takeovers (Schwert, 2000).

The presence of a takeover defense is not significantly related to acquisition likelihood, suggesting that it could be used to negotiate higher offer premiums rather than aggressively deter all possible attempts (Heron & Lie, 2006, 2015). TENDER is positive and statistically significant at 1%. This strong and robust result supports the view that tendering offer is an effective method to increase the takeover probability of success, which is in line with many previous studies. Bidding public targets, however, is less likely to be accepted. I also find a negative influence of CASH which is consistent with the hypothesis that the proportion of cash is positively connected with the likelihood of competition (Jennings & Mazzeo, 1993). Transactions with a similar industry between M&A entities are less likely to be consummated. This might be due to the special interests of anti-trust authorities in preventing anti-competitive combinations of firms. In addition,

rival acquirers are not welcomed due to their sufficient management skills to run the targets (Flanagan et al., 1998). The coefficient of COMPETE is -0.96(0.17) and statistically significant at 1%, indicating that the presence of multiple offers for a given target will decrease the probability that the current offer will be accepted (Walkling, 1985).

4.2 CEO's learning and competence

Model 4 and Table 3 interprets the increase in the takeover likelihood of success across levels of accumulated experience as evidence of CEOs' learning. In short, CEOs learn and accumulate experience from previous transactions to complete the prospective transaction. However, this can also represent the importance of the CEOs' inherent abilities in producing persistence of success. In order to distinguish between learning and inherent competence, I follow the two-stage methodology of Gompers et al. (2010). I decompose the success probability of the first takeover bid into two parts. The first part is predicted by the observable firm deal characteristics and industry year rate of success, and the second part that is not explained by them (first-stage regression). The latter can be interpreted as a factor including the CEOs' competence. I then regress the takeover outcome of the later deals in acquisition programs on the CEOs' competence and learning, as well as an interaction between them (second-stage regression).

Specifically, to estimate the CEOs' competence, I first generate success rate (IRS) as the mean of completion for each industry year during the period 1992-2012. It is noted that first bids of acquisition programs are properly excluded from the calculation to prevent any sort of "hard-wiring relationship". I regress the success outcome of the first transaction in acquisition programs on the industry-year success rate and other target-deal characteristics. The residuals of this regression, which are consider as an indirect measurement of CEOs' competence (SKILL),

represent a part of takeover success that cannot be explained by simply being involved in an easy takeover market or selecting easy targets.

Table 5 shows results of first-stage and second-stage regression outputs. Model 1 presents OLS estimation of the first transaction' outcome with robust standard errors. IRS is positive and statistically significant at 10%, indicating that participating in an easy industry with good timing can improve the likelihood of success. Other control variables are consistent with findings in Table 4 except SALEGR and COMPETE. The result shows that targets with high sales growth rate tend to reject offers from acquirers. Particularly, SALEGR is negative and statistically significant at 5%. The coefficient of COMPETE is negative, but statistically significant at 5%.

Insert table 5 here

Model 2 displays the results of probit regressions of transaction outcome on SKILL and ALE. Although SKILL weakly affects the transaction outcome, the transaction outcome is positively related to the level of CEOs' learning experience. In Model 3, I include an interaction term between SKILL and ALE. The coefficient of the interaction term is -0.078(0.041), statistically significant at 5%. This suggests that CEOs who have better inherent abilities are less like to learn to improve takeover probability of success. The coefficient of ALE increases slightly compared to that in Model 3, and the conclusion about the learning effect of CEOs remains unchanged.

5. Robustness check

5.1 Unobserved Heterogeneity

Econometricians warn us about the "cluster problems" (Gibbons & Hedeker, 1994). Specifically, CEOs within acquisition programs may share similar characteristics that lead to persistence of success in acquisition programs. The estimator of probit models without correction

for the correlation of the error terms will lead to incorrect results because the standard deviations of the coefficients are heavily biased (Guilkey & Murphy, 1993). I, therefore, set up a panel data with dimensions of CEOs and deal orders, and use random-effects probit models to control for the unobserved effects. Table 6 provides estimation results of random-effects probit models. Although likelihood ratio test compared pool estimator (probit) with panel estimator rejects its null hypothesis at 1% significance level, the conclusion about ALE is not affected. Specifically, Model 1 shows that the coefficient of ALE are lower than that of pool probit model, but it is still statistically significant at 1%. Similarly, Model 2, 3 and 4 confirm the conclusion of learning effects while controlling for year and industry.

Insert table 6 here

5.2 Missing variables

Although in Section 5, I control for CEOs' inherent abilities and firm-deal specific factors interests, CEOs' preferences and incentives indeed affect the transaction outcome (Agrawal & Walkling, 1994; Bliss & Rosen, 2001; Grinstein & Hribar, 2004; Harford & Li, 2003). Besides personal characteristics of CEOs, such as tenure, gender, and age, I control for compensation factors including CEO pay slice (SLICEPAY), CEO variable pay (VARPAY) and CEO equity pay (EQPAY). SLICEPAY represents the relative ranking of the CEO' compensation, and his abilities to to extract rents (Bebchuk, Cremers, & Peyer, 2011); VARPAY and EQPAY control for the alignment between CEOs' wealth and the benefits of stockholders. Model 1 includes compensation factors SLICEPAY and EQPAY while Model 2 controls for SLICEPAY and VARPAY. The influence of ALE on the transaction outcome is positive and statistically significant, and it is robust to the inclusion of CEO-specific control variables. Personal characteristics of CEOs including AGE, TENURE, and GENDER show no influence on transaction outcome. In addition, there is no

strong relation between EQPAY, SLICEPAY and transaction outcome. However, Model 2 shows a positive but week relation between VARPAY and the transaction probability of success, suggesting that the higher alignment between CEOs and shareholders, the more efforts CEOs to consummate the prospective transaction.

Insert Table 7 here

5.3 Program definition and adjustments towards market reaction

It is possible that a different definition of acquisition programs will affect the measurement of CEOs' learning which posibly cause different estimated results in predicting completion likelihood. A typical example is the definition of Aktas et al. (2011) in that an acquisition program is a group of two successive takeover bids announced by the same CEO-firm. According to my baseline hypothesis with the new definition of acquisition programs, takeover success of the prior transaction (PRSUCC) is positively related to the success of the present transaction. Model 1 in Table 8 shows the probit regression of the transaction outcome on PRSUCC and other control variables. PRSUCC is 0.185 (0.052) and statistically significant at 1%, suggesting that the conclusion of learning effect is robust to the alternative definition of acquisition programs.

Insert Table 8 here

Luo (2005) and Kau et al. (2008) provide evidence that CEOs listen to market and decide whether the deal is consummated. I therefore examine whether CEOs adjust their decision towards market reactions during the announcement date of the transaction. I estimate the cumulative abnormal return (CAR) by summing up abnormal returns from day -1 to 1 given that day 0 is the announcement. Abnormal returns are different between between normal returns and predicted

returns from market model of which parameters are estimated using daily stock returns and CRSP value-weighted returns during 252 tradings day between (-262, -10).

Model 2 and 3 show that the effect of ALE is positive and statistically significant, and robust to the inclusion of CAR. Also noted that the coefficient of CAR is statistically significant, -1.085(0.422) in Model 2 contradicting to the learning during acquisition hypothesis. I conjecture that too negative market reaction of an announcement is evidence of overbidding as more wealth is transferred to the target. As a result, the target is likely to accept the bid. Model 3, however, shows no evidence of adjustments according to levels of experience. The interaction terms between ALE*CAR is positive but insignificant at 10%, indicating that the effect of ALE on transaction outcome does not depend on market reactions.

6. Conclusion

Learning theory in the context of acquisition programs suggests that CEOs accumulate experience from previous transactions, and transfer it into the completion of prospective transactions. I model the completion probability of a transaction as a function of ALE and other firm-deal characteristics. I then collect a sample of 6677 transactions announced between 1992 to 2012 from Thomson Financial SDC database. This sample consists two subsamples of 1507 programs and 1186 single transactions. The empirical evidence uncovers a clear and significant relation between the takeover probability of success and ALE. Probit regression suggests that the takeover likelihood of success increases by 14.6% when ALE increases from zero to five, holding other factors constant at mean. The conclusion is robust to the inclusion of CEOs' inherent abilities, personal characteristics, compensation-related factors and adjustments towards market reactions.

Appendix

1. Definition of control variables

Variable name	Definition	Source
SUCC	Success dummy equals one if the takeover is classified as "completed" in the SDC database.	SDC database
VAL	Value of transaction quoted in million dollars.	SDC database
SIZE	Transaction size is the natural logarithm of the transaction value.	SDC database
DEBT	Debt ratio equals the ratio of the target' total liabilities over its total assets (#TLIA/ #TASS).	SDC database
SALEGR	Sales growth rate equals the growth rate of sales in the previous fiscal year (#SALES1/ #SALES2).	SDC database
TENDER	Tender offer dummy equals one the acquirer launched a tender offer for the target.	SDC database
DEFENSE	Defense dummy equals one if the target employs at least one defensive tactic against unwanted bidders.	SDC database
PUBLIC	Public status dummy equals one if the target status is public.	SDC database
CASH	Cash ratio is the proposition of cash in offer (#PCT_CASH/100).	SDC database
INDUS	Industry dummy variable is a dummy indicator equal to if the target belongs to the same industry group with the acquirer (Industry groups are classified according to Fama and French (1997))	SDC database
COMPETE	COMPETE equals one if there is more than one entity bidding for the target.	SDC database
GENDER	CEO gender dummy equals one if CEOs are male, and zero otherwise.	ExecuComp
TENURE	CEO tenure is the number of years being CEO in the acquirer firm.	ExecuComp
AGE	CEO age is the natural logarithm of CEO's age.	ExecuComp
EQPAY	CEO equity pay is the sum of restricted stock grants (#RSTKGRNT) and stock option grants (#OPTION_AWARDS_BLK_VALUE), scaled by the CEO total compensation (#TDC1).	ExecuComp
VARPAY	CEO variable pay is the difference between total compensation (#TDC1) and salary (#SALARY), scaled by total compensation.	ExecuComp
SLICEPAY	CEO pay slice is the percentage of compensation as of the sum of the top-five executive team (Bebchuk et al., 2011)	ExecuComp

Table 1: Distribution of M&A transactions across year and industry

Table 1 describes the distribution of M&A 6677 mergers and acquisitions (transaction value greater than one million dollars) announced during the period 1992-2012 across year and industry. The acquirers are listed in Thomson SDC Mergers and Acquisitions database and have CEOs identified in Standard and Poor's ExecuComp database. Serial transactions are defined as transactions that belong to one of 1507 acquisition programs. Single transactions include all transactions that do not belong to any acquisition programs. The industry codes are classified as Fama and French (1997)'s 48 industry portfolios. All financial and utility targets and acquirer are excluded from the sample.

	Single transaction	Serial transaction	All
Panel A: Distribution across year			
1992	2	6	8
1993	21	84	105
1994	64	250	314
1995	65	312	377
1996	58	420	478
1997	76	410	486
1998	98	515	613
1999	87	451	538
2000	63	347	410
2001	51	225	276
2002	37	171	208
2003	37	174	211
2004	43	239	282
2005	54	255	309
2006	63	250	313
2007	82	329	411
2008	97	319	416
2009	22	162	184
2010	49	203	252
2011	67	220	287
2012	50	149	199
Panel B: Distribution across industry			
Business Services	160	707	867
Retail	83	406	489
Electronic Equipment	80	377	457
Insurance	46	389	435
Pharmaceutical Products	41	267	308
Computers	45	225	270
Trading	75	186	261
Machinery	54	173	227
Medical Equipment	29	196	225
Wholesale	36	189	225
Others	537	2376	2913
Total	1186	5491	6677

Table 2: Descriptive statistics

Table 2 shows descriptive statistics of 6677 M&A transactions announced during the period 1992-2012. The acquirers are publicly traded firms, and the targets are classified as private, public or subsidiary firms. The acquirers are listed in Thomson SDC Mergers and Acquisitions database and have CEOs identified Standard and Poor's ExecuComp database. The subsample of serial transactions includes all acquisition programs which are created by acquirers who announce at least 2 bids within 5 years. The remaining transactions belong to the subsample of single transactions. VAL is the total transaction value quoted in million dollars. SIZE is the natural logarithm of transaction value. ROA is the ratio of the target's total returns over its total assets in the previous fiscal year. SALEGR is the growth rate of the target's total sales in the previous fiscal year. DEBT equals the ratio of the target' total liabilities over its total assets. TENDER equals one the acquirer launched a tender offer for the target. DEFENSE equals one if the target employs at least one defensive tactic against unwanted bidders. PUBLIC equals one if the target status is public, zero otherwise. CASH is the proposition of cash in offer. INDUS is a dummy indicator equal to if the target belongs to the same industry group with the acquirer. COMPETE equals one if there is more than one entity bidding for the target.

	Single transaction			Serial transaction			All		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median	Mean	Standard deviation	Median
VAL	555.9	1880.5	100.0	1067.2	4951.6	175.0	976.3	4563.8	150.0
ROA	0.082	0.166	0.095	0.083	0.174	0.100	0.083	0.173	0.099
SIZE	4.725	1.679	4.605	5.146	1.818	5.165	5.071	1.801	5.011
SALEGR	1.178	0.385	1.097	1.195	0.446	1.097	1.192	0.436	1.097
LEVERAGE	0.506	0.250	0.502	0.522	0.245	0.521	0.519	0.246	0.517
CASH	0.829	0.364	1	0.815	0.375	1	0.817	0.373	1
SUCC	0.304	0.460	0	0.384	0.487	0	0.370	0.483	0
TENDER	0.070	0.255	0	0.083	0.276	0	0.081	0.273	0
DEFENSE	0.026	0.160	0	0.033	0.179	0	0.032	0.175	0
PUBLIC	0.944	0.229	1	0.964	0.187	1	0.960	0.196	1
CASH	0.829	0.364	1	0.815	0.375	1	0.817	0.373	1
INDUS	0.907	0.290	1	0.876	0.329	1	0.882	0.323	1
COMPETE	0.019	0.138	0	0.018	0.134	0	0.019	0.135	0
N		1186			5491			6677	

Table 3: CEOs' accumulated learning experience and takeover success

Table 3 summarizes the completion rate of transactions across CEOs' accumulated learning experience (ALE). ALE is generated by summing up the number of completed deals CEOs conducted in all previous transactions. Completion proportion is the ratio between the total of completed transaction and the total of transactions in each level of experience. A completed transaction is identified as "complete" status in Thomson SDC Mergers and Acquisitions database.

ALE	Total	Failed	Completed	Completion proportion
0	1510	1061	449	29.74%
1	1313	810	503	38.31%
2	507	279	228	44.97%
3	270	149	121	44.81%
4	132	53	79	59.85%
5	90	36	54	60.00%
>5	162	65	97	60.00%
Total	3984	2453	1531	38.42%

Table 4: Probit models on completed and withdrawn transactions.

The dependent variable, SUCC, equals one if the transaction is completed, and zero otherwise. Model 1 does not control for year and industry. Model 2 controls for year. Model 3 controls for industry. Model 4 control for both year and industry. ALE equals the total number of previous completed transactions in acquisition programs. SIZE is the natural logarithm of transaction value. ROA is the ratio of the target's total returns over its total assets in the previous fiscal year. SALEGR is the growth rate of the target's total sales in the previous fiscal year. DEBT equals the ratio of the target' total liabilities over its total assets. TENDER equals one the acquirer launched a tender offer for the target. DEFENSE equals one if the target employs at least one defensive tactic against unwanted bidders. PUBLIC equals one if the target status is public, zero otherwise. CASH is the proposition of cash in offer. INDUS is a dummy indicator equal to if the target belongs to the same industry group with the acquirer. COMPETE equals one if there is more than one entity bidding for the target. ***, **, and * denote statistically significant at 1 %, 5 %, and 10 % levels, respectively.

Dependent variable SUCC=1 if transaction is completed								
	Model 1		Model 2		Model 3		Model 4	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
ALE	0.068***	0.014	0.066***	0.014	0.059***	0.014	0.056***	0.014
SIZE	0.020	0.014	0.045***	0.015	0.016	0.015	0.043***	0.016
ROA	-1.221***	0.175	-1.347***	0.180	-1.203***	0.186	-1.330***	0.190
SALEGR	0.084	0.059	0.045	0.061	0.073	0.061	0.033	0.062
LEVERAGE	-0.150	0.105	-0.242**	0.107	-0.126	0.122	-0.199	0.125
TENDER	1.807***	0.105	1.788***	0.107	1.872***	0.108	1.848***	0.110
DEFENSE	0.138	0.158	0.070	0.160	0.142	0.159	0.062	0.162
PUBLIC	-1.816***	0.244	-1.936***	0.248	-1.866***	0.251	-1.988***	0.257
CASH	-1.432***	0.075	-1.377***	0.077	-1.440***	0.077	-1.383***	0.079
INDUS	-0.936***	0.088	-0.955***	0.089	-0.964***	0.091	-0.988***	0.093
COMPETE	-0.956***	0.168	-0.965***	0.169	-0.920***	0.173	-0.929***	0.174
CONST	3.216***	0.282	3.870	0.452	3.561***	0.424	4.154***	0.566
Control for year	No		Yes		No		Yes	
Control for industry	No		No		Yes		Yes	
N	3984		3984		3970		3970	
pseudo R-sq	0.35		0.37		0.37		0.38	

Table 5: Regressions of takeover success on CEOs' experience and skill

Model 1 shows the OLS estimation of takeover success of the first deal in acquisition programs on industry success rate. SKILL are estimated residuals in Model 1. Model 2 provides probit regression of the takeover success of later deals in acquisition programs on CEOs' learning experience and SKILL. Model 3 controls for the interaction term between CEOs' learning experience and SKILL. The dependent variable, SUCC, equals one if the takeover bid is completed, and zero otherwise. Model 1 controls for CEOs' equity pay. Model 2 controls for CEOs' variable pay. ALE equals the total number of previous completed takeover bids in acquisition programs. SIZE is the natural logarithm of transaction value. ROA is the ratio of the target's total returns over its total assets in the previous fiscal year. SALEGR is the growth rate of the target's total sales in the previous fiscal year. DEBT equals the ratio of the target' total liabilities over its total assets. TENDER equals one the acquirer launched a tender offer for the target. DEFENSE equals one if the target employs at least one defensive tactic against unwanted bidders. PUBLIC equals one if the target status is public, zero otherwise. CASH is the proposition of cash in offer. INDUS is a dummy indicator equal to if the target belongs to the same industry group with the acquirer. COMPETE equals one if there is more than one entity bidding for the target. ***, **, and * denote statistically significant at 1 %, 5 %, and 10 % levels, respectively.

Dependent variable SUCC=1 if transaction is completed						
	Model 1		Model 2		Model 3	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
IRS	0.081*	0.046	-	-	-	-
ALE	-	-	0.050***	0.016	0.061***	0.017
SKILL	-	-	0.118*	0.071	0.234**	0.093
ALE*SKILL	-	-	-	-	-0.078**	0.041
SIZE	0.0004	0.007	0.048***	0.017	0.048***	0.017
ROA	-0.208***	0.060	-1.300***	0.198	-1.295***	0.198
SALEGR	-0.054**	0.023	0.026	0.066	0.028	0.066
LEVERAGE	0.038	0.045	-0.166	0.130	-0.160	0.130
TENDER	0.550***	0.043	1.887***	0.119	1.885***	0.119
DEFENSE	0.103*	0.059	0.098	0.181	0.087	0.181
PUBLIC	-0.412***	0.042	-1.980***	0.262	-1.985***	0.263
CASH	-0.521***	0.037	-1.394***	0.083	-1.394***	0.084
INDUS	-0.158***	0.037	-1.023***	0.099	-1.031***	0.099
COMPETE	-0.137	0.099	-0.856***	0.196	-0.868***	0.196
CONST	1.327***	0.071	4.160***	0.551	4.183***	0.553
Year/Industry	No		Yes		Yes	
N	1384		3624		3624	
R-sq/pseudo R-sq	0.38		0.39		0.39	

Table 6: Random-effects probit models on completed and withdrawn transactions

The dependent variable, SUCC, equals one if the transaction is completed, and zero otherwise. Model 1 does not control for year and industry. Model 2 controls for year. Model 3 controls for industry. Model 4 controls for both year and industry. ALE equals the total number of previous completed transactions in acquisition programs. SIZE is the natural logarithm of transaction value. ROA is the ratio of the target's total returns over its total assets in the previous fiscal year. SALEGR is the growth rate of the target's total sales in the previous fiscal year. DEBT equals the ratio of the target' total liabilities over its total assets. TENDER equals one the acquirer launched a tender offer for the target. DEFENSE equals one if the target employs at least one defensive tactic against unwanted bidders. PUBLIC equals one if the target status is public, zero otherwise. CASH is the proposition of cash in offer. INDUS is a dummy indicator equal to if the target belongs to the same industry group with the acquirer. COMPETE equals one if there is more than one entity bidding for the target. ***, **, and * denote statistically significant at 1 %, 5 %, and 10 % levels, respectively.

Dependent variable SUCC=1 if transaction is completed								
	Model 1		Model 2		Model 3		Model	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
ALE	0.043**	0.018	0.049***	0.017	0.044***	0.018	0.046***	0.017
SIZE	0.025	0.016	0.049***	0.016	0.018	0.016	0.045***	0.017
ROA	-1.319***	0.192	-1.425***	0.193	-1.252***	0.196	-1.367***	0.198
SALEGR	0.090	0.063	0.052	0.064	0.076	0.063	0.035	0.064
LEVERAGE	-0.163	0.114	-0.250**	0.115	-0.123	0.128	-0.195	0.129
TENDER	1.926***	0.118	1.882***	0.118	1.941***	0.118	1.902***	0.118
DEFENSE	0.168	0.166	0.095	0.167	0.165	0.164	0.079	0.166
PUBLIC	-1.921***	0.258	-2.028***	0.261	-1.934***	0.262	-2.046***	0.266
CASH	-1.504***	0.083	-1.438***	0.085	-1.484***	0.083	-1.419***	0.085
INDUS	-0.990***	0.095	-1.002***	0.096	-0.993***	0.096	-1.014***	0.097
COMPETE	-1.034***	0.178	-1.032***	0.178	-0.965***	0.180	-0.967***	0.180
CONST	3.398***	0.304	4.012***	0.476	3.706	0.456	4.272	0.593
Control for year	No		Yes		No		Yes	
Control for industry	No		No		Yes		Yes	
N	3984		3984		3984		3984	

Table 7: Probit regressions of takeover success on CEOs' experience and characteristics.

The dependent variable, SUCC, equals one if the transaction is completed, and zero otherwise. Model 1 controls for CEOs' equity pay. Model 2 controls for CEOs' variable pay. ALE equals the total number of previous completed transactions in acquisition programs. SIZE is the natural logarithm of transaction value. ROA is the ratio of the target's total returns over its total assets in the previous fiscal year. SALEGR is the growth rate of the target's total sales in the previous fiscal year. DEBT equals the ratio of the target' total liabilities over its total assets. TENDER equals one the acquirer launched a tender offer for the target. DEFENSE equals one if the target employs at least one defensive tactic against unwanted bidders. PUBLIC equals one if the target status is public, zero otherwise. INDUS equals one if both target and acquirer belong to the same industry group. COMPETE equals one if there is more than one entity bidding for the target. AGE is the natural logarithm of CEO's age. TENURE is the number of years being CEO in the acquirer firm. EQPAY is the total of restricted stock grants and stock option, scaled by the CEO total compensation. VARPAY is the difference between total compensation and salary, scaled by total compensation. PAY SLICE is the percentage of compensation as of the sum of the top-five executive team. ***, **, and * denote statistically significant at 1 %, 5 %, and 10 % levels, respectively.

Dependent variable SUCC=1 if transaction is completed				
	Model 1		Model 2	
	Coefficient	Standard deviation	Coefficient	Standard deviation
ALE	0.048***	0.015	0.047***	0.015
SIZE	0.045***	0.017	0.040**	0.017
ROA	-1.385***	0.195	-1.400***	0.195
SALEGR	0.003	0.065	-0.005	0.065
LEVERAGE	-0.182	0.127	-0.203	0.128
TENDER	1.816***	0.112	1.817***	0.112
DEFENSE	0.007	0.165	0.010	0.165
PUBLIC	-2.010***	0.261	-2.019***	0.261
CASH	-1.391***	0.082	-1.389***	0.082
INDUS	-0.970***	0.094	-0.965***	0.094
COMPETE	-0.957***	0.177	-0.953***	0.177
AGE	-0.240	0.211	-0.232	0.210
TENURE	0.004	0.058	-0.004	0.059
GENDER	0.192	0.236	0.189	0.235
EQPAY	0.085	0.109	-	-
VARPAY	-	-	0.247*	0.145
SLICEPAY	-0.018	0.092	-0.048	0.094
CONST	5.748***	1.13	5.674	1.128
Control for year	Yes		Yes	
Control for industry	Yes		Yes	
N	3792		3792	
pseudo R-sq	0.378		0.378	

Table 8: Robust checks

The dependent variable, SUCC, equals one if the transaction is completed, and zero otherwise. Model 1 tests an alternative definition of acquisition programs in which prior deal status represents CEOs' experience. Model 2 includes cumulative abnormal return, CAR, as an explanatory variable. Model 3 adds an interaction term between CAR and ALE. ALE is the total number of previous completed transaction in acquisition programs. PRSUCC is a dummy indication which equals one if the prior bid is completed in acquisition programs of two successive bids. CAR is cumulative abnormal returns between from day -1 to day 1, with day 0 defined as the announcement date. SIZE is the natural logarithm of transaction value. ROA is the ratio of the target's total returns over its total assets in the previous fiscal year. SALEGR is the growth rate of the target's total sales in the previous fiscal year. DEBT equals the ratio of the target' total liabilities over its total assets. TENDER equals one the acquirer launched a tender offer for the target. DEFENSE equals one if the target employs at least one defensive tactic against unwanted bidders. PUBLIC equals one if the target status is public, zero otherwise. CASH is the proposition of cash in offer. INDUS is a dummy indicator equal to if the target belongs to the same industry group with the acquirer. COMPETE equals one if there is more than one entity bidding for the target. ***, **, and * denote statistically significant at 1 %, 5 %, and 10 % levels, respectively.

Dependent variable SUCC=1 if transaction is completed						
	Model 1		Model 2		Model 3	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
PRISUCC	0.185***	0.052	-	-	-	-
ALE	-	-	0.056***	0.014	0.055***	0.014
CAR	-	-	-1.085***	0.422	-1.288***	0.533
ALE_CAR	-	-	-	-	0.170	0.273
SIZE	0.052***	0.016	0.041***	0.016	0.041***	0.016
ROA	-1.342***	0.189	-1.325***	0.190	-1.325***	0.190
SALEGR	0.033	0.062	0.032	0.063	0.030	0.063
LEVERAGE	-0.186	0.124	-0.196	0.125	-0.195	0.125
TENDER	1.844***	0.110	1.867***	0.111	1.871***	0.111
DEFENSE	0.051	0.162	0.050	0.162	0.049	0.162
PUBLIC	-1.960***	0.257	-2.017***	0.258	-2.018***	0.258
CASH	-1.381***	0.079	-1.359***	0.080	-1.360***	0.080
INDUS	-1.013***	0.093	-0.972***	0.093	-0.974***	0.093
COMPETE	-0.970***	0.174	-0.930***	0.174	-0.930***	0.174
CONST	4.109***	0.576	4.268***	0.577	4.281***	0.578
Control for year	Yes		Yes		Yes	
Control for industry	Yes		Yes		Yes	
N	3963		3963		3963	
pseudo R-sq	0.381		0.383		0.383	

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