Journal of Banking and Finance 168 (2024) 107288

Contents lists available at ScienceDirect

Journal of Banking and Finance

journal homepage: www.elsevier.com/locate/jbf

The timing of stock repurchases: Do well-connected CEOs help or harm?☆

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ARTICLE INFO

JEL classification:
G30
G35

Keywords:
Repurchase timing
CEO network centrality
Daily repurchase transactions

ABSTRACT

Using a sample of daily repurchase transactions, we find that CEOs with extensive professional networks execute buybacks at higher prices relative to their less-connected peers. This finding survives a large battery of robustness tests and is unlikely to be the product of endogeneity biases. Monitoring by institutional investors, blockholders, and independent directors, as well as low levels of board busyness mitigate the detrimental effect of a well-connected CEO on repurchase timing. Moreover, better-connected CEOs are more associated with insider net sales around repurchase transactions. Overall, our evidence is consistent with CEO-shareholder agency conflict explanations and CEO power mechanisms.

1. Introduction

Although finance research has long concentrated on the features of corporations to explain firm performance and corporate financial decisions, the focus in recent years has gradually shifted towards the personal characteristics of the corporate decision-makers. For instance, recent studies highlight that CEOs are key drivers of firm performance (Bennedsen et al., 2020) and stress the importance of the traits and attributes of CEOs and directors, such as managerial styles (Bertrand and Schoar, 2003; Schoar and Zuo, 2017), gender (Adams and Ferreira, 2009), overconfidence (Hirshleifer et al., 2012; Phua et al., 2018), professional experience (Dittmar and Duchin, 2016), and cognitive and non-cognitive abilities (Adams et al., 2018). The takeaway from this line of research is that a firm's success partly depends on its ability to identify and appoint CEOs and other executives with features that are value-enhancing and coherent with the firm's characteristics.

One important factor here that is attracting growing attention among financial economists is the professional network of executives and other directors. Prior literature suggests that the appointment of a CEO with an extensive professional network (i.e. a CEO with high network centrality) can both benefit and undermine the corporate decision-making process given the possible presence of alternative and contrasting mechanisms. Our paper contributes to this important strand of the literature and focuses on a CEO's network of professional ties and their impact on the timing of UK open market repurchase transactions. The focus on CEOs rather than other executives is justified given that the annual repurchase activity of the average UK firm is significant, amounting to approximately 1% of market capitalization (BEIS, 2019). CEOs are, in fact, ultimately responsible for any corporate decision that can substantially affect firm value and are, therefore, likely to be directly involved in the decision-making process with respect to buybacks.[1] Unlike their US peers, UK firms are obliged to disclose detailed pricing and volume information on their daily buyback activities. The comprehensive UK disclosure regime has been exploited in previous studies (e.g., Andriosopoulos et al., 2013), and allows us to build an extensive and granular dataset of repurchase transactions carried out by a large and representative set of firms, and to use such a dataset to evaluate the timing of each transaction accurately.

☆ We thank Thorsten Beck (the Editor), the Associate Editor, and two anonymous Referees for several helpful comments that greatly improved the paper. We are also grateful for the detailed suggestions to Ettore Croci, Konstantinos Stathopoulos, and conference participants at the 2021 FMA Annual Meeting and the 2021 EFMA Annual Meeting. All errors are ours.

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[1] Indeed, Graham et al. (2015) report some survey evidence showing that CEOs tend not to delegate decisions in the area of payout policy. Furthermore, 38.7% of the responding CEOs state that they dominate payout decisions, with no or minimal input from others. Only 3.6% of the CEOs claim that they have little involvement in payout choices.

https://doi.org/10.1016/j.jbankfin.2024.107288
Received 27 January 2023; Accepted 7 August 2024
Available online 12 August 2024

Several studies document that firms, on average, buy back own stock on the open market at bargain prices (Brockman and Chung, 2001; Cook et al., 2004; De Cesari et al., 2012; Ben-Rephael et al., 2014; Dittmar and Field, 2015).[2] Well-timed repurchase transactions boost firm value by essentially transferring wealth from selling shareholders to the firm itself. In contrast, buybacks that are carried out at comparatively high prices produce the opposite effect and diminish firm value. Practitioners seem to be fully aware that buybacks can reduce firm value if they are not timed properly. For example, on 13 October 2011, James Dimon, CEO of JPMorgan Chase & Co., apologized for buybacks carried out earlier in the year at prices that appeared to be excessive: "It would have been wiser to wait. We are sorry".[3] Moreover, according to PricewaterhouseCoopers, firms should expect their shareholders to ask questions about repurchase timing, such as: "Why is the company expending funds for common stock buybacks?"; "What was the average price paid?"; "In light of declines in the company's stock price, will the company implement or continue a stock buyback program?"; and/or "Why did the company repurchase so much stock earlier at such a high price?".[4]

Overall, the timing of buyback transactions represents an ideal setting in which to investigate the impact of a CEO's network on firm value because the CEO's network centrality is likely to shape the cross-sectional variation in repurchase timing. Unlike other transactions (e.g. mergers and acquisitions), stock repurchases are less transformative but quite frequent, common, and widespread among firms. These features enable us to study a representative dataset and generate findings with significant external validity on the nexus between executive network centrality and corporate decision-making. Furthermore, while most managerial decisions are not observable, the detailed terms of UK buybacks are publicly available, enabling us to exploit a large and rich dataset of daily repurchase transactions. A final strength of our study is that the effect of executive network centrality on the timing of buybacks is hard to predict *ex ante* given that several contrasting mechanisms can direct this relation.

One such possible mechanism is based on the notion that firms may value CEOs that are capable of enlarging the firm's information set and gather novel, relevant information from outside sources, which can improve the decision-making process and help to generate innovative strategic insights. For example, previous studies document that executives consider peer firms' investments and their stock market valuations as important sources of information that influence the executives' investment strategy (Foucault and Fresard, 2014; Bustamante and Fresard, 2021). The evidence reported by De Cesari and Huang-Meier (2015) is consistent with the notion that executives acquire novel information from the past stock returns of their firm and use such information to make dividend policy choices. CEOs with extensive professional connections can, therefore, be particularly valuable owing to their ability to obtain information from their many contacts. Faleye et al. (2014) show that executives' connections boost corporate innovation. Meanwhile, several recent studies find that companies pursue similar policies when their decision-makers are socially and professionally connected (Shue, 2013; Fracassi, 2017). Information obtained by executives from professional contacts can complement the sets of information they already possess on their firm and enhance the executives' ability to time repurchase transactions.

However, the downside of well-connected CEOs is that an extensive network of ties provides such CEOs with power, ability to influence the appointment and activities of non-executive directors, and labor market insurance. El-Khatib et al. (2015) highlight that social ties protect CEOs from the discipline of the market of corporate control and the managerial labor market. Relatedly, dismissed workers face shorter periods of unemployment if their former colleagues remain employed at the time (Cingano and Rosolia, 2012). CEOs that are forced to leave a firm are more likely to obtain a comparable or better job if they are socially connected, and they are less likely to be fired for poor performance if they share some social ties with their directors (Nguyen, 2012). This issue is particularly relevant in the context of buybacks given that Friesen et al. (2022) show that poor repurchase timing increases the likelihood of a CEO's involuntary turnover, indicating that harsh consequences can indeed follow buybacks at prices that may appear excessive to shareholders.[5] Overall, social connections can weaken CEOs' incentives to act in the best interests of their firm by, for instance, attempting to purchase own stock at the lowest possible price. Such connections can also strengthen CEOs' ability and resolve to pursue self-serving objectives, which may drive them to conduct repurchases at comparatively high prices with the sole purpose of temporarily inflating stock market valuations.

On the whole, the actual impact of the CEO's centrality on corporate decisions is an empirical issue ideally to be studied in the context of buybacks. We use a unique dataset of 18,067 daily repurchase transactions carried out by 335 firms over the period 1998–2014 to investigate whether firms led by CEOs with more extensive professional connections are more likely to repurchase own stock at bargain prices. Our main finding supports the view that firms managed by better-connected CEOs are less likely to purchase own stock at bargain prices.

In our baseline, multivariate tests, we focus on the relation between the relative price at which stock is repurchased and a CEO's professional network centrality as measured by a very common proxy, namely the normalized degree of the CEO. In these tests, we control for a long set of repurchase timing determinants and cluster the standard errors at the CEO level. In line with a study by Dittmar and Field (2015), we consider the relative price as an inverse measure of timing that is built upon the ratio between the price at which stock is bought back and benchmarks based on average market closing prices of the same stock over one, three, and six calendar months after the transaction. Normalized degree is a measure of network centrality that reflects the total number of direct professional ties (both current and historical) with other directors and executives. We report a positive and statistically significant relation between the relative price of a firm's buyback transaction and the degree of the firm's CEO.

One limitation of our baseline tests is that executives are not allocated in a random fashion to firms and the endogenous matching of companies and CEOs is a possible source of endogeneity biases. We adopt several empirical strategies aimed at minimizing any such biases that could affect our baseline tests and consistently obtain qualitatively similar results. First, we include firm fixed effects in our regression specifications, which allow us to control for time-invariant omitted variables. Second, we concentrate on small subsets of buybacks that occur around CEO turnover events, which often cause significant variations in a firm's CEO's network centrality without any notable changes in firm characteristics. In this analysis, we can control for any time-invariant feature of a firm through turnover fixed effects, but time-variant unobservables may still affect turnover events. To deal with this important limitation we also consider smaller sets of turnover events that are more likely to be exogenous and not associated with

[2] However, Bonaimé et al. (2016) document that managers can time buybacks only in the short term, and that in the long term firms would be better off if their executives simply smoothed repurchases evenly over time.

[3] https://www.thestreet.com/investing/stocks/dimon-says-sorry-for-buyback-screw-up-11276957

[4] https://criticaleye.com/inspiring/insights-servfile.cfm?id=431&view=1

[5] The recent case of LPL Financial Holdings Inc. further corroborates the notion that buybacks at excessive prices can be costly to executives. A buyback carried out by the firm in 2015 with the aim of boosting its stock price subsequently sparked a shareholder class action in the wake of a very significant decline in the stock price. The plaintiff claimed that the buyback program had been "a wasteful and inefficient use of company capital" ("LPL's problems keep piling up" by Bruce Kelly, *Investment News* (April 4, 2016)).

significant changes in a firm's conditions. Third, we estimate some standard instrumental variable regression models by considering instrumental variables that capture the average characteristics in terms of the professional network of the pool of executives that a firm is likely to be able to recruit. We observe that these instruments are indeed related to our main test variable. Finally, we formally evaluate the sensitivity of our primary regression findings to the inclusion of an omitted variable, and conclude that our inferences are not particularly sensitive.

In addition, our key results are generally robust to the use of: a binary dependent variable for repurchases at prices below average future market prices; alternative definitions of a CEO's degree and network centrality measures; the CFO's normalized degree as an additional control variable in our baseline models; dependent variables based on stock returns; alternative clustering methods of the standard errors; alternative definitions of a firm's CEO; a dependent variable that is not affected by the market reaction to a repurchase transaction; the inclusion of past timing measures as additional controls; and the exclusion of the control variable for firm size.

What is the network mechanism behind the empirical regularity key to our study? In cross-sectional tests, we document that the tendency of CEOs with extensive professional networks to purchase own stock at comparatively high prices is more prevalent in firms with low levels of institutional ownership concentration and without non-individual blockholders (i.e. legal entities with blocks of 5% or higher). The negative relation between a CEO's network and repurchase timing is also weaker in firms with independent boards and low non-executive director busyness. This evidence is coherent with agency conflict and CEO power explanations: powerful CEOs with extensive networks are less likely to undertake repurchase transactions that do not benefit their firms when they are subject to monitoring by institutional investors, non-individual blockholders, and independent directors.

We may wonder about the incentives underlying the behavior of well-connected CEOs that fail to repurchase own stock at bargain prices. One possibility is that these CEOs legitimately privilege other more consequential and valuable corporate activities and deliberately choose to pay limited attention to repurchase timing. However, it is hard to reconcile this explanation with our finding that when monitoring mechanisms are effective, well-connected CEOs tend to undertake better-timed buybacks. Another plausible mechanism we consider here is CEO shirking (Jensen and Meckling, 1976). Prior literature provides extensive and convincing evidence on shirking and similar phenomena that can lead firms to underperform (e.g., Bertrand and Mullainathan, 2003; Giroud and Mueller, 2010; Manso, 2011; Biggerstaff et al., 2017). In our context, entrenched and powerful executives, who lack discipline, could be unwilling to work out the optimal time window in which to buy back own stock, an exercise that requires their effort but brings them limited benefits.

Moreover, powerful well-connected executives can afford to carry out stock repurchases for their own purposes irrespective of whether the target stock is undervalued. In particular, repurchase transactions can be executed by CEOs to support stock market valuations (e.g., Dittmar and Field, 2015; Liu and Swanson, 2016; Busch and Obernberger, 2017; Andriosopoulos and Hoque, 2018). A boost to stock prices allows CEOs to sell their own personal shares under more favorable conditions and inflate the value of their equity-linked pay. Edmans et al. (2022) report that CEO equity sales routinely follow stock repurchase transactions, a clear sign that buybacks are timed by CEOs to push stock market valuations upward. Bonaime and Ryngaert (2013) find that the likelihood of net insider selling is particularly high in quarters where stock repurchases occur and Moore (2023) highlights the existence of a positive causal relation between executive equity sales and buybacks. Wang et al. (2021) show that the boost to repurchase activities caused by the legalization of buybacks in a particular country coincides with higher stock prices in the short term and a significant reduction in insider ownership.

Consistently, in additional tests, we document that CEOs with an above-median degree are especially likely to be net sellers of their firm's stock over the short period surrounding a buyback trade. This behavior by well-connected CEOs can be highly controversial in that they signal their belief of stock market overvaluation through their personal sales, while at the same time purchasing stock on behalf of their firm. While this evidence is not sufficient to prove that these CEOs are acting in a way that benefits themselves at the expense of their firms, their willingness to pursue such potentially controversial transactions can be seen as further proof of their power.[6]

In our last set of empirical analyses, we evaluate two alternative mechanisms that could explain our results, but fail to provide any supportive evidence. Indeed, our study lacks any evidence in favor of an alternative asymmetric-information mechanism that hinges upon the notion that larger networks tend to convey more inside information to outsiders, make the stock market more efficient, and, therefore, undermine a CEO's ability to time repurchases. We observe that there is no relation between the average degree of non-CEO directors, who can also diffuse inside information through their networks, and the relative price of buybacks. In addition, the level of information asymmetry does not significantly affect our main cross-section findings. It is also possible that the poorer timing we observe in buybacks carried out by better-connected CEOs actually originates from the style of their price-support activities. In other words, CEOs with larger professional networks might be more prone to use repurchase transactions to counteract significant and high-momentum price declines even when they are unlikely to be stabilized or reversed by such actions. Their repurchases then tend to be followed by further downward trends and turn out to be poorly-timed. However, this explanation is not consistent with our finding of an insignificant relation between past stock returns and the timing of buybacks. Furthermore, past returns do not affect the extent to which a CEO's degree has an impact on timing.

Our study contributes to the expanding literature on the interplay between social networks and corporate financial decisions and outcomes. Some previous studies concentrate on firm policies in general (Shue, 2013; Fracassi, 2017), firm performance (Larcker et al., 2013), the effectiveness of boards of directors (Fracassi and Tate, 2012; Nguyen, 2012), risk-taking (Ferris et al., 2017; Ferris et al., 2019), innovation (Faleye et al., 2014), the cost and terms of private debt (Fogel et al., 2018), and IPO characteristics (Bajo et al., 2016). Our findings are particularly related to previous papers that highlight the potential value-destroying effect of well-connected, powerful CEOs in the context of acquisitions (Chikh and Filbien, 2011; Fracassi and Tate, 2012; Ishii and Xuan, 2014; El-Khatib et al., 2015). While the focus on acquisitions is well-justified given that they can influence the value of an acquiring firm to a significant extent, the benefit of studying daily stock repurchase transactions is that these are very frequent, common, and transparent in the UK market, allowing us to analyze the decisions of a representative sample of CEOs in great detail. In a contemporaneous study, Evgeniou et al. (2022) investigate the relation between long-run excess returns following repurchase announcements and firm centrality in the input–output trade flow network. In contrast, we are instead interested in the association between the centrality of top executives in a professional network and the relative price at which actual repurchase transactions are carried out.

[6] Repurchase transactions can also be executed by executives to mechanically inflate earnings per share (EPS) figures and help them match EPS targets set by financial analysts (e.g., Hribar et al., 2006; Almeida et al., 2016) or contained in their compensation contracts (e.g., Young and Yang, 2011; Cheng et al., 2015; Kim and Ng, 2018). We expect powerful CEOs with many social ties to be particularly likely to engage in EPS-boosting buybacks, even when their shareholders perceive the stock to be overvalued, and irrespective of any repurchase timing considerations. However, recent evidence casts doubt on the notion that UK firms commonly use repurchase transactions to meet or beat EPS targets (BEIS, 2019).

Our paper also contributes to previous studies highlighting the impact of a firm's corporate governance on the use and execution of repurchase programs by its executives. For example, there is substantial evidence on buybacks aimed at boosting EPS (e.g., Hribar et al., 2006; Almeida et al., 2016), which are less common in firms with better governance (Farrell et al., 2013). Moreover, executives can engage in "false–signaling" strategies by announcing repurchase programs to generate a positive market reaction without intending to subsequently purchase own stock.[7] Wu (2012) and Han et al. (2014) report that more effective governance mechanisms lend credibility to repurchase announcements and reduce the incidence of false signaling. Our findings contribute to this literature by highlighting the crucial role of governance in limiting well-connected CEOs' tendency to purchase own stock at comparatively high prices.

The paper is structured as follows: we describe the dataset of repurchase transactions in Section 2; Section 3 provides information on the variable construction process alongside some descriptive statistics; the main findings of the study can be found in Section 4; Section 5 discusses possible endogeneity biases and presents related tests; in Section 6, we present several robustness tests and additional analyses; Section 7 presents some cross-sectional tests on a mechanism based on agency conflicts and CEO power; Section 8 focuses on the effect of the CEO's network centrality on the relation between buybacks and insider trading; in Section 9, we evaluate alternative mechanisms that may be coherent with our baseline results; and Section 10 concludes.

2. Dataset of daily repurchase transactions

We use a very large dataset of 24,655 daily observations on open market repurchase transactions executed by 576 UK listed companies, excluding financial (SIC between 6000 and 6999) and utility firms (SIC between 4900 and 4949). Previous research on the timing of repurchase transactions has primarily focused on US listed firms and employed data at a monthly or lower frequency (e.g., Dittmar and Field, 2015). The use of daily transactions allows us to measure the timing of buyback transactions more precisely. Our dataset covers the period 1998–2014, collected from the Company REFS database. For each daily observation, we include the date of the announcement of the buyback transactions and information on pricing and volume. Announcements of repurchase transactions either coincide with or occur shortly after the trading day of the actual execution. UK listed firms are obliged to disclose their actual repurchases as soon as possible and not later than 7:30 a.m. on the subsequent business day.

Since variable construction requires the collection of information from several other sources, the baseline dataset in our paper comprises 18,067 daily observations for 335 companies. A significant number of observations are lost in the first few years of our sample period owing to the limited coverage in Boardex, the database from which the CEO's professional ties are obtained.

3. Variable construction and descriptive statistics

We follow the influential paper by Dittmar and Field (2015) to construct our inverse measures of repurchase timing, allowing us to investigate whether there is a relation between a CEO's professional connections and the firm's tendency to carry out buybacks at bargain prices. For each repurchase transaction, we compute the relative differences between the repurchase price and the average closing price of the same stock over several intervals surrounding the date of the repurchase transaction. *Relative price –t to +t* is the ratio between the price at which the stock is bought back and the average closing price between month *–t* and month *+t*, minus one.[8] We alternatively set *t* equal to one, three, or six. Closing prices are obtained from the London Share Price Database (LSPD) and are adjusted for dividend payments and stock splits to make them comparable to the related repurchase price. On average, *Relative price –t to +t* should be lower for firms that are more capable and/or more willing to purchase own stock from the open market at favorable prices.

We can observe negative values for *Relative price –t to +t* because the repurchasing firm is trying to support its stock price after a market decline. This is a strategy that can be pursued by any firm or trader, regardless of the possession of any information on stock market undervaluation and possibly without any intention to time the market. On the other hand, managers with more forward-looking inside information should be more capable of buying back stock at prices that are lower than future market valuations. Dittmar and Field (2015) highlight the importance of studying forward-looking measures of buyback timing. Hence, we expect another variable that we build, namely *Relative price 0 to +t*, to be a more meaningful repurchase timing measure given that it compares buyback prices with future closing prices. We also build dummy variables based on the relative price measures that are equal to one when the measures are negative, and are otherwise set to zero.

Table 1 contains the distributions for the repurchase timing measures. The median values of the continuous measures *Relative price –t to +t* and *Relative price 0 to +t* are all negative, and the medians of the related binary proxies always take a value of one. We can conclude that more than 50% of the repurchase transactions in our sample are conducted at prices that are lower than average closing prices. This is not unexpected and confirms prior evidence on repurchase timing (e.g., De Cesari et al., 2012; Ben-Rephael et al., 2014; Dittmar and Field, 2015).

We use the UK version of the Boardex database and rely on social network analysis tools to build a measure of a CEO's professional connections (or network centrality in the jargon of social network analysis). For each year and each CEO, we count the total number of the CEO's current and historical professional ties with other directors and executives provided in the database. We assume that a tie is established between two individuals if they work for the same listed company as executives and/or directors at the same time.[9] Through this procedure, we construct the variable *Degree* that measures the number of direct professional links a CEO has in the given network of all executives and directors. We employ quite an extensive definition of "CEO" based on job title information gleaned from Boardex. When no executive can be found with a "CEO" job title, we first look for the presence of an executive "Chairman" or "Chairwoman", and finally consider whether the firm has a "Managing Director" or "MD". When a company has multiple joint or co-CEOs, we select the CEO with the highest salary. In our robustness tests, we consider alternative approaches to construct our main test variables, including amendments to the CEO definition.

Table 1 shows that the average value of a CEO's professional connections is 304.55 (median 164) and its minimum value is two. Similarly to Bajo et al. (2016), Fracassi (2017), and Manu and Qi (2023), in our empirical analyses, we use the test variable *Normalized degree*, which is a scaled version of *Degree*. It is calculated by taking the ratio of a CEO's *Degree* to the total number of directors and executives (excluding the same CEO) that belong to the overall Boardex network in the same year. Using the normalized degree measure allows us to mitigate

[7] A study by Bonaimé (2012) indicates that these strategies may be particularly effective in firms with significant past repurchase completion rates.

[8] To mitigate the effect of outliers, we winsorize 2% (1% in each tail) of the observations of this and all the other continuous variables in the study.

[9] We concentrate on employment-related connections rather than other types of social connections (e.g. those based on education links and social activities) given that they are arguably more likely to influence firm policies to a significant extent, a view that is supported by previous studies (e.g., Fracassi and Tate, 2012; Fracassi, 2017; Ke et al., 2019). In line with El-Khatib et al. (2015), we only consider information on ties through listed firms as the related information is probably more reliable than that for private firms.

Table 1
Summary statistics.

	n	mean	p25	p50	p75	sd	min	max
Relative price −1 to +1	18,067	0.0001	−0.0223	−0.0029	0.0161	0.0630	−0.1532	0.4665
Relative price −3 to +3	18,067	−0.0018	−0.0383	−0.0027	0.0284	0.0772	−0.2170	0.4438
Relative price −6 to +6	18,067	−0.0046	−0.0498	−0.0058	0.0359	0.0924	−0.2723	0.4607
Relative price 0 to +1	18,067	0.0010	−0.0317	−0.0071	0.0202	0.0793	−0.1708	0.5607
Relative price 0 to +3	18,067	0.0010	−0.0584	−0.0158	0.0317	0.1336	−0.2340	0.9674
Relative price 0 to +6	18,067	−0.0040	−0.0884	−0.0304	0.0384	0.1697	−0.2942	1.0871
Relative price −1 to +1 dummy	18,067	0.5445	0	1	1	0.4980	0	1
Relative price −3 to +3 dummy	18,067	0.5241	0	1	1	0.4994	0	1
Relative price −6 to +6 dummy	18,067	0.5358	0	1	1	0.4987	0	1
Relative price 0 to +1 dummy	18,067	0.5780	0	1	1	0.4939	0	1
Relative price 0 to +3 dummy	18,067	0.5987	0	1	1	0.4902	0	1
Relative price 0 to +6 dummy	18,067	0.6273	0	1	1	0.4835	0	1
Degree	18,067	304.5535	45	164	390	424.5032	2	2455
Normalized degree	18,067	0.0011	0.0002	0.0005	0.0013	0.0016	0.0000	0.0081
Number of repurchase transactions	18,067	11.7642	6	12	17	6.2509	1	23
Log market capitalization	18,067	15.1361	13.6479	15.1038	17.2895	2.4086	8.8371	18.8556
Operating profits	18,067	0.1409	0.0819	0.1292	0.1813	0.0823	−0.0616	0.3577
Market-to-book	18,067	1.6607	0.9341	1.4150	2.2083	0.9528	0.2966	4.4535
Leverage	18,067	0.6129	0.4837	0.6229	0.7155	0.2073	0.0852	1.3455
Cash holdings	18,067	0.1097	0.0461	0.0817	0.1508	0.0935	0.0009	0.4892
Capex	18,067	0.0471	0.0203	0.0361	0.0679	0.0356	0.0018	0.1592
Dividend yield	18,067	0.0351	0.0214	0.0326	0.0421	0.0240	0.0000	0.1588
Turnover	18,067	0.0972	0.0613	0.0706	0.1315	0.0693	0.0014	0.3596
Volatility	18,067	295.2286	210.4167	265.6667	337.1667	117.2028	140.4167	699.1667
Male CEO	18,067	0.9614	1	1	1	0.1927	0	1
CEO age	18,067	51.9604	48	52	57	6.7741	31	87
CEO tenure	18,067	5.9111	2.0000	4.6000	7.2000	5.5784	0	50
CEO direct compensation	18,067	7.0636	6.6372	7.2546	7.8484	1.3124	0	8.6091
CEO equity-based compensation	18,067	6.3910	5.8684	7.2569	8.4299	2.9641	0	9.9391
CEO delta	18,067	4.5746	3.4341	4.5458	5.8599	1.7110	0	7.8709

This table reports summary statistics for our main variables and for the sample used in the baseline regression analyses. This sample comprises 18,067 daily observations on open market repurchase transactions executed by 335 UK listed companies. All variables except the binary variables, the *Number of repurchase transactions*, *CEO age*, and *CEO tenure* are winsorized at the 1% level. Detailed variable definitions can be found in the Appendix.

two possible time-biases in our dataset. First, for an individual, *Degree* tends to mechanically increase over time as more information about the individual's employment history accumulates and is recorded in Boardex. Second, Boardex's coverage has significantly improved over time, and this makes information on professional connections incomparable between two different periods. In Table 1, the mean (median) value of *Normalized degree* is 0.0011 (0.0005), implying that on average a CEO is connected with 0.01% of the directors and executives in our dataset. The maximum value of 0.0081 for this variable indicates that the CEO with the most extensive set of professional ties is related to nearly 1% of the other directors and executives.

To avoid omitted variable biases, we consider an extensive set of control variables in our regression specifications that are defined in detail in Table A.1 in the Appendix. The *Number of repurchase transactions* executed in the same calendar month is likely to affect a transaction's timing since there is evidence that frequent repurchasers buy back stock at relatively high prices (Dittmar and Field, 2015). Firm characteristics such as firm size, profitability, and leverage could matter here too. They should influence the level of asymmetric information, the amount of resources available to purchase own stock, and the riskiness of the firm's security. We include the following firm-specific variables in our multivariate tests: *Log market capitalization*; *Operating profits*; *Market-to-book*; *Leverage*; *Cash holdings*; *Capex*; and *Dividend yield*. A firm's ability to conduct repurchase transactions at bargain prices could also depend on stock liquidity and volatility, two important dimensions that we capture through the variables *Turnover* and *Volatility*. Finally, some executive traits and attributes could correlate both with the timing of stock repurchases and our measures of professional ties. As we want to make sure that our findings are not driven by spurious correlations, we consider executive features capturing whether the CEO is a male (*Male CEO*), the age (*CEO age*) and tenure (*CEO tenure*) of the CEO, the CEO's direct (*CEO direct compensation*) and equity-based (*CEO equity-based compensation*) pay, and the delta of the CEO's wealth in the firm (*CEO delta*). In some extensions of our baseline analyses, we use information on the features of non-CEO board members from Boardex, ownership data from Refinitiv Eikon, and insider trading data from Company REFS.

The descriptive statistics for all of the control variables in the baseline multivariate models can be found in Table 1. Firms that repurchase stock in a particular month tend to do so quite actively and frequently. The mean (median) value of *Number of repurchase transactions* is 11.76 (12). Untabulated statistics show that in our dataset the average fraction of outstanding shares that is bought back on any day with repurchases is 0.161%, with minimum and maximum values of 0.001% and 6.948%, respectively. We can conclude that UK firms that conduct repurchases transact in their own stock quite frequently and that the volume of daily repurchases can be substantial. Managers may, therefore, provide non-negligible benefits to their shareholders by effectively timing repurchase transactions. As for other variables, on average, 3.51% of a firm's market value of equity is distributed through cash dividends. 96% of CEOs are males, and the average CEO's age and tenure are around 52 and six years, respectively.

4. Main results

In Table 2 we report the baseline ordinary least squares (OLS) regression outputs for six alternative specifications: three for the continuous inverse timing measure *Relative price –t to +t* and three for the other dependent variable *Relative price 0 to +t*. In our multivariate models, we include the extensive set of control variables described in Section 3 alongside the calendar month[10] and SIC-2 industry dummies.

[10] The calendar month dummies capture the actual month and year in which their respective transactions took place (e.g. January 2010 or August 2012) rather than just the month (e.g. January or August). They, therefore, allow us to control for the effects of omitted macro variables that similarly affect all observations from the same calendar month. In some robustness tests presented below, we cluster the standard errors of our regressions at the calendar month or calendar day level.

Table 2
Relative repurchase price and the CEO's network centrality: baseline OLS model.

	(1) Relative price −1 to +1	(2) Relative price −3 to +3	(3) Relative price −6 to +6	(4) Relative price 0 to +1	(5) Relative price 0 to +3	(6) Relative price 0 to +6
Normalized degree	3.9401*	3.4272	2.2215	6.8679***	14.9786***	19.5985***
	(1.782)	(1.559)	(0.957)	(2.606)	(3.550)	(3.926)
Number of repurchase transactions	0.0022**	0.0024**	0.0029**	0.0025**	0.0044**	0.0056**
	(2.022)	(2.280)	(2.514)	(2.029)	(2.065)	(2.328)
Log market capitalization	−0.0079	−0.0076	−0.0081	−0.0094	−0.0186*	−0.0266**
	(−1.433)	(−1.414)	(−1.424)	(−1.445)	(−1.700)	(−2.108)
Operating profits	0.0518	0.0583	0.1036*	0.0907*	0.1156	0.1305
	(1.222)	(1.243)	(1.705)	(1.824)	(1.166)	(1.003)
Market-to-book	−0.0021	0.0004	0.0001	−0.0075	−0.0085	−0.0109
	(−0.413)	(0.068)	(0.012)	(−1.411)	(−0.998)	(−0.969)
Leverage	−0.0255	−0.0314	−0.0505*	−0.0366	−0.0578	−0.0682
	(−1.013)	(−1.241)	(−1.779)	(−1.208)	(−1.154)	(−1.169)
Cash holdings	−0.0589	−0.0777	−0.0881	−0.0597	−0.1026	−0.1272
	(−1.171)	(−1.522)	(−1.560)	(−0.996)	(−1.010)	(−1.081)
Capex	−0.0278	−0.0798	−0.1130	−0.0000	0.0389	0.0362
	(−0.552)	(−1.268)	(−1.206)	(−0.000)	(0.301)	(0.196)
Dividend yield	−0.0134	0.0017	−0.0213	0.0255	0.2096	0.2732
	(−0.221)	(0.022)	(−0.169)	(0.331)	(1.193)	(0.998)
Turnover	−0.0043	−0.0270	−0.0645	0.0821	0.1935	0.3656**
	(−0.062)	(−0.408)	(−0.968)	(1.062)	(1.585)	(2.098)
Volatility	−0.0000	−0.0000	−0.0000	−0.0000	−0.0001	−0.0001
	(−1.129)	(−1.092)	(−0.562)	(−1.201)	(−1.176)	(−0.910)
Male CEO	−0.0039	−0.0131	−0.0247*	−0.0134	−0.0322	−0.0652
	(−0.515)	(−1.419)	(−1.897)	(−1.302)	(−1.339)	(−1.417)
CEO age	−0.0014	−0.0013	−0.0012	−0.0017	−0.0031	−0.0028
	(−1.324)	(−1.279)	(−1.128)	(−1.369)	(−1.481)	(−1.199)
CEO tenure	0.0012	0.0014*	0.0018**	0.0015	0.0033**	0.0043**
	(1.463)	(1.747)	(2.014)	(1.569)	(2.006)	(2.164)
CEO direct compensation	0.0019	0.0013	0.0022	0.0025	0.0026	0.0040
	(0.775)	(0.517)	(0.761)	(0.866)	(0.489)	(0.590)
CEO equity-based compensation	−0.0023	−0.0023	−0.0022	−0.0033	−0.0058	−0.0068
	(−1.184)	(−1.161)	(−1.040)	(−1.463)	(−1.580)	(−1.576)
CEO delta	0.0033	0.0014	0.0006	0.0031	0.0017	−0.0010
	(1.106)	(0.452)	(0.184)	(0.859)	(0.283)	(−0.141)
Constant	0.1660	0.2208*	0.2486*	0.1677	0.4096	0.5708*
	(1.291)	(1.768)	(1.886)	(1.104)	(1.590)	(1.936)
Observations	18,067	18,067	18,067	18,067	18,067	18,067
Adjusted R-squared	0.208	0.233	0.260	0.262	0.336	0.388
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes	Yes	Yes

This table contains ordinary least squares (OLS) estimates of the relation between the relative price at which a stock is repurchased and the CEO's network centrality, proxied by the *Normalized degree*. The relative repurchase price is computed as the relative difference between the repurchase price paid by the firm in a repurchase transaction and the average closing price of the firm's stock during the following time windows: from one, three, or six months before the repurchase date to one, three, or six months after this date; and from the repurchase date to one, three, or six months after the repurchase. All variables except the binary variables, the *Number of repurchase transactions*, *CEO age*, and *CEO tenure* are winsorized at the 1% level. Detailed variable definitions can be found in the Appendix. All of our specifications include calendar month (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Since our test variable *Normalized degree* is CEO-specific, we compute the *t-statistics* of the regression coefficients employing conservative standard errors that are robust to heteroskedasticity and clustered at the CEO level to account for within-CEO serial correlation. As we explain below, our findings are qualitatively unchanged even when alternative clustering strategies are considered.

The first three columns of Table 2 show that a CEO's *Normalized degree* is positively related to the three alternative versions of the dependent variable *Relative price –t to +t*. However, the coefficient of the test variable is statistically significant at a 10% level only when the benchmark average closing price is calculated over the two-month period around the repurchase event. We can conclude that there is some very weak evidence that CEOs with more extensive professional connections tend to buy back the own stock of their firm at prices that are above average on the stock market.

The remaining three columns of the table provide stronger evidence in favor of this notion in relation to a type of dependent variable that constitutes a more direct measure of timing ability and is forward-looking (Dittmar and Field, 2015). We report a positive and statistically significant (always at a 1% level) relation between our test variable *Normalized degree* and the inverse timing measure *Relative price 0 to +t*. The coefficient of the test variable becomes larger and more statistically significant as we extend the interval over which the benchmark average price is recorded.[11]

[11] The calendar month and industry fixed effects explain a substantial portion of the variation in the dependent variable. The adjusted R-squared of the same three regressions without any fixed effects ranges from 0.08 to 0.15.

If we consider the regression coefficients of the sixth column, we calculate that a one standard deviation change in *Normalized degree* is associated with an increase in *Relative price 0 to +6* of approximately 0.18 standard deviations. The effect of a CEO's degree on the timing of repurchase transactions appears to be economically significant. Another statistically significant factor is the frequency of repurchase transactions, captured by the variable *Number of repurchase transactions* for which a positive coefficient is reported. In line with our expectations and previous evidence (Dittmar and Field, 2015), firms that frequently repurchase stock tend to do so at relatively high prices. The economic significance of *Number of repurchase transactions* is only marginally larger than that of *Normalized degree*, indicating that both of these variables represent first-order determinants of repurchase timing. For instance, a one standard deviation boost to the former variable is related to a positive change in *Relative price 0 to +6* of around 0.21 standard deviations. An additional control variable that is statistically significant in column (6) and in half of the other columns is *CEO tenure*. It is often argued that executives with longer tenures are more entrenched and can afford to under-perform (e.g., Berger et al., 1997). This view could explain why we observe that a CEO's tenure is negatively associated with repurchase timing.

Based on the same regression of column (6), we estimate the mean predicted value of the dependent variable to be −0.004 (−0.015) for a CEO with a mean (median) value of degree. This value is approximately zero at the upper quartile of degree, and substantially increases after this threshold, reaching a value of 0.022 for a CEO's degree equal to the 90th percentile of the distribution. Hence, in firms managed by highly-connected CEOs, repurchase transactions are carried out at a premium, and this could ultimately hurt shareholders.

To better gauge the economic damage of poorly-timed buybacks, we highlight that in column (6) a change in a CEO's degree from the lower quartile to the upper quartile of the distribution would cause a 2.16% increase in the repurchase price. For the average daily transaction in our dataset this difference implies an additional cash disbursement of around £346,580. This is 2.16% of £16,045,390, which is the amount of cash distributed in each transaction on average. If we consider that, in months with buybacks, the firms in our dataset undertake a median number of daily transactions of 12, the overall additional cash outflow during such months amounts to £4,158,960. A similar calculation would return a much larger incremental outflow of £8,683,765 when comparing the 90th percentile of the degree distribution to the 10th percentile. These cash outflows appear non-negligible if we consider that the median value of a CEO's direct (equity-linked) compensation is £2,056,000 (£2,142,000) in our dataset. Shareholders actively use say on pay laws to reduce the growth in CEO pay, especially when it is excessive (Correa and Lel, 2016). Thus, incremental cash outflows caused by poor repurchase timing are large enough to similarly constitute a source of contention and conflict between a CEO and their shareholders.

Overall, our multivariate tests show that CEOs that are more central in the network of executives and directors and have more extensive professional ties execute repurchases at prices that are comparatively high relative to the market values of their stocks over the months immediately following the repurchase. We also show that the impact of such poor timing is economically relevant for a typical firm with a highly-connected CEO. In the next two sections, we aim to evaluate whether endogeneity biases significantly affect and/or even drive our findings (Section 5) and carry out an extensive set of robustness tests and additional analyses (Section 6). From this point onwards, we only focus on the dependent variables *Relative price 0 to +t* that are built on comparisons between the prices of current repurchase transactions and the average future market prices of the respective stock. Compared with the alternative measures *Relative price –t to +t*, the variables *Relative price 0 to +t* are more meaningful in that they represent more direct measures of timing.

5. Endogeneity biases

In the previous section, we have provided evidence on an inverse relation between the extent of a CEO's professional connections and their firm's tendency to purchase own stock at relatively low prices. However, executives are not allocated in a random fashion to firms, and the endogenous matching of companies and CEOs is a potential source of endogeneity biases. Reverse causality probably does not compromise our tests since firms and CEOs are unlikely to choose one another based on considerations pertaining to repurchase transactions and their timing. Besides, our evidence indicates that CEOs that could be appointed by firms owing to their extensive networks and informational advantages are associated with less, rather than more, timing. In contrast, omitted variable biases represent a serious concern. Despite our efforts to control for a very large set of possible determinants of buyback timing, we cannot rule out the possibility of one or more omitted variables biasing our findings.

We describe below several additional tests aimed at evaluating the effect of possible endogeneity biases on our findings and mitigating their impacts. We start by re-estimating our baseline OLS specifications of Table 2 with the inclusion of firm fixed effects (Section 5.1). We then look at the timing of repurchase transactions around CEO turnover events, which should lead to significant changes in the professional connections of a firm's CEO without substantial changes to the firm's features (Section 5.2). We next consider tests with more standard instrumental variable regressions based on several instruments that should not have a direct impact on our timing variables (Section 5.3). Finally, we investigate the extent to which an omitted variable should be correlated to both the outcome and the test variables in our baseline regressions to invalidate our main findings (Section 5.4).

5.1. Firm fixed effect tests

In our baseline specifications, we do not include firm fixed effects for two main reasons. First, a firm's CEO can repurchase stock quite frequently during a particular year. Since the CEO's degree is measured at an annual frequency, it may not vary at all across a significant number of observations in our dataset. Second, time-variation in the degree of a firm's CEO is further attenuated by the circumstance that the size of the CEO's network of professional connections tends to be stable over time, and firms do not replace CEOs very frequently. Nevertheless, the inclusion of firm fixed effects carries some clear benefits in that it allows us to account for time-invariant omitted variables at the firm level.

The regression estimates of Table 3 indicate that our baseline OLS results remain qualitatively very similar when firm fixed effects are controlled for. Compared to Table 2, in Table 3 the variable *Normalized degree* is still statistically significant at a 1% level, its coefficient is always positive, and the coefficient becomes even larger for the dependent variable *Relative price 0 to +6*.

5.2. CEO turnover tests

An alternative approach to control for time-invariant, firm-level omitted variables is through the investigation of the relation between the test variable *Normalized degree* and the timing measures *Relative price 0 to +t* around CEO turnover events. Here, an additional important benefit is that turnovers may lead to significant changes in the features of the professional network of a firm's CEO, something that is less likely to be observed at other times. In other words, a firm can replace a CEO with a very extensive set of professional links with one that is far less connected, or vice versa. It is thus valuable to investigate whether and how these sudden shocks affect the extent to which repurchases are executed at bargain prices.

We select instances of CEO turnover using information taken from Boardex, identifying cases in which the identity of a company's CEO

Table 3
Relative repurchase price and the CEO's network centrality: OLS model with firm fixed effects.

	(1) Relative price 0 to +1	(2) Relative price 0 to +3	(3) Relative price 0 to +6
Normalized degree	4.4820***	13.2505***	24.0390***
	(2.933)	(4.066)	(5.532)
Number of repurchase transactions	0.0006***	0.0013***	0.0018***
	(2.835)	(3.067)	(3.205)
Log market capitalization	−0.0117*	−0.0255**	−0.0650***
	(−1.946)	(−1.969)	(−2.961)
Operating profits	0.1034*	0.0999	0.1277
	(1.769)	(0.979)	(0.885)
Market-to-book	−0.0176**	−0.0220*	−0.0217
	(−2.172)	(−1.894)	(−1.343)
Leverage	0.0025	−0.0085	−0.0686
	(0.139)	(−0.229)	(−1.086)
Cash holdings	0.0439	0.0459	0.0281
	(1.642)	(0.770)	(0.307)
Capex	0.0300	0.2776**	0.5780***
	(0.332)	(1.996)	(2.637)
Dividend yield	−0.0379	0.0145	0.0002
	(−0.594)	(0.084)	(0.000)
Turnover	0.2677***	0.3832***	0.4701***
	(2.647)	(3.302)	(3.070)
Volatility	−0.0000	−0.0000	0.0000
	(−1.430)	(−0.293)	(0.362)
Male CEO	−0.0169**	−0.0243**	−0.0194
	(−2.560)	(−2.031)	(−1.148)
CEO age	0.0015***	0.0024***	0.0031**
	(2.842)	(2.689)	(2.508)
CEO tenure	−0.0007	−0.0012	−0.0017
	(−1.494)	(−1.335)	(−1.199)
CEO direct compensation	−0.0010	−0.0073**	−0.0117**
	(−0.773)	(−2.185)	(−2.108)
CEO equity-based compensation	0.0004	0.0010	0.0012
	(0.608)	(0.695)	(0.539)
CEO delta	0.0000	−0.0026	−0.0058
	(0.012)	(−0.838)	(−1.286)
Constant	0.0489	0.2801*	0.8104***
	(0.761)	(1.916)	(3.390)
Observations	18,067	18,067	18,067
Adjusted R-squared	0.602	0.689	0.700
Firm FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes

This table contains regressions that replicate the baseline analyses presented in columns (4)–(6) of Table 2 but with the inclusion of firm fixed effects in place of two-digit SIC code industry fixed effects. Detailed variable definitions can be found in the Appendix. All of our specifications include calendar month fixed effects (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011). *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

changes from one year to the next. Specific turnover dates are obtained from the Boardex Announcements file. We create two different datasets of repurchase transactions around turnover events. In the first one, which comprises 31 turnovers, we focus on transactions taking place over the two-year period around the turnover date. In the second one (34 turnovers), we extend the timeframe to include two years before and two years after the given date, building a slightly larger dataset in the process. In both cases, we drop changes in CEO without buyback transactions both before and after the turnover date. We also exclude those events that are contaminated by other CEO turnovers taking place over the respective pre- and post-turnover windows.

In Table A.2 of the Online Appendix, we test whether there are systematic changes in our independent and dependent variables when a turnover takes place. We find that the values of the variables *Relative price 0 to +t* increase around a turnover event and that such changes are sometimes weakly statistically significant in our larger dataset of turnovers. In contrast, the value of the test variable *Normalized degree* tends to decline, but the variation is not statistically significant. This is somewhat reassuring in that it shows that any findings that we may obtain in our multivariate tests are unlikely to be the by-product of changes in the test variable that are common across many firms and merely driven by turnovers. Besides, if anything, these simple preliminary tests would point towards a positive relation, rather than negative, between an executive's professional ties and the timing of stock repurchases. While the variation in *Normalized degree* is on average small and insignificant around a turnover, we observe that large within-firm changes in the variable are quite common. For example, the 90th (top) percentile of the change in *Normalized degree* amounts to 0.0005 (0.0010). This change would push the median CEO in our baseline sample with a median *Normalized degree* of 0.0005 to just below (well above) the 75th percentile of this variable. We also find that new CEOs are significantly younger (with a shorter tenure as expected) and enjoy smaller direct compensations and deltas. Variations in firm-specific variables around turnover events are statistically significant for the number of repurchase transactions in the same month, leverage, capex, and stock volatility.

Table 4
Relative repurchase price and the CEO's network centrality: CEO turnover events.

Panel A. Tests based on the full sample of CEO turnovers

	(1) Relative price 0 to +1	(2) Relative price 0 to +3	(3) Relative price 0 to +6	(4) Relative price 0 to +1	(5) Relative price 0 to +3	(6) Relative price 0 to +6
Normalized degree	6.3364***	13.5867***	11.4939***	1.8789	5.8810***	11.0653***
	(3.905)	(5.784)	(4.149)	(1.586)	(3.337)	(5.278)
Observations	2,101	2,101	2,101	3,509	3,509	3,509
Adjusted R-squared	0.022	0.075	0.167	0.066	0.185	0.283
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Turnover FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of turnovers	31	31	31	34	34	34

Panel B. Tests based on the sub-sample of exogenous CEO turnovers

	(1) Relative price 0 to +1	(2) Relative price 0 to +3	(3) Relative price 0 to +6	(4) Relative price 0 to +1	(5) Relative price 0 to +3	(6) Relative price 0 to +6
Normalized degree	6.5729***	14.5270***	12.3893***	3.4550***	8.5552***	12.7466***
	(3.983)	(6.074)	(4.421)	(2.800)	(4.686)	(5.915)
Observations	2,036	2,036	2,036	3,330	3,330	3,330
Adjusted R-squared	0.024	0.079	0.173	0.086	0.222	0.316
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Turnover FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of turnovers	29	29	29	31	31	31

Panel C. Tests based on the sub-sample of CEO turnovers in which the new CEO is from inside the firm

	(1) Relative price 0 to +1	(2) Relative price 0 to +3	(3) Relative price 0 to +6	(4) Relative price 0 to +1	(5) Relative price 0 to +3	(6) Relative price 0 to +6
Normalized degree	10.5168***	21.1921***	12.4064***	4.3903***	10.9764***	13.3049***
	(4.988)	(6.777)	(3.354)	(3.080)	(5.387)	(5.299)
Observations	1,530	1,530	1,530	2,678	2,678	2,678
Adjusted R-squared	0.031	0.071	0.189	0.050	0.138	0.206
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Turnover FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of turnovers	21	21	21	23	23	23

Panel D. Tests based on the sub-sample of CEO turnovers that are both exogenous and in which the new CEO is from inside the firm

	(1) Relative price 0 to +1	(2) Relative price 0 to +3	(3) Relative price 0 to +6	(4) Relative price 0 to +1	(5) Relative price 0 to +3	(6) Relative price 0 to +6
Normalized degree	12.0982***	25.3105***	14.7385***	4.9585***	11.8247***	12.1420***
	(5.420)	(7.676)	(3.796)	(3.329)	(5.566)	(4.718)
Observations	1,505	1,505	1,505	2,597	2,597	2,597
Adjusted R-squared	0.034	0.080	0.195	0.053	0.144	0.226
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Turnover FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of turnovers	20	20	20	22	22	22

This table contains regressions that replicate the baseline analyses presented in columns (4)–(6) of Table 2, but only using repurchase transactions that take place around a CEO turnover event. Events that are not both followed and preceded by buyback transactions are discarded. In models (1), (2), and (3), transactions that take place over the two-year period around the turnover date (a maximum of 31 turnovers in Panel A) are considered. In models (4), (5), and (6), transactions that happen during the two years before and the two years after the turnover date (a maximum of 34 turnovers in Panel A) are used. In Panel A, we consider the full sample of CEO turnovers. In Panel B, we only keep turnovers that are probably exogenous in that they are planned in advance or happen suddenly due to the CEO's personal issues such as death, illness, or retirement. These turnovers are unlikely to be caused by poor performance or significant changes in corporate conditions and characteristics. In Panel C, we use a sub-sample in which the new CEO is already an employee of the firm before the event. In Panel D, we consider a sub-sample, namely the intersection between those in Panels B and C. All of our specifications include the control variables of Table 2. Detailed variable definitions can be found in the Appendix. All of our specifications include turnover fixed effects. *t-statistics* are in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

In the first three columns of Panel A of Table 4, we replicate our baseline regression models presented in Table 2 considering the datasets of repurchase transactions taking place over the two-year period around the turnover date (31 turnovers), while in the remaining three columns, we employ the second, more extensive dataset based on transactions taking place over the four-year period around the turnover date (34 turnovers). In these regressions, we include turnover fixed effects to control for time-invariant omitted variables, such as unobservable firm features that do not change from the pre- to the post-turnover period together with the same control variables of our baseline analyses. In five models out of six, the coefficient of *Normalized degree* is positive and statistically significant at a 1% level notwithstanding the substantial sample drop. This evidence aligns with the findings from our baseline tests and indicates that a firm experiences an increase in the relative price paid for buybacks if the firm replaces its CEO with a new executive with more extensive professional ties.

We further refine our analysis by taking into consideration that a CEO turnover is not necessarily an exogenous event given that it is dependent on decisions made by the firm and/or the CEO; such decisions could, in turn, be related to changes in one or more underlying corporate variables, which could also influence the timing of repurchase transactions. To address this potential shortcoming and attenuate any possible biases, we follow Dittmar and Duchin (2016) and re-run the analyses on sub-samples of observations related to turnovers that are unlikely to be linked to significant changes in a firm's conditions (e.g., changes in the firm's performance, characteristics, and strategies). In Panel B of Table 4, we only keep turnover events that are probably exogenous in that they are either related to the firm's succession plan or are associated with the CEO's personal matters and issues such as death, illness, or retirement. To this end, we read all the relevant news contained in the Factiva database published during the two years around the given turnover date. Turnovers not covered in the database are dropped from the sample. In Panel C, we utilize information from Factiva and Boardex to focus on the sub-sample of internal turnovers, in which the new CEO was already an employee of the firm. The logic here is that internal turnovers are unlikely to be associated with major variations in a firm's conditions. In Panel D, we further restrict the sample to CEO turnover events that are both exogenous and internal. Despite the use of reduced samples, across Panels B to D we report findings that are consistent with, and statistically stronger than, those of Panel A.

5.3. Instrumental variable regressions

In this section, we estimate some instrumental variable regression models to account for the endogeneity issues affecting our test variable. Valid instrumental variables should be strongly correlated with the size of a CEO's professional network without directly affecting the timing of the stock repurchases carried out by the CEO's firm. Finding such instrumental variables is very challenging. Moreover, instruments' exclusion restrictions cannot be tested directly, and this represents a major limitation of the analysis.

Nevertheless, we propose that variables capturing the supply of qualified executives on the CEO job market could represent suitable instruments. Job markets for executives are segmented in that firms face some frictions, such as a lack of information and searching costs when attempting to recruit a new CEO. Thus, their choice is somewhat limited, and some qualified candidates are more likely to be hired than others, irrespective of the recruiting firm's ideal preferences. In other words, the endogenous matching of firms and CEOs is partly driven by frictions, regardless of the preferences of the parties involved.

We conjecture that, for the position of CEO, a company tends to recruit executives that belong to the industry in which it operates. In other words, a company is more likely to hire CEOs with previous professional experience from the same industry than executives without any relevant industry experience. Firms very often hire CEOs internally without resorting to the external job market (e.g., Parrino, 1997; Cremers and Grinstein, 2014), and internal recruits obviously belong to the industry in which their firm operates. In the case of external appointments, there is evidence that a large fraction of newly-recruited CEOs have relevant industry experience (e.g., Parrino, 1997; Bertrand and Schoar, 2003; Cremers and Grinstein, 2014). Moreover, firms' actions sometimes appear to be motivated by concerns that their executives could be poached by rival companies operating in their industry. A manager's compensation is often benchmarked against the pay offered by industry peers in order to facilitate retention (e.g., Bizjak et al., 2008; Bizjak et al., 2011; Coles et al., 2018).

Grounded on these premises, we argue that firms tend to recruit CEOs from industry-specific pools of potential candidates, meaning that the features of the appointed CEOs are more likely to resemble those of directors that are professionally linked to the firm's industry. We, therefore, build an instrumental variable that exploits this empirical regularity and considers the supply of executives. For instance, for a repurchase transaction made by a focal firm, we compute the average value of *Normalized degree* for all directors in Boardex UK for the same year of the repurchase and the same SIC-2 industry as the firm's, excluding the firm's CEO. The average number of directors we employ to build this variable is 342. We observe that the instrument varies quite substantially and ranges from a minimum of 0.00009 to a maximum of 0.0022 (the range is 0.00002–0.0081 for the instrumented test variable *Normalized degree*). This result shows that there are significant industry effects associated with the extent of an executive's professional connections.

In columns (2)–(4) of Table 5, we report the second-stage instrumental variable regressions replicating our baseline regression models of Table 2. In line with the baseline OLS findings, we find that the coefficients of *Normalized degree* are positive and statistically significant, and quite similar in terms of magnitude to those we obtain in our initial tests. The first-stage estimates, which can be found in column (1), confirm our conjecture that a CEO's professional network is strongly related to that of their industry peers. The coefficient of the instrument is positive and very significant, and the instrument appears to be very strong. The p-value of the underidentification test is well below 10% and the Kleibergen–Paap rk Wald F statistic is significantly above 10.

We are not aware of any reason as to why our instrument should directly affect the timing of repurchase transactions rather than indirectly through its impact on the degree of the CEO. Our approach is consistent with many studies in recent years employing instruments built using averages of the instrumented variable for sub-groups of firms (e.g., Laeven and Levine, 2007; Faccio et al., 2011; Lin et al., 2011; Ferrell et al., 2016). Nevertheless, Larcker and Rusticus (2010) and Gormley and Matsa (2014) describe some limitations of these instruments, essentially highlighting that industry-average values of the test variable could comprise a component that is endogenous. This concern is arguably less relevant in our case since we build our instrument considering a complete set of directors (both executive and non-executive) and not just the CEOs of industry peers. Moreover, the inclusion of industry fixed effects in all our specifications at least allows us to control for any industry-level time-invariant omitted variables.

It is also reassuring that further tests reported in the Online Appendix show that our second-stage instrumental variable results remain qualitatively similar if we use two alternative instruments. Specifically, these are the average *Normalized degree* for the CEOs (as opposed to directors) of industry peer firms measured in the same year (excluding the firm's CEO) (Panel A of Table A.3 in the Online Appendix) and the number of listed firms that are located within 60 miles of the focal firm's headquarters (Panel B of Table A.3 in the Online Appendix). The rationale underlying the latter instrument is that besides industry segmentation, the labor market is also geographically segmented. In the presence of time constraints and travel costs, relevant outside opportunities are more likely to come from firms located nearby than from firms farther away. Therefore, we would expect an executive's

Table 5
Relative repurchase price and the CEO's network centrality: IV regressions.

	(1) Normalized degree	(2) Relative price 0 to +1	(3) Relative price 0 to +3	(4) Relative price 0 to +6
Normalized degree		7.2651*	14.1762**	22.2064***
		(1.683)	(2.002)	(2.691)
Number of repurchase transactions	−0.0000	0.0025**	0.0044**	0.0056**
	(−0.404)	(2.048)	(2.085)	(2.350)
Log market capitalization	0.0001***	−0.0094	−0.0185*	−0.0268**
	(3.226)	(−1.452)	(−1.696)	(−2.133)
Operating profits	0.0008	0.0905*	0.1161	0.1288
	(0.883)	(1.846)	(1.185)	(0.998)
Market-to-book	0.0001	−0.0075	−0.0083	−0.0113
	(0.874)	(−1.415)	(−0.985)	(−1.015)
Leverage	−0.0001	−0.0365	−0.0580	−0.0677
	(−0.495)	(−1.220)	(−1.170)	(−1.176)
Cash holdings	0.0007	−0.0599	−0.1024	−0.1280
	(1.641)	(−1.004)	(−1.013)	(−1.093)
Capex	−0.0024**	0.0017	0.0355	0.0472
	(−2.136)	(0.024)	(0.267)	(0.252)
Dividend yield	−0.0005	0.0259	0.2087	0.2761
	(−0.401)	(0.339)	(1.194)	(1.016)
Turnover	−0.0016***	0.0822	0.1933	0.3662**
	(−2.694)	(1.072)	(1.599)	(2.116)
Volatility	0.0000***	−0.0000	−0.0001	−0.0001
	(2.856)	(−1.211)	(−1.176)	(−0.940)
Male CEO	−0.0003	−0.0132	−0.0324	−0.0645
	(−1.098)	(−1.280)	(−1.358)	(−1.393)
CEO age	0.0000***	−0.0017	−0.0031	−0.0029
	(2.868)	(−1.377)	(−1.472)	(−1.222)
CEO tenure	−0.0000	0.0015	0.0033**	0.0042**
	(−0.605)	(1.588)	(2.040)	(2.178)
CEO direct compensation	0.0001***	0.0025	0.0027	0.0038
	(3.631)	(0.864)	(0.506)	(0.560)
CEO equity-based compensation	0.0000	−0.0033	−0.0058	−0.0068
	(0.813)	(−1.471)	(−1.578)	(−1.599)
CEO delta	0.0000	0.0031	0.0017	−0.0010
	(1.252)	(0.867)	(0.286)	(−0.142)
Degree of directors from the same industry and year	4.1609***			
	(5.840)			
Constant	−0.0020***	0.1687	0.4075	0.5777*
	(−3.044)	(1.110)	(1.578)	(1.958)
Observations	18,067	18,067	18,067	18,067
Adjusted R-squared	0.868	0.262	0.336	0.388
Industry FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes
Underidentification test (Kleibergen–Paap rk LM statistic)	4.281			
Underidentification test *p*-value	0.0385			
Weak identification test (Kleibergen–Paap rk Wald F statistic)	34.11			

This table contains instrumental variable (IV) regression estimates of the relation between the relative price at which a stock is repurchased and the CEO's network centrality, proxied by the *Normalized degree*. The relative repurchase price is computed as the relative difference between the repurchase price paid by the firm in a repurchase transaction and the average closing price of the firm's stock during the following time windows: from the repurchase date to one, three, or six months after this date. The IV *Degree of directors from the same industry and year* is the average *Normalized degree* for directors that belong to the same two-digit SIC code industry and year as the focal firm, excluding the firm's CEO. Column (1) contains the coefficients of the first-stage regression, while columns (2), (3), and (4) report the coefficients of the second-stage regression in which the dependent variable is the relative repurchase price. All variables except the binary variables, the *Number of repurchase transactions*, *CEO age*, and *CEO tenure* are winsorized at the 1% level. Detailed variable definitions can be found in the Appendix. All of our specifications include calendar month (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

number of directorships to be larger when more opportunities are available in geographically proximate areas. We indeed find a positive relation between the geographical instrument and *Normalized degree*, although the instrument is rather weak.

5.4. Impact threshold for an omitted variable

In this section, we evaluate the sensitivity of our primary regression findings to the inclusion of an omitted variable. Regression estimates for a test variable are biased when an omitted variable is correlated with both such a variable and the dependent variable. Intuitively, the higher the correlation, the greater the bias and the likelihood that the inferences for the test variable are not valid. Frank (2000) and Xu et al. (2019) propose a method to estimate a threshold for such correlation that we apply to obtain the following three estimates for Table 2: 0.08, 0.12, and 0.13 for columns (4), (5), and (6), respectively. These correlations mean that, for instance, in column (4) our inference on the variable *Normalized degree* could potentially be altered if the product of the partial correlations (after taking into account all of the observed covariates) of an omitted variable with both the dependent variable and *Normalized degree* is at least equal to $0.08^2 = 0.0064$. Correlations for unobserved, omitted variables cannot obviously be computed, but we can use those for the large set of observed control variables as benchmarks. If we consider the pairs of partial correlations of all the controls of the specification in column (4), only for *Time in role* the product of the two correlations is equal or above the threshold of 0.0064 ($0.11 \times 0.10 = 0.011$). In the other two columns, we cannot find any observed variable with large enough partial correlations to invalidate our main findings. Thus, we can conclude that our inferences seem quite robust to the inclusion of variables that are currently omitted.

6. Robustness tests and additional analyses

6.1. Linear probability models

We re-run the OLS regression specifications of Table 2 columns (4)–(6) by replacing the continuous relative price measures with their respective binary versions, employing a linear probability model estimation method. The results for these additional tests can be found in Table 6 and are consistent with our expectations. The coefficient of the independent variable of interest *Normalized degree* is always negative and statistically significant. If we focus on the third column of the table, a one standard deviation reduction in *Normalized degree* is associated with an increase in the probability of a repurchase at a bargain price of 6.69%, which represents around 11% of the average value of *Relative price 0 to +6 dummy*.

As for the control variables in Table 6, the regression coefficient of *Number of repurchase transactions* is always negative and highly statistically significant. There is a confirmation here that a firm's likelihood of timing repurchase transactions is lower if the firm purchases own stock more frequently. In column (3) the economic significance of *Number of repurchase transactions* is lower than that of *Normalized degree*. A one standard deviation decrease in the former variable is related to an increase in *Relative price 0 to +6 dummy* that amounts to just 6% of its mean. Other findings are not always as statistically significant, but we observe that repurchase timing is consistently positively (negatively) associated with the variables *Market-to-book* and *CEO equity-based compensation* (*Turnover*).

6.2. Alternative network measures

Several methods have been suggested in previous studies to standardize measures of executive professional ties. An alternative approach to ours is adopted by El-Khatib et al. (2015), who utilize the percentile of a CEO's degree computed annually and based on the distribution of the same variable for all executives and directors of public companies in the same year. We replace *Normalized degree* with a similar percentile variable for our *Degree* measure in the multivariate tests. The new findings can be found in the top three rows of Table A.4 in the Online Appendix. As expected, the coefficient of the new test variable is positive and statistically significant, albeit only at a 10% level. The reduction in significance could be explained by the loss of information driven by the percentile transformation of the continuous proxy. Another approach to standardize *Degree* is based on the removal of any time trends from this variable in the spirit of Faleye et al. (2014). In rows (4)–(6) of Table A.4, we consider a detrended version of *Degree* and again report coefficients that are always positive and statistically significant. Overall, our main findings are not very sensitive to variations in the standardization method.

Moreover, the findings remain robust even when our test variable is not standardized. Specifically, in rows (7)–(9) of Table A.4, the test variable is the raw *Degree* measure (scaled by 100) and we can confirm a positive and statistically significant relation between this variable and the three relative repurchase price measures.

The CEO degree measure we employ in the baseline tests is based on all of the professional links available in the UK Boardex database up to the current year, irrespective of their strength and whether they are still active. Following El-Khatib et al. (2015), we calculate two alternative, and narrower, degree measures based on subsets of connections. First, we purge our connections dataset of all links that have been inactive in the past five years and obtain an *active* version of the *Normalized degree*. Second, we only keep links that last for at least three years and drop the remaining ones, resulting in a test variable based on *stable* links. The regression coefficients for these two alternative test variables can be found in rows (10)–(15) of Table A.4. They are always positive and statistically significant at least at a level of 5%. It is important to highlight that the size of the coefficients for the degree measure built using active links are significantly larger than those reported in Table 2 for the main test variable, while those for the proxy based on stable connections are approximately equivalent to the baseline case. Whether professional ties are currently active or not has an effect on the timing of buyback transactions carried out by the CEO, which is in line with previous studies (e.g., Fracassi, 2017) showing that current employment connections are more relevant than past employment ties.

Degree is by far the most widely-used network centrality measure, but previous studies have also considered three main alternatives (e.g., El-Khatib et al., 2015; Fracassi, 2017): closeness, betweenness, and eigenvector. It is beyond the scope of this paper to provide detailed technical definitions of these alternative network variables, which can be found in earlier studies. We construct them employing all of the information on professional links (both current and historical) from the UK version of Boardex and adopting the same scaling as for *Degree*. Intuitively, closeness reflects how easily an executive can reach other directors, by capturing the inverse of the average distance between a CEO and every other individual in the network. Meanwhile, betweenness measures how important a CEO is in terms of connecting other directors, as it measures the number of shortest paths connecting two individuals in the network that go through the CEO. Elsewhere, eigenvector essentially links a CEO's centrality to their neighbors' characteristics, capturing how important, central, or influential a CEO's connections are. As documented in Table A.5 in the Online Appendix, the results for both *Normalized closeness* and *Normalized betweenness* strongly support our conclusion that employing a well-connected CEO is associated with poorer repurchase timing. Surprisingly, we cannot report any statistically significant coefficients for *Normalized eigenvector*.

Table 6
Relative repurchase price dummy and the CEO's network centrality: LPM model.

	(1) Relative price 0 to +1 dummy	(2) Relative price 0 to +3 dummy	(3) Relative price 0 to +6 dummy
Normalized degree	−21.1583**	−20.5469**	−41.7960***
	(−2.455)	(−2.080)	(−3.555)
Number of repurchase transactions	−0.0083***	−0.0059***	−0.0061***
	(−4.789)	(−2.930)	(−2.940)
Log market capitalization	0.0081	0.0116	0.0232
	(0.815)	(0.949)	(1.526)
Operating profits	−0.3368*	−0.3630	−0.4359
	(−1.806)	(−1.384)	(−1.166)
Market-to-book	0.0404**	0.0619**	0.1007***
	(2.032)	(2.548)	(3.143)
Leverage	0.0341	0.0091	−0.0248
	(0.587)	(0.124)	(−0.278)
Cash holdings	0.0212	0.0459	0.0696
	(0.179)	(0.318)	(0.401)
Capex	−0.4203	−0.0041	−0.3339
	(−1.311)	(−0.010)	(−0.638)
Dividend yield	−0.2487	−0.8158**	−0.7006
	(−0.781)	(−2.023)	(−1.400)
Turnover	−0.5373***	−0.9380***	−1.1090***
	(−2.838)	(−3.563)	(−4.070)
Volatility	−0.0001	0.0002	0.0002
	(−0.523)	(1.309)	(1.579)
Male CEO	0.0162	−0.0215	−0.0483
	(0.306)	(−0.275)	(−0.573)
CEO age	0.0004	−0.0017	−0.0035
	(0.199)	(−0.850)	(−1.477)
CEO tenure	−0.0025	−0.0030	−0.0017
	(−1.232)	(−1.238)	(−0.666)
CEO direct compensation	0.0011	0.0126	0.0084
	(0.134)	(1.359)	(0.700)
CEO equity-based compensation	0.0071*	0.0104*	0.0107*
	(1.804)	(1.842)	(1.679)
CEO delta	0.0008	0.0100	0.0137
	(0.086)	(0.888)	(1.211)
Constant	0.9955***	0.8080***	0.7394***
	(4.812)	(3.335)	(2.726)
Observations	18,067	18,067	18,067
Adjusted R-squared	0.162	0.260	0.329
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes

This table contains linear probability model (LPM) estimates of the relation between a binary variable based on the relative price at which a stock is repurchased and the CEO's network centrality, proxied by the *Normalized degree*. The relative repurchase price dummy is equal to one when the relative repurchase price is negative, and zero otherwise. The relative repurchase price is computed as the relative difference between the repurchase price paid by the firm in a repurchase transaction and the average closing price of the firm's stock during the following time windows: from the repurchase date to one, three, or six months after this date. All variables except the binary variables, the *Number of repurchase transactions*, *CEO age*, and *CEO tenure* are winsorized at the 1% level. Detailed variable definitions can be found in the Appendix. All of our specifications include calendar month (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Our results suggest that it is the CEO's position in the network of directors and executives and their centrality that matters, not the centrality of the directors linked to them. Degree, closeness, and betweenness are network centrality measures that primarily capture the relevance of a CEO's connections in terms of number of links and/or potential for connectivity. In contrast, eigenvector reflects more the relevance of the individuals to whom the CEO is connected. From this perspective, degree, closeness, and betweenness are arguably more strongly related to managerial entrenchment than eigenvector, which in turn better reflects a CEO's informational advantage over other agents according to Goergen et al. (2019).

We next evaluate whether other social ties matter besides those linked to professional roles and board directorships that we consider more relevant in our study. In Table A.6 in the Online Appendix, we replicate our baseline regressions by including a CEO's *Overall network size* from Boardex, which broadly reflects professional and educational connections together with those attributable to other activities undertaken by the CEO. We find that this variable is not significantly related to our timing measures, constituting further justification for our focus on professional connections.

We finally consider whether the size of the professional network of a firm's CFO is related to buyback timing in Table A.7 in the Online Appendix. We re-estimate our baseline specifications by first replacing a CEO's *Normalized degree* with that of the respective CFO, and then by including both measures. The latter specification may be problematic given the high correlation between the degree measures of the two top executives (0.75) but we still obtain qualitatively similar findings for CEOs. In relation to CFOs, their *Normalized degree* is also positively

related to the relative price of a buyback, but statistical significance is lacking when the dependent variable is *Relative price 0 to +1*. In line with our expectations, repurchase timing seems to be more strongly related to a CEO's professional network.

6.3. Buy-and-hold returns

A common premise in the existing literature is that a repurchase transaction is well-timed if the price at which the stock is bought back is lower than its average market value over subsequent periods. Our dependent variable *Relative price 0 to +t* is based on this rationale. A possible alternative view of repurchase timing is more concerned with whether the stock appreciates after being bought back. In this context, the buy-and-hold stock returns following buyback transactions are more relevant.

In Table A.8 in the Online Appendix, we analyze the relation between *Normalized degree* and buy-and-hold returns over the one-month, three-month, and six-month periods following the date of the focal buyback. In line with our expectations and the findings for the dependent variable *Relative price 0 to +t*, the coefficient of *Normalized degree* is always negative and statistically significant at the 1% level. We confirm that repurchases carried out by better-connected CEOs are followed by comparatively lower returns.

6.4. Other robustness tests

In Table A.9 in the Online Appendix, we comprehensively evaluate the robustness of our baseline multivariate results to changes in the clustering of the standard errors. While our main test variable is CEO-specific, other control variables are recorded at the firm level. Moreover, a CEO's professional connections can also be influenced by the features of the firm for which they work. Another aspect to consider is the cross-sectional correlation induced by the overlapping periods over which the repurchase transactions sometimes take place, with many repurchases occurring during the same calendar month or even calendar day. Taking all of this into account, we re-estimate our baseline regressions while adopting the following alternative clustering approaches: clustering by firm, double clustering by both firm and calendar day, double clustering by both firm and calendar month, double clustering by both CEO and calendar day, and double clustering by both CEO and calendar month. We confirm that *Normalized degree* is consistently a positive and statistically significant determinant of a firm's relative repurchase price.

Besides adjusting the standard errors for time clustering, another approach we consider is a monthly-level aggregation of observations from the same calendar month and firm. We build a new dataset of 3056 firm-months in which each observation is obtained by averaging the values of all the dependent and independent variables of a firm's observations from a particular calendar month. The results reported in Table A.10 in the Online Appendix align with our expectation of a positive and statistically significant relation between the average value of *Normalized degree* and the average values of the three relative price variables.

Next, we evaluate whether the baseline findings of our study are sensitive to alternative definitions of a firm's CEO. In Table A.11 in the Online Appendix, we re-estimate our regression models employing a dataset that is purged of firm-years with multiple CEOs. In addition, we employ a stricter definition of CEO and exclude observations for firms without an executive with a "CEO" job title. In all these tests we observe that the results for the test variable *Normalized degree* are qualitatively similar to those in Table 2.

We further investigate whether reactions to announcements of daily transactions may influence our findings. A possible concern is that repurchase transactions carried out by less known and more opaque firms, which may employ executives that are less socially connected, could generate larger positive market reactions. This empirical regularity could create the positive relation we report between *Normalized degree* and the repurchase timing measures *Relative price 0 to +t*. However, as reported in Table A.12 in the Online Appendix, our results are robust to the use of alternative timing measures based on the average closing price computed over periods that do not include the day of the buyback announcement and the two subsequent days.[12]

Since a CEO's repurchase timing might be quite persistent, it is also valuable to test whether the baseline results of this study survive the inclusion of controls that measure past timing. For each repurchase transaction, we build the variable *Past timing 0 to +t*. This is the average of the variable *Relative price 0 to +t dummy* across all of the firm's past repurchases undertaken by the same CEO, excluding repurchases during the *t*-month period before the date of the focal transaction. This filter is applied to make sure that current and past timing measures are not based on information from overlapping periods. *Past timing 0 to +t* essentially reflects a CEO's past tendency to time repurchases. We add this additional control variable in Table A.14 in the Online Appendix and discover that our main findings remain robust. Moreover, past timing does not seem to be associated with the relative repurchase price of current transactions.

Finally, we notice that the correlation between our main test variable and the control *Log market capitalization* is not very high, albeit still quite large. Our results remain robust if we drop this control variable in our regressions (Table A.15 in the Online Appendix).

7. The monitoring mechanism behind repurchases at higher prices by well-connected CEOs

In the previous sections, we have provided substantial evidence that CEOs more central in the professional network of directors and executives do not buy back stock at bargain prices. On the contrary, they actually spend comparatively more relative to future market valuations to carry out repurchase transactions compared with executives with fewer professional connections. CEOs with extensive professional networks do not seem to exploit the private information they possess (or can gather) to properly time repurchases to the benefit of their firm. What underlying network mechanisms can explain our findings?

We argue that the most plausible mechanism is related to the notion that a CEO with an extensive professional network is powerful and arguably well-protected from the discipline of the corporate control and managerial labor markets (Cingano and Rosolia, 2012; El-Khatib et al., 2015) or the actions of their firm's directors in the event of poor performance (Nguyen, 2012). Friesen et al. (2022) find that CEOs face significant consequences for poorly-timed repurchases, for example forced turnovers. In this context, the protective effects of an extensive set of connections can reduce executives' incentives to maximize shareholder value and rather strengthen their propensity to shirk their responsibilities or even to pursue self-serving objectives. Consistent with this mechanism, we would expect the association between a CEO's degree and our inverse timing measures to be less positive in those firms endowed with more effective governance mechanisms, which can limit the actions of powerful CEOs with misaligned incentives. For example, effective monitoring mechanisms can reduce the number of instances in which repurchases are executed at market prices that are considered overvalued by firm insiders and/or outside investors that gather and possess private information on the firm. Institutional investors, especially those holding substantial blocks of shares, are arguably capable of, and interested in, monitoring the firms in which

[12] Moreover, the multivariate findings of Table A.13 in the Online Appendix do not offer support for the conjecture that market reactions are larger in firms with less-connected CEOs. We observe that a CEO's *Normalized degree* does not significantly affect the cumulative abnormal returns computed over several short-term intervals around the announcement of a repurchase transaction.

Table 7
Relative repurchase price, the CEO's network centrality, and institutional ownership concentration.

	(1) Relative price 0 to +1	(2) Relative price 0 to +1	(3) Relative price 0 to +3	(4) Relative price 0 to +3	(5) Relative price 0 to +6	(6) Relative price 0 to +6
Normalized degree	8.7568**	9.1774***	18.4780***	18.5424***	27.4826***	26.3370***
	(2.261)	(2.589)	(2.749)	(3.125)	(3.401)	(3.842)
High institutional ownership HHI (50%)	0.0268		0.0447		0.0494	
	(1.370)		(1.365)		(1.330)	
High institutional ownership HHI (75%)		0.0181		0.0317		0.0406
		(1.344)		(1.411)		(1.550)
Normalized degree *						
High institutional ownership HHI (50%)	−5.1023		−9.8498		−23.0051*	
	(−0.933)		(−1.028)		(−1.681)	
Normalized degree *						
High institutional ownership HHI (75%)		−13.5570*		−21.2877		−41.1767*
		(−1.926)		(−1.468)		(−1.841)
Ownership of other institutions	−0.0003	−0.0003	−0.0003	−0.0003	−0.0005	−0.0003
	(−0.825)	(−0.825)	(−0.459)	(−0.427)	(−0.549)	(−0.399)
Ownership of individuals	0.0001	−0.0000	0.0004	0.0001	0.0002	0.0000
	(0.755)	(−0.016)	(1.009)	(0.399)	(0.576)	(0.051)
Observations	18,067	18,067	18,067	18,067	18,067	18,067
Adjusted R-squared	0.273	0.268	0.345	0.341	0.395	0.394
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes	Yes	Yes

This table contains regressions that extend the baseline analyses presented in columns (4)–(6) of Table 2 by testing whether the relation between the relative repurchase price and a CEO's professional network is affected by the concentration of institutional ownership. Ownership concentration variables are interacted with *Normalized degree*. *High institutional ownership HHI (50%)* (*High institutional ownership HHI (75%)*) is equal to one if the Herfindahl–Hirschman Index (HHI) for all the institutional holdings is higher than or equal to the sample median (upper quartile), and zero otherwise. *Ownership of individuals* (*Ownership of other institutions*) is the percentage of shares held by individuals (institutions that are not classified as institutional investors). All of our specifications include the control variables of Table 2 together with calendar month (e.g. dummies for all the months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. Detailed variable definitions can be found in the Appendix. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

they invest (e.g., Chen et al., 2019), and so too possibly are other types of corporations with substantial equity stakes.

To test our expectations, in Table 7 we conduct a battery of cross-sectional tests based on interactions between the *Normalized degree* and two binary variables capturing the level of ownership concentration of institutional investors. In particular, we introduce two dummies that are equal to one if the level of concentration of institutional ownership (as measured by the Herfindahl–Hirschman Index (HHI)) is at least equal to the median or the upper quartile of the sample distribution. In all of the regressions, we include the same set of control variables as used in the baseline models alongside other ownership variables.[13] We show that the interaction terms between *Normalized degree* and the dummies for firms with high levels of institutional ownership concentration are negative and statistically significant in half of the cases. The coefficients are more economically and statistically significant when we concentrate on firms with highly concentrated institutional ownership (i.e. for the dummy *High institutional ownership HHI (75%)*). We can conclude that the underperformance in terms of repurchase timing is more likely to affect well-connected CEOs of firms in which institutional ownership is rather dispersed across many small holdings.

This conclusion is further supported in Panels A and B of Table 8 in which we observe that high-degree CEOs are more likely to buy back stock at bargain prices when there are institutional investors and/or other types of institutions with blocks of shares of at least 5%. The coefficients of the interactions between *Normalized degree* and several dummies capturing the presence of blockholders in the firm are consistently negative and in most cases statistically significant. Having just one blockholder seems to provide limited benefits in terms of better timing in that most findings are statistically insignificant. In contrast, the presence of multiple blockholders significantly counteracts the detrimental effect of a CEO's degree on the timing of buybacks.

A common theme in the corporate governance literature is that effective monitoring of executives can also be carried out by independent, non-executive directors, particularly those that can dedicate enough time and resources to their role (e.g., Fich and Shivdasani, 2006). Thus, in Table 9, we study whether the negative relation between a CEO's degree and repurchase timing is dependent on three variables: a dummy for firms with more than 50% of non-executive board members (*High board independence*), and two dummies identifying observations with levels of board busyness below the median or the lower quartile of the sample. A firm's board busyness is proxied by the average number of board seats held by non-executive directors.

In Panel A of the table, we observe that the coefficient of the interaction term between *Normalized degree* and *High board independence* is always negative and statistically significant. A conclusion we can draw here is that CEOs with high levels of *Normalized degree* tend to repurchase stock at relatively high prices especially when their board does not have a majority of independent members. Similarly, we report in Panel B a negative coefficient of the interaction between *Low board busyness* and *Normalized degree*, although the findings are significant

[13] Our ownership dataset is from Refinitiv Eikon and includes information on ownership stakes held by institutional investors ("Bank and Trust", "Brokerage Firms", "Endowment Fund", "Hedge Fund", "Hedge Fund Portfolio", "Independent Research Firm", "Insurance Company", "Investment Advisor", "Investment Advisor/Hedge Fund", "Mutual Fund", "Pension Fund", "Pension Fund Portfolio", "Private Equity", "Research Firm", "Sovereign Wealth Fund", and "Venture Capital"), other institutions ("Corporation", "Foundation", and "Holding Company"), and individuals.

Table 8
Relative repurchase price, the CEO's network centrality, and block ownership.

Panel A. Tests based on the presence of institutional blockholders (with 5% or higher holdings)

	(1) Relative price 0 to +1	(2) Relative price 0 to +1	(3) Relative price 0 to +1	(4) Relative price 0 to +3	(5) Relative price 0 to +3	(6) Relative price 0 to +3	(7) Relative price 0 to +6	(8) Relative price 0 to +6	(9) Relative price 0 to +6
Normalized degree	7.9668**	11.3708**	11.0958**	17.4680**	22.1280***	21.8455***	27.0807***	31.0924***	30.5822***
	(2.069)	(2.311)	(2.239)	(2.546)	(2.691)	(2.648)	(3.299)	(3.354)	(3.299)
Dummy institutional blockholder (1 block)	0.0032			0.0049			0.0117		
	(0.364)			(0.317)			(0.583)		
Dummy institutional blockholder (2 blocks)		0.0209			0.0344			0.0385	
		(1.607)			(1.560)			(1.510)	
Dummy institutional blockholder (3 blocks)			0.0309*			0.0514*			0.0621*
			(1.795)			(1.810)			(1.928)
Normalized degree *									
Dummy institutional blockholder (1 block)	−2.4837			−6.1919			−19.1948		
	(−0.450)			(−0.626)			(−1.568)		
Normalized degree *									
Dummy institutional blockholder (2 blocks)		−15.2662*			−24.4302*			−41.3486**	
		(−1.845)			(−1.683)			(−2.376)	
Normalized degree *									
Dummy institutional blockholder (3 blocks)			−16.4693*			−27.0574			−44.6259**
			(−1.677)			(−1.569)			(−2.122)
Ownership of other institutions	−0.0004	−0.0003	−0.0002	−0.0004	−0.0003	−0.0002	−0.0005	−0.0003	−0.0002
	(−1.035)	(−0.811)	(−0.654)	(−0.678)	(−0.436)	(−0.293)	(−0.618)	(−0.362)	(−0.293)
Ownership of individuals	−0.0000	0.0000	0.0002	0.0000	0.0001	0.0004	−0.0001	−0.0000	0.0003
	(−0.248)	(0.059)	(0.916)	(0.094)	(0.441)	(1.298)	(−0.151)	(−0.040)	(0.863)
Observations	18,067	18,067	18,067	18,067	18,067	18,067	18,067	18,067	18,067
Adjusted R-squared	0.264	0.271	0.277	0.337	0.343	0.350	0.391	0.397	0.401
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B. Tests based on the presence of institutional or corporate blockholders (with 5% or higher holdings)

	(1) Relative price 0 to +1	(2) Relative price 0 to +1	(3) Relative price 0 to +1	(4) Relative price 0 to +3	(5) Relative price 0 to +3	(6) Relative price 0 to +3	(7) Relative price 0 to +6	(8) Relative price 0 to +6	(9) Relative price 0 to +6
Normalized degree	8.1745**	11.9197**	12.0633**	18.3674***	23.3116***	23.3615**	28.0624***	33.0284***	32.5223***
	(2.122)	(2.350)	(2.201)	(2.602)	(2.726)	(2.562)	(3.322)	(3.406)	(3.184)
Dummy blockholder (1 block)	0.0093			0.0181			0.0260		
	(0.931)			(1.030)			(0.182)		
Dummy blockholder (2 blocks)		0.0221*			0.0343			0.0391	
		(1.709)			(1.555)			(1.519)	
Dummy blockholder (3 blocks)			0.0284*			0.0458*			0.0542*
			(1.785)			(1.732)			(1.800)
Normalized degree *									
Dummy blockholder (1 block)	−2.9076			−8.0818			−21.2136*		
	(−0.529)			(−0.825)			(−1.751)		
Normalized degree *									
Dummy blockholder (2 blocks)		−16.6556**			−27.8605*			−46.3606***	
		(−1.994)			(−1.879)			(−2.601)	
Normalized degree *									
Dummy blockholder (3 blocks)			−19.7426*			−32.0488			−50.0570**
			(−1.707)			(−1.611)			(−2.154)
Ownership of individuals	−0.0000	0.0000	0.0001	0.0001	0.0001	0.0003	−0.0000	−0.0000	0.0002
	(−0.192)	(0.032)	(0.558)	(0.188)	(0.344)	(0.909)	(−0.052)	(−0.129)	(0.427)
Observations	18,067	18,067	18,067	18,067	18,067	18,067	18,067	18,067	18,067
Adjusted R-squared	0.263	0.271	0.276	0.337	0.343	0.348	0.390	0.399	0.401
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table contains regressions that extend the baseline analyses presented in columns (4)–(6) of Table 2 by testing whether the relation between the relative repurchase price and a CEO's professional network is affected by the presence of blockholders. In particular, blockholder dummies are interacted with *Normalized degree*. *Dummy institutional blockholder (1 block)* is equal to one if there is at least one institutional investor with a holding of 5% or more, and zero otherwise. Similarly, *Dummy institutional blockholder (2 blocks)* and *Dummy institutional blockholder (3 blocks)* are set to one when there are at least two and three institutional blockholders, respectively. The variables *Dummy blockholder (1 block)*, *Dummy blockholder (2 blocks)*, and *Dummy blockholder (3 blocks)* respectively identify observations with at least one, two, and three non-individual investors (i.e. institutional investors or other types of legal entities) with a holding of 5% or more. *Ownership of individuals* (*Ownership of other institutions*) is the percentage of shares held by individuals (institutions that are not classified as institutional investors). All our specifications include the control variables of Table 2 together with calendar month (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. Detailed variable definitions can be found in the Appendix. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 9
Relative repurchase price, the CEO's network centrality, and board characteristics.

Panel A. Tests based on board independence

	(1) Relative price 0 to +1	(2) Relative price 0 to +3	(3) Relative price 0 to +6
Normalized degree	47.2173**	88.3125**	95.3517**
	(2.159)	(2.366)	(2.121)
High board independence	0.0357*	0.0600*	0.0670*
	(1.786)	(1.808)	(1.762)
Normalized degree *			
High board independence	−41.6316*	−75.4849**	−78.6936*
	(−1.955)	(−2.060)	(−1.781)
Board size	−0.0015	−0.0025	−0.0003
	(−1.017)	(−0.764)	(−0.108)
Observations	18,067	18,067	18,067
Adjusted R-squared	0.274	0.348	0.396
Control variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes

Panel B. Tests based on board busyness

	(1) Relative price 0 to +1	(2) Relative price 0 to +1	(3) Relative price 0 to +3	(4) Relative price 0 to +3	(5) Relative price 0 to +6	(6) Relative price 0 to +6
Normalized degree	7.2388**	7.5500***	15.9240***	16.5670***	21.2019***	22.3231***
	(2.473)	(2.628)	(3.360)	(3.553)	(3.912)	(4.210)
Low board busyness (50%)	0.0020		0.0057		0.0104	
	(0.318)		(0.483)		(0.647)	
Low board busyness (25%)		0.0302		0.0478		0.0561
		(1.624)		(1.566)		(1.574)
Normalized degree *						
Low board busyness (50%)	−5.0867		−12.1154		−19.4432	
	(−0.864)		(−1.185)		(−1.551)	
Normalized degree *						
Low board busyness (25%)		−21.2218		−47.7169**		−79.9146***
		(−1.495)		(−2.018)		(−2.655)
Observations	18,067	18,067	18,067	18,067	18,067	18,067
Adjusted R-squared	0.263	0.271	0.337	0.344	0.389	0.395
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes	Yes	Yes

This table contains regressions that extend the baseline analyses presented in columns (4)–(6) of Table 2 by testing whether the relation between the relative repurchase price and a CEO's professional network is affected by board characteristics. Board variables are interacted with *Normalized degree* while the size of the board is used as an additional control when board independence is the focus of the analysis. *High board independence* is equal to one if the proportion of non-executive members of the board is higher than 50%, and zero otherwise. *Low board busyness (50%)* (*Low board busyness (25%)*) is equal to one if the average number of board seats held by each non-executive director in other listed firms is lower than the median (lower quartile) of the sample, and zero otherwise. *Board size* is the number of directors on the board. All of our specifications include the control variables of Table 2 together with calendar month (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. Detailed variable definitions can be found in the Appendix. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

only when we focus on firms with levels of busyness below the lower quartile. Buybacks carried out at bargain prices are significantly less common in firms with well-connected CEOs and busy boards.

The above findings for ownership variables and board characteristics are consistent with a mechanism according to which CEOs with extensive networks are less incentivized to repurchase stock at relatively low prices owing to their power and superior ability to minimize any form of discipline. In firms with better monitoring by investors and independent, non-executive directors, these executives appear to behave more like their peers with fewer professional ties. Importantly, the influence of monitoring mechanisms on the behavior of well-connected CEOs seems to be inconsistent with the alternative (and plausible) view that the observed tendency of well-connected CEOs to poorly time buybacks is caused by their preference to focus on other corporate actions that are more consequential and valuable for shareholders.[14]

8. Repurchases and trades by CEOs

In this section, we study the interplay between stock repurchases and insider trades by CEOs to further evaluate our argument that having an extensive network of professional connections boosts the CEO's power.

CEOs, whether powerful or not, obviously have strong incentives to undertake personal sales of their firm's stock when it is overvalued, and to refrain from doing so when it is undervalued. On the other hand, CEOs' incentives to undertake stock repurchases to exploit market undervaluation are more questionable since the benefits of well-timed buybacks largely accrue to shareholders. These incentives to time repurchases are probably much more significant for a weak CEO with a precarious professional position than for a powerful CEO that does not need to perform as well in order to keep their job. In a similar vein, a weak CEO could ill afford to engage in what we define as controversial repurchases (i.e. repurchase transactions that are preceded or followed by the CEO's equity sales). These buybacks can be seen as highly controversial (especially if the buybacks are poorly performing) in that an inconsistent behavior emerges when a CEO uses their firm's capital to repurchase shares while trading in the opposite direction when they commit their own wealth.

Previous studies indicate that controversial repurchases are not uncommon. Edmans et al. (2022) show that CEOs' equity sales tend to follow stock repurchase transactions. Similarly, Bonaime and Ryngaert (2013) report that in quarters with stock repurchases, the likelihood of net insider selling is higher than usual, while Moore (2023) shows a positive causal link between equity sales by executives and stock repurchases. Broader international evidence is offered by Wang et al. (2021) who find that the increase in repurchase activities caused by the legalization of buybacks coincides with higher stock prices in the short term and a significant reduction in insider ownership.

The aim of the empirical tests in this section is to ascertain whether controversial repurchases are more common in firms led by CEOs with large professional networks. In particular, we study CEO insider trading activities around dates of repurchase transactions, as well as testing whether insider trading strategies depend on executive network centrality. Data on insider trades from Company REFS are used to build our dependent variables here. These are two dummies that capture whether a firm's CEO is a net seller of their firm's shares over the period from one month before to one month after a repurchase transaction, or during the month following the transaction. We exclude insider deals related to the exercise of executive stock options since these could routinely happen on pre-set dates. Trades by CEOs are not that frequent and our dummies very often take a value of zero. This is a limitation that could prevent us from obtaining robust and statistically significant findings.

The multivariate analyses of Table 10 provide some evidence on the positive relation between a CEO's degree and the probability that they are a net insider seller over periods surrounding buyback trades. The coefficient of the continuous variable *Normalized degree* is statistically insignificant in columns (1) and (3). In contrast, in the remaining columns of the table, we report statistically significant evidence that CEOs with levels of network centrality that are equal to or higher than the sample median are more likely to be net sellers of their firms' stocks than less-connected CEOs. On the whole, we can report some evidence in favor of our above prediction: the association between stock buybacks and contemporaneous or subsequent net sales of shares by CEOs is stronger in firms led by executives with larger networks.

9. Alternative mechanisms

In Section 7 we have provided evidence supportive of a CEO power and corporate monitoring mechanism underlying our main findings while the analyses of Section 8 on stock sales by CEOs around repurchase transactions further reinforces the argument that extensive professional connections make CEOs powerful and more prone to selfish behavior. In this section we consider two alternative mechanisms that could also have explanatory power.

We start by considering an alternative mechanism based on information asymmetry since a professional network can also function as an information conduit that facilitates the diffusion of inside corporate information. Outsiders are more likely to obtain insider private information on a particular firm if they belong to the professional network of the firm's CEO. A CEO can (whether deliberately or not) convey value-relevant, material information on her company to her acquaintances who can then exploit it through trading. This phenomenon can be particularly significant when the CEO has many connections. Past studies find that firms with better connected directors experience more informed trading of their stock by sophisticated traders (Cohen et al., 2008; Akbas et al., 2016; Cheng et al., 2019). In our context, recipients of inside information can then use it to personally purchase the stock of the firm whenever it appears to be undervalued, making undervaluation less common and more transient and repurchase timing more challenging. Thus, the negative relation between a CEO's network and her ability to time repurchases is possibly explained by the circumstance that inside information is diffused more widely across a larger network of connections.

If this were the case, we would expect to find firms with well-connected directors (on top of well-connected CEOs) to experience lower timing of repurchase transactions. The professional network of these directors can spread inside information as much as that of the CEO. The results reported in Table A.17 in the Online Appendix appear to contradict our expectation and do not offer support for our second mechanism. Both the *Degree of other directors* and the *Degree of other executive directors*, which reflect the professional network centrality of non-CEO directors, are not significantly related to our timing measures, unlike *Normalized degree* the coefficient of which still has a positive sign. Furthermore, additional tests show that the effect of a CEO's degree on the relative price at which stock is repurchased is not weaker in low-asymmetric information firms in which an informational mechanism should be less effective. In our tests of Table A.18 in the Online Appendix we assume that such firms are large and have a high stock turnover, a low stock volatility, a high number of EPS forecasts, a low dispersion of EPS forecasts, and a low EPS forecast error.

The second alternative explanation we evaluate builds on the view that firms tend to support their stock price through buybacks following poor past stock returns (e.g., Dittmar and Field, 2015; Liu and Swanson, 2016; Busch and Obernberger, 2017; Andriosopoulos and

[14] It is also argued that the detrimental actions of powerful executives are facilitated by the availability of large cash holdings. However, as documented in Table A.16 in the Online Appendix, we do not find that the level of industry-adjusted cash holdings significantly affects the relation between a CEO's degree and the timing of stock repurchases.

Table 10
Net insider sales by the CEO and the CEO's network centrality.

	(1) CEO net sales over months –1 and +1	(2) CEO net sales over months –1 and +1	(3) CEO net sales over month +1	(4) CEO net sales over month +1
Normalized degree	3.5208		3.0622	
	(0.921)		(0.948)	
High normalized degree		0.0269**		0.0177*
		(2.025)		(1.898)
Observations	18,067	18,067	18,067	18,067
Adjusted R-squared	0.198	0.199	0.152	0.153
Control variables	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
CEO clustering	Yes	Yes	Yes	Yes

This table reports linear probability model (LPM) regressions of the likelihood of a CEO's net insider sales around the date of a repurchase transaction on the CEO's *Normalized degree*. *CEO net sales over months –1 and +1* (*CEO net sales over month +1*) is a dummy that equals one if the CEO is a net seller of their firm's shares between month –1 and month +1 around (over the month following) a repurchase date, and zero otherwise. The CEO's network centrality is proxied either by the continuous variable *Normalized degree* or by the dummy *High normalized degree* that is equal to one if degree centrality is higher than or equal to the sample median, and zero otherwise. All of our specifications include the control variables of Table 2 (except the *Number of repurchase transactions*) together with calendar month (e.g. dummies for all months of each specific calendar year, such as June 2009 or September 2011) and two-digit SIC code industry fixed effects. Detailed variable definitions can be found in the Appendix. *t-statistics* (in parentheses) are based on heteroskedasticity-robust standard errors clustered at the CEO level to account for within-CEO serial correlation. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Hoque, 2018). Price-support activities may lead to two main alternative outcomes in terms of repurchase timing. On the one hand, they may be unsuccessful in their attempt to avoid a further price decline thus leading to poor repurchase timing. This might happen when the declining trend is very significant and has momentum, which may indicate the existence of negative news that are very value-relevant. In this case, the repurchase price tends to be higher than subsequent stock market valuations. On the other hand, repurchase transactions may be successful in stabilizing stock market valuations and may be considered well-timed when they stop or even reverse a downward trend. Less persistent and significant downward trends (perhaps based on rumors rather than verified news) are more likely to be offset by buyback transactions.

In light of these premises, it is possible that well-connected CEOs may tend to engage in less successful price-support activities to counteract significant and persistent price declines. We, therefore, test whether past returns are associated with repurchase timing and more importantly whether past returns moderate the relation between degree and timing. In Table A.19 in the Online Appendix we include two additional controls for the buy-and-hold returns over the past six and twelve months. We find that past returns do not actually affect our timing measures in a significant way, while *Normalized degree* remains a significant determinant. The complementary tests in the same table further indicate that the impact of *Normalized degree* on repurchase timing is not really dependent on whether the stock has performed well or poorly in the past six or twelve months. Overall, while buybacks may indeed be carried out to support a declining price, a firm's past stock performance does not seem to exercise a significant influence either on repurchase timing or on the association between timing and a CEO's degree.

10. Conclusion

We use a very large dataset of UK daily buyback transactions to study whether a CEO's professional ties have an impact on the timing of stock repurchases. CEOs that are central in the professional network of directors and executives are particularly capable of gathering information that can enhance their ability to purchase own stock at bargain prices. However, well-connected CEOs are more powerful and entrenched, while enjoying ample opportunities to find a new position in the event of being dismissed from their current job. Thus, CEOs with extensive professional networks may have weak incentives to optimize the execution of buybacks and minimize repurchase prices. Weak incentives may, in turn, lead CEOs to exert low effort (i.e. shirking) or even pursue selfish objectives, such as boosting stock market valuations in the short term.

Our main finding is that CEOs with high network centrality tend to carry out buybacks at higher prices relative to less-connected peers. A mechanism based on agency conflicts and CEO power seems to be best suited to explain our findings here. In particular, the presence of a concentrated institutional ownership structure, blockholders, and independent directors, as well as a low level of board busyness make the inverse relation between a CEO's network and repurchase timing significantly weaker. In contrast, other explanations based on informational mechanisms or price-support activities through buybacks do not help us to rationalize our findings.

CRediT authorship contribution statement

Amedeo De Cesari: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Nicoletta Marinelli:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Rohit Sonika:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

Data availability

The authors do not have permission to share data.

Appendix A. Variable definitions

See Table A.1

Table A.1
Variable definitions.

Panel A. Main dependent and network variables

Variable	Definition
Relative price $-t$ to $+t$	Daily repurchase price scaled by the average value of the closing price (adjusted for dividends and splits) from t months before to t months after the day of the repurchase announcement, minus one (sources: Company REFS and LSPD).
Relative price 0 to $+t$	Daily repurchase price scaled by the average value of the closing price (adjusted for dividends and splits) from the day of the repurchase announcement to t months after this date, minus one (sources: Company REFS and LSPD).
Relative price $-t$ to $+t$ dummy	Binary variable that is set to one if *Relative price –t to +t* is less than zero, and otherwise is set to zero (sources: Company REFS and LSPD).
Relative price 0 to $+t$ dummy	Binary variable that is set to one if *Relative price 0 to +t* is less than zero, and otherwise is set to zero (sources: Company REFS and LSPD).
Degree	The total number of a CEO's direct professional ties with other directors and executives. A tie is assumed to exist if two individuals work for the same firm at the same time. Both current and historical information on employment profiles are considered here (source: Boardex UK).
Normalized degree	A CEO's *Degree* scaled by the total number of directors and executives (excluding the same CEO) that belong to the overall network in the same year (source: Boardex UK).
High normalized degree	Binary variable that equals one if *Normalized degree* is higher than or equal to the sample median, and otherwise is set to zero (source: Boardex UK).
Degree of directors from the same industry and year	Average *Normalized degree* for directors that belong to the same industry and year as the focal firm, excluding the firm's CEO (source: Boardex UK).

Panel B. Other variables

Variable	Definition
Number of repurchase transactions	Total number of repurchase transactions carried out by the same firm in the same calendar month (source: Company REFS).
Log market capitalization	Log of inflation-adjusted market capitalization in thousands of 2014 GBP (source: Worldscope).
Operating profits	Operating income over total assets (source: Worldscope).
Market-to-book	Market value of assets over book value of assets (source: Worldscope).
Leverage	Total liabilities over total assets (source: Worldscope).
Cash holdings	Cash and cash equivalents over total assets (source: Worldscope).
Capex	Capex over total assets (source: Worldscope).
Dividend yield	Common dividends over market capitalization (source: Worldscope).
Turnover	Average monthly turnover (value of shares traded over market capitalization) for the year of the repurchase transaction. A minimum of six monthly observations is needed to compute this variable (source: LSPD).
Volatility	Average monthly stock return volatility for the year of the repurchase transaction. A minimum of six monthly observations is needed to compute this variable (source: LSPD).
Male CEO	Dummy that is set to one if the CEO is a male, and otherwise is set to zero (source: Boardex UK).
CEO age	Age of the CEO in years (source: Boardex UK).
CEO tenure	CEO's time in role in years (source: Boardex UK).
CEO direct compensation	Log of one plus the CEO's inflation-adjusted direct compensation in thousands of 2014 GBP (source: Boardex UK).
CEO equity-based compensation	Log of one plus the CEO's inflation-adjusted equity-based compensation in thousands of 2014 GBP (source: Boardex UK).
CEO delta	Log of one plus the change in the CEO's inflation-adjusted wealth in the firm in thousands of 2014 GBP for each 1% change in the stock price (source: Boardex UK).
High institutional ownership HHI	Binary variable that equals one if the Herfindahl–Hirschman Index (HHI) of holdings held by institutional investors is higher than or equal to either the sample median (*50%*) or the upper quartile (*75%*), and otherwise is set to zero (source: Refinitiv Eikon).
Ownership of other institutions	Percentage of shares held by institutions that are not classified as institutional investors (source: Refinitiv Eikon).
Ownership of individuals	Percentage of shares held by individuals (source: Refinitiv Eikon).
Dummy institutional blockholder	Binary variable that equals one if there are at least one (*1 block*), two (*2 blocks*), or three (*3 blocks*) institutional investors with a holding of 5%, and otherwise is set to zero (source: Refinitiv Eikon).
Dummy blockholder	Binary variable that equals one if there are at least one (*1 block*), two (*2 blocks*), or three (*3 blocks*) non-individual investors (i.e. a legal entity) with a holding of 5%, and otherwise is set to zero (source: Refinitiv Eikon).
High board independence	Binary variable that equals one if the proportion of non-executive members of the board is higher than 50% (source: Boardex UK).
Board size	Number of directors on the board (source: Boardex UK).
Low board busyness	Binary variable that equals one if the average number of board memberships held by each non-executive director in other listed firms is lower than the sample median (*50%*) or lower quartile (*25%*) (source: Boardex UK).
CEO net sales over months –1 to +1	Binary variable that equals one if the CEO is a net seller of their firm's shares between month –1 and month +1 around the repurchase date, and otherwise is set to zero (source: Company REFS).
CEO net sales over month +1	Binary variable that equals one if the CEO is a net seller of their firm's shares over month +1 after the repurchase date, and otherwise is set to zero (source: Company REFS).

This table reports detailed definitions of all the variables used in the study.

Appendix B. Supplementary materials

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jbankfin.2024.107288.

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