

Article

Determinants of Repurchase Size: Evidence from the UK

Adhiraj Sodhi ^{1,*}, Cesario Mateus ², Irina Mateus ² and Aleksandar Stojanovic ¹

¹ The Business School, University of Greenwich, London SE10 9LS, UK

² The Business School, Aalborg University, 9220 Aalborg, Denmark

* Correspondence: adhiraj.sodhi@greenwich.ac.uk

Abstract: The paper focuses on the factors that determine the size of an open market share repurchase in the UK. The testing covers the time period 1985–2014 and tests if the traditional motives for repurchasing shares also determine the size of the repurchase. The testing also checks if the influences of these determinants are non-linear, U-shaped or inverted U-shaped, which, to the best of our knowledge, is also a novel empirical approach. The consideration of non-linear influences on repurchase size is relevant due to the overlapping of repurchase determinants. For instance, if the distribution of excess cash is the motive for undertaking the repurchase and not replacing dividend distribution, then the influence of dividend distribution on repurchase size may conflict with the traditional expectation of repurchases being used as dividend replacements. The testing finds that the motive of using repurchases for signalling stock undervaluation has the most consistent influence on repurchase size, followed by the motives of adjusting the reported EPS when earnings are negative and for distributing surplus cash. The motive for using repurchases to adjust the capital structure to increase the debt exposure has a U-shaped influence on repurchase size, while board independence has an inverted U-shaped influence. Overall, when compared to the current literature, this paper is able to demonstrate that there is a strong consistency between the motives that lead to repurchases in the UK, and the determinants of repurchase size.

Keywords: repurchases; determinants; non-linearity

JEL Classification: G32; G34; G35



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1. Introduction

The majority of all repurchases in the UK are undertaken via the ‘open market’ route (Rau and Vermaelen 2002; Oswald and Young 2004), which is a straightforward corporate event; the managerial enters the market like any other investor and purchases shares, with the exception that the buyer is also the stock’s issuer. Renneboog and Trojanowski (2011) and Geiler and Renneboog (2015) find that repurchases in the UK have been on an upswing since 2002, making it the leader in Europe (Sonika et al. 2014). Denis and Osobov (2008) find that despite the UK being heavily dividend preferential, repurchases are not seen as their replacements; they are independent corporate payouts that complement dividends. This is consistent with Ferris et al.’s (2006) finding that dividends in the UK are declining and that repurchases are still not being used as substitutes.

Our research’s primary aim is to determine if there is a consistency between the motives that influence the undertaking of repurchases and their influence on repurchase size. Such an exploration is important due to the fact that the existing literature hosts several contradictions, which are explored in the paper’s literature review. This begins by assessing the three leading motives that British managers have cited in Dhanani’s (2016) survey for undertaking repurchases: distributing excess cash, adjusting the reported Earnings Per Share (EPS) and signalling stock undervaluation. Furthermore, the contradictions in the use of repurchases for the following reasons are also assessed: replacing dividend distribution, providing shareholders with a tax-friendlier corporate payout, to signal asymmetric

information and to adjust the capital structure to increase firm-level leverage. Including these motives, the influence of board independence is also tested. Further, empirical testing was also used to investigate if the influences of the size-specific determinants are non-linear, U-shaped, or inverted U-shaped. We define U-shaped as an initial negative influence that turns positive after a certain point, and inverted-U-shaped as an initial positive influence that turns negative after a certain point. This is important due to the overlapping of factors that may lead to inaccurate/faulty assessments. For instance, let us assume that the motive for undertaking repurchases is to distribute excess cash, which British managers have stated in [Dhanani's \(2016\)](#) survey is the number one reason for repurchasing shares. Simultaneously, the firm holds its dividend distribution constant since they do not intend to replace dividends with repurchases. Then, there may be inaccurate estimations drawn by analysts or the findings of empirical investigations may conflict with the expected influence of the dividends. Thus, due to the contemporaneous existence of multiple forces that influence the repurchase decision making, there may be instances when any one or more of the above-mentioned forces has a contradictory influence when compared to traditional expectations.

To conduct the empirical investigation, we test a sample of open market repurchase announcements¹ of firms listed on the London Stock Exchange starting from 1985, the farthest historic year to which our data source, SDC Platinum² extends, up to 2014. Our sample effectively constitutes 360 repurchase announcements and, on average, each announcement is worth GBP 797mn (nominal) and represents 10% outstanding market equity; thus, this indicates that the combined market value of the announcing firms is just under GBP 3trn.

The empirical results reveal that the three leading motivational hypotheses that determined repurchase size were as follows: to use repurchases to signal stock undervaluation, to adjust the reported EPS when earnings are negative and to distribute excess cash. Thus, it is clear that the research's three leading determinants of repurchase size are identical to the top three motives for repurchasing shares in the UK, as highlighted in [Dhanani's \(2016\)](#) survey. The only discrepancy is the order of preference, which is unsurprising given the differences in timelines, sampling and methodologies. This highlights that since the survey is undertaken for a cross-sectional period (2003–2007) of this research's tested timeline (1985–2014), the managerial attitude remains consistent over the long run. This may also be due to their understanding with shareholders about their expectations, as regulations require their approval for an open market repurchase. Furthermore, we find that the motive of using repurchases for adjusting the capital structure in favour of debt has a U-shaped influence on repurchase size, while the impact of board independence has an inverted U-shaped influence. The influence of the motive to use repurchases as dividend substitutes is contradictory, as it has a positive influence, while the motives for using repurchases to signal asymmetric information or for its tax efficiency have not shown significant influences, either linearly or non-linearly.

The paper's empirical findings advance existing knowledge in two aspects. First it checks if the top motives professed by British managers for undertaking repurchases are also the top three determinants of repurchase size. Thus, if there is consistency in the influences of factors that motivate repurchases and their corresponding influence on the size of the repurchase, it will reveal a stable decision-making pattern. Further, the consistency is checked against the responses given by British managers who undertook repurchase during a five-year period (2003–2007) ([Dhanani 2016](#)), and this paper's testing of a timeline spanning for 30 years (1985–2014). Thus, if consistency between the two sets of studies is obtained, then it will also establish that the repurchase policy of British PLCs has remained very stable and consistent over the last three decades. The stability will echo a hallmark regulatory directive, which is not applied in the world's largest repurchasing country, the US, of requiring shareholder approval for repurchases ([Dhanani and Roberts 2009](#)), as shareholders would have essentially also shown consistency in their preferential circumstances to provide their vote of approval. The second contribution is testing if the determinants of repurchase size have a U-shaped or an inverted U-shaped influence. The

approach is an empirical verification of a logical assumption that due to the multiple factors that can compel repurchases, when one factor is a determinant for undertaking repurchases, then the influences of the remainder determinants may be contrary to their conventional expectations. Thus, this facilitates accurate analysis and investigatory ventures for future research.

2. Literature Review

This subsection focuses on the discussion regarding the determinants that have compelled repurchases in the UK. The analyses initially discuss the three leading motives for undertaking repurchases, as stated by British managers in [Dhanani's \(2016\)](#) survey, which are using repurchases for distributing excess cash, adjusting the reported EPS and signalling a stock undervaluation. Following, a discussion is provided on the motives for undertaking repurchases for signalling asymmetric information, providing a tax-friendlier corporate payout, replacing dividends and adjusting the capital structure to increase debt exposure.

[Dhanani \(2016\)](#) recently surveyed UK managers who repurchased shares between 2003 and 2007, and they stated that returning excess cash was the leading motive. This motive essentially states that firms generally divert cash reserves towards outlets such as investment, but when there is surplus cash accumulation, a repurchase is plausible due to two-fold reasoning ([Guay and Harford 2000](#); [Brav et al. 2005](#)). If the investment opportunities are unsuitable, managers may still undertake them, causing principal-agent conflicts, and buying the firm's stock restricts agent-centricity. [Burns et al.'s \(2015\)](#) testing of 15 European countries, of which the UK was the largest data-holder (42%), indicates that excess cash improves the prospects of repurchase undertaking. [Cesari and Ozkan \(2015\)](#) also found that within a sample of five European countries, of which the UK was again the largest data-holder (75%), excess cash increases the repurchase weighting in the total payout. Similarly, [Lee et al. \(2010\)](#) found that the UK's repurchases see an increment in value due to excess cash, consistent with [Lee and Suh's \(2011\)](#) finding that temporary and surplus cash are diverted towards the financing of repurchases. Thus, there is strong empirical support for managerial assertion in [Dhanani's \(2016\)](#) survey.

Further, the 2nd and 3rd most popular motives outlined in [Dhanani's \(2016\)](#) survey are assessed to improve EPS and signal stock undervaluation, respectively. The motive for adjusting EPS is essentially exploiting a repurchase's trait of reducing the outstanding stock volume, which makes the firm's earnings relative per outstanding share seem more attractive ([Dhanani and Roberts 2009](#)); the lower the number of shares, the greater the earnings distribution amongst them. While the motive for signalling stock undervaluation states that when firms are convinced that the stock is underpriced, for instance, due to economic uncertainty, an act of repurchase will signal to the market of the presence of mispricing, thus pushing the price up to its fair value ([Dittmar 2000](#)). [Sonika et al.'s \(2014\)](#) testing of the UK partially supports the managerial responses, as they find that positive EPS deters the undertaking of repurchases; however, undervaluation is not a motivator, but overvaluation shows tendencies of triggering a repurchase-withdrawal. Similar is [Geiler and Renneboog's \(2015\)](#) finding that stock valuation has no impact on repurchase decision making in the UK. Correspondingly, [Crawford and Wang \(2012\)](#) find that the market's reaction to repurchases does not indicate signalling stock undervaluation as a probable motive, similar to [Andriosopoulos and Lasfer \(2015\)](#).

The signalling of asymmetric information using repurchases is controversial in the UK. The motive states the usage of repurchases to signal information that cannot be directly communicated ([Dittmar 2000](#)), which may cause information opaqueness that impacts the stock value. It is generally believed that the information transparency between firms and the wider market are inversely related ([Ikenberry et al. 1995](#)), as given the enormity of large-cap firms, they have a much swifter and clearer information channel with the market, while the analytical focus is also more on them rather than smaller firms. Thus, using repurchases to reduce asymmetric information bias is typical with smaller firms; however, in the UK,

the contrary is seen. [Cesari and Ozkan \(2015\)](#) find that firm size has consistently motivated the undertaking of repurchases, which is consistent with [Lee et al. \(2010\)](#), [Andriosopoulos and Hoque \(2013\)](#) and [Burns et al. \(2015\)](#). However, [Andriosopoulos and Lasfer \(2015\)](#) use the same sample as [Andriosopoulos and Hoque \(2013\)](#) and show that firm size deters the market's reaction to a repurchase announcement, indicating a disconnection between managerial outlook and market expectation. The positive impact of firm size on managerial attitude is not consistent with the logic supported by [Ikenberry et al.'s \(1995\)](#) seminal research, and this research is highly supportive of the said fundamental. Supporting this assertion is [Mazzi et al.'s \(2018\)](#) finding that in Europe, a firm's size and its compliance with governance directives is positively related, thus revealing a predisposed propensity of smaller firms to refrain from divulging information.

The research further investigates the tax preferential hypothesis. Usually, the taxation on capital gains and dividends are different, and the hypothesis states the use of repurchases for their tax efficiency over dividend distribution ([Barclay and Smith 1988](#); [De'Jong et al. 2003](#)). The motive is circumstantial to a country's tax regime; for instance, it is currently irrelevant in the US and Germany since they tax capital gains and dividends at the same rates ([Deloitte 2016](#); [IRS 2016](#)). However, in the UK, it is highly relevant; since 1981, successive governments have reduced the tax on capital gains while contemporaneously increasing that on dividends ([HMRC 2017](#); [IFS 2017](#)). Empirically, [Ji \(2016\)](#) finds that the tax regime in the UK is co-integrated with the corporate payout policy. [Alzahrani and Lasfer \(2012\)](#) indicate a reduction in repurchase prospects if they are tax-friendlier than dividends; however, [Oswald and Young \(2008\)](#) find the exact opposite, which complements [Andriosopoulos and Lasfer's \(2015\)](#) conclusion that a repurchase's tax efficiency strengthens the market reaction to its announcement. Completely averse to these findings are the conclusions of [Oswald and Young \(2004\)](#) and [Geiler and Renneboog \(2015\)](#), that the tax efficiency of repurchases has no bearing on the managerial decision to undertake them. Thus, the continual alterations of tax rates in the UK are accompanied by conflicts in the literature regarding the repurchase–taxation relationship.

The Miller–Modigliani Dividend Irrelevance Theory ([Miller and Modigliani 1961](#)) implies that in a frictionless capital market, a shareholder's investment assessment is solely linked to earnings, and if the firm's strategy is acceptable, then they remain indifferent between repurchases and dividends, while any economic shortfall is absorbable through a proportionate sale of the equity holding. Thus, this indicates that repurchases and dividends are identical corporate payouts, creating the dividend substitution hypothesis, wherein firms use repurchases as dividend replacements. For the UK, [Ji \(2016\)](#) suggests that repurchases are mildly used as dividend replacements. This is consistent with repurchase's rising popularity as independent corporate payouts and not dividend replacements ([Ferris et al. 2006](#); [Denis and Osobov 2008](#)). [Burns et al. \(2015\)](#) find that dividends are complementary to repurchases in Europe, and when they remove the UK from their testing, the results lose statistical significance. However, [Lee et al. \(2010\)](#) find that dividend distribution does not influence managerial decision making. This is partially consistent with [Sonika et al.'s \(2014\)](#) finding that dividend-paying firms are averse from repurchases, indicating dividend substitution; however, the actual dividend distribution does not impact the decision-making. The market reaction to repurchases has also remained uninfluenced by dividend history ([Lee et al. 2010](#); [Andriosopoulos and Lasfer 2015](#)). Thus, it can be seen that overall, the UK as a country does not see strong evidence of repurchases being viewed as dividend replacements; rather, the two payouts are considered peers.

Multiple factors can influence the capital structure's debt–equity split, such as firm type and financial constraints; nonetheless, the tradeoffs between debt and equity are consistent ([Marsh 1982](#)). Debt provides a tax shield but mandates fixed coupon payments, thus making it a cheaper source of capital than equity. Firms may opt for increasing their debt exposure to reduce the cost of capital, and the capital restructuring hypothesis states the achieving of this motive through the use of repurchases ([Dittmar 2000](#); [Mitchell and Dharmawan 2007](#)). [Lee and Suh \(2011\)](#), [Burns et al. \(2015\)](#) and [Cesari and Ozkan \(2015\)](#)

reveal that lower levels of debt exposure positively influence repurchase undertaking in the UK, thus supporting the presence of the capital restructuring hypothesis. However, [Benhamouda and Watson \(2010\)](#), [Lee et al. \(2010\)](#) and [Sonika et al. \(2014\)](#) find that leverage has no impact and is completely inconsistent with [Andriosopoulos and Lasfer's \(2015\)](#) conclusion that higher leverage has a positive influence on the market's reaction towards repurchases. Overall, it is seen that the relationship between firm-level leverage and repurchases is mostly either as insignificant or consistent with the capital restructuring hypothesis.

3. Sample, Research Objectives and Methodologies

3.1. Sample Selection

The initial dataset (Table 1) comprised 419 announcements between 1981 and 2014, with the first announcement being made in 1985. We do not hold survivorship bias but were unable to locate the annual reports of 59 non-existent firms, which results in a sample of 360 repurchases that are, on average, worth GBP 797mn (nominal) and represent a repurchase of 10% outstanding equity. The data required for constructing firm-level control variables are extracted from their annual filings, which are obtained from the Companies House. The taxation and macroeconomic data are obtained from multiple sources, which include the archives of HMRC, the Institute for Fiscal Studies, the Office for National Statistics, the Bank of England and generic government records.

Table 1. Dataset.

Panel I: Sample Selection			Panel II: Sample Statistics		
Time Period	# Repurchases (Initial)	# Repurchases (Sample)	Time Period	Average % of Shares Sought	Average Value (GBPmn)
1985–1989	13	12	1985–1989	10.66	98
1990–1994	84	67	1990–1994	9.21	96
1995–1999	212	180	1995–1999	9.91	439
2000–2004	33	32	2000–2004	11.19	195
2005–2009	41	39	2005–2009	10.76	1033
2010–2014	36	30	2010–2014	8.52	1124
1985–2014	419	360	1985–2014	9.90	797

Figure 1 provides the size-specific frequency distribution of the repurchases, i.e., their value relative to the market capitalisation, and their information is summarised in Table 2 alongside the Mann–Whitney Rank Sum results that reveal if repurchases are different across size-specific quartiles. The frequency distribution is lopsided and indicates managerial liking for large-sized repurchases; the average quantity of shares sought by the upper (lower) 50% of the firms is 13.50% (6.30%). This is a pragmatic managerial approach, as shareholder consent does not mandate that the repurchase must be of the approved size; rather, it must be capped at that level. Thus, approval for a larger size provides flexibility in the payout's execution, which is important since factors such as repurchase timing are crucial for success, as proven throughout time by the testing of global markets ([Kahle 2001](#); [Chan et al. 2007](#); [Ishikawa and Takahashi 2011](#); [Cesari et al. 2012](#)). The Mann–Whitney results find significance across the quartiles; thus, there is a statistical difference between repurchases of different values.

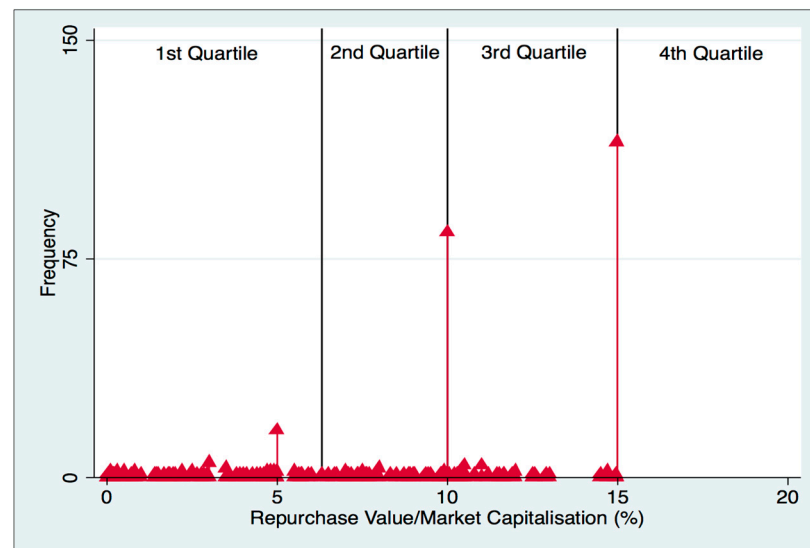


Figure 1. Repurchase size-specific frequency distribution.

Table 2. Repurchase size-specific summary and Mann–Whitney results.

Quartile	Panel I: Quartile-Level Statistics		Panel II: Mann–Whitney Rank Sum	
	Quartile Width (%)	Average % of Shares Sought	Quartile Pair	Z-Score
1st	0.03–6.31	3.20	1st and 2nd	−11.751 *** (0.000)
2nd	6.50–10.00	9.31	1st and 3rd	−11.634 *** (0.000)
3rd	10.00–14.99	11.90	1st and 4th	−12.392 *** (0.000)
4th	14.99–15.00	14.99	2nd and 3rd	−9.794 *** (0.000)
			2nd and 4th	−12.582 *** (0.000)
			3rd and 4th	−9.764 *** (0.000)

Superscripts indicate statistical significance at the 0.01 (***) percent levels, and *p*-values are in the parenthesis.

3.2. Research Objective

The paper’s objective is to ascertain the factors that determine the size of a repurchase, with a strong focus on the consistency between the motives that compel repurchase undertaking and their size-specific influence, while also checking if their influences on repurchase size are non-linear (U-shaped or inverted U-shaped). In Table 3 we discuss the Primary Influencers, which constitute seven motives of undertaking repurchases and board independence, and Secondary Influencers, which are sectioned into two categories, namely firm-level profitability and macrofinancial conditions. Thus, their combination of testing captures a spectrum of internal and external influences via the following three hypotheses.

- H₁₀ = Primary influencers do not determine the size of a repurchase.
- H₁₁ = Primary influencers determine the size of a repurchase.
- H₂₀ = Profitability does not determine the size of a repurchase.
- H₂₁ = Profitability determines the size of a repurchase.
- H₃₀ = Macrofinancial conditions do not determine the size of a repurchase.
- H₃₁ = Macrofinancial conditions determine the size of a repurchase.

Table 3. Description of primary and secondary influencers.

	Summary	Linear Proxy	Expected Influence	Non-Linear Proxy	Expected Influence
Panel I: Primary Influencers: Testing H ₁					
Excess Cash Distribution	Firms utilise cash for investment; however, upon surplus accumulation, a repurchase is plausible (Guay and Harford 2000; Brav et al. 2005). British managers state that adjusting earnings is a leading motive for undertaking repurchases (Dhanani 2016); it is thus possible that cash flow may also have a negative influence on repurchase size	Cash Income Pre-tax and depreciation relative to assets.	Positive	Cash ²	Negative
Adjusting EPS	Repurchases reduce the stock volume, thus increasing the EPS. Managers use this approach to adjust the EPS (Dhanani and Roberts 2009), the top motive in the UK (Dhanani 2016). We are interested in seeing if negative earnings compel such managerial attitudes.	EPS Binary, '1' if the earnings are negative.	Positive	n/a	n/a
Signalling Stock Undervaluation	Spending cash to buy their own shares is a signal of undervaluation (Dittmar 2000). Since repurchases are used for window dressing the EPS (Dhanani and Roberts 2009), they may also be used to support a stock overvaluation, which indicates the non-linear influence of firm valuation	M/B Ratio Market value relative to book value	Negative	M/B Ratio ²	Positive
Signalling Information Asymmetry	Given the absence of a perfect market (Latif et al. 2011), repurchases are used for signalling information bias (Ikenberry et al. 1995; Dittmar 2000); the larger the firm, the greater the transparency. The UK has shown the opposite to be true (Lee et al. 2010; Andriosopoulos and Hoque 2013; Burns et al. 2015; Cesari and Ozkan 2015).	Size The natural log of the book value of assets.	Negative	Size ²	Positive
Dividend Substitution	Repurchases and dividends are considered interchangeable payouts (Miller and Modigliani 1961). In the UK, these two are independent from each other (Ferris et al. 2006; Denis and Osobov 2008; Burns et al. 2015), thus conflicting with the traditional nature of being substituted.	Dividend Ordinary dividend relative to net income.	Negative	Dividend ²	Positive
Capital Restructuring	Firms may opt to use repurchase to increase their debt exposure to reduce the cost of capital (Dittmar 2000; Mitchell and Dharmawan 2007). However, highly leveraged firms may opt for repurchases, especially since the market positively reacts to repurchase announcements of such firms (Andriosopoulos and Lasfer 2015).	Debt Ratio Total debt value relative to total asset value.	Negative	Debt Ratio ²	Positive
Tax Preferential	The motive states the usage of repurchases over dividends purely due to the tax regime making repurchases more economical than dividends (Barclay and Smith 1988; De'Jong et al. 2003). From 1981, successive British governments have reduced the tax on capital gains from repurchases while contemporaneously increasing that on dividends earned (Table 2) (HMRC 2017; IFS 2017), and investigating this aspect is highly important. A repurchase's tax friendliness reduces the prospects of its undertaking in the UK (Oswald and Young 2008).	Taxation The effective (higher) dividend tax rate relative to capital gains tax (Alzahrani and Lasfer 2012)	Positive	Taxation ²	Negative
Board Independence	The UK's regulations state that shareholder approval is required for a repurchase (Dhanani and Roberts 2009). If the firm is seeking approval, then they favour the repurchase, indicating potential principal-agent conflicts that are common with repurchases (Fenn and Liang 2001; Maxwell and Stephens 2003). Shareholders will depend on independent directors to ensure repurchase monitoring ^a .	Board The independent directors relative to the board size.	Positive	Board ²	Negative

Table 3. Cont.

	Summary	Linear Proxy	Expected Influence	Non-Linear Proxy	Expected Influence
Panel II: Additional Influencers: Testing H ₂ and H ₃					
Profitability	Given that excess cash is a by-product of increased profitability, we also test the influence of profitability using a host of indicators. It is also seen that declining profitability can impact the stock value, and repurchases are capable of supporting a plunge (Dhanani and Roberts 2009), while British managers have stated that adjusting the reported EPS is a leading repurchase motive (Dhanani 2016). The use of ROA is popular, as shown in past repurchase studies of the UK, such as Lee and Suh (2011) and Burns et al. (2015); however, the factor’s computation uses the balance sheet’s estimation of non-tangible assets as well, introducing complexity.	Return on Assets (ROA) Natural logarithm of net profit relative to total asset value	Positive	ROA ²	Negative
	Andonova and Ruiz-Pava (2016) find that the estimation of total asset value and its reporting can impact profitability, which is supported by Sacer et al. (2016). Furthermore, Ze-To (2016) finds that the stock performance of British PLCs is highly predictable by using asset liquidity estimates. We know that in the UK, stock performance has not just impacted the market reception to repurchases (Andriosopoulos and Lasfer 2015) but also the decision of repurchasing shares (Burns et al. 2015). Thus, for additional reliability, the dependence on ROA as a reliable control variable for representing profitability’s influence on repurchase size is too strong; thus, we also include Net Profit.	Net Profit Natural logarithm of the net profit scaled by 1000.	Positive	Net Profit ²	Negative
Macrofinancial Conditions	Factors associated with repurchases are also associated with macro-level conditions, such as excess cash, business cycle conditionality impacting profitability (Issah and Antwi 2017) and productivity (Giglio et al. 2016), which directly impact cash reserves. We assume that repurchases are more likely during an economic upswing, primarily due to British managers stating that distributing excess cash is the leading motive for undertaking repurchases (Dhanani 2016). Further, repurchases are often financed using new debt, which is consistent with the UK’s literature (Lee and Suh 2011; Burns et al. 2015; Cesari and Ozkan 2015), and bank lending (Pasiouras and Kosmidou 2007; Caglayan and Xu 2016), debt issuance (Dang 2013) and credit worthiness (Bouvatier et al. 2012) are pro-cyclical.	Expansion ^b			
		Recession	Positive	n/a	n/a
		These take the value ‘1’ if a repurchase is announced during economic expansion and recession, respectively	Negative	n/a	n/a
	Furthermore, there is evidence that the UK’s stock market is pro-cyclical (Masduzzaman 2012) and coi-ntegrated with the business cycle (Apergis et al. 2015). Thus, we also test short-term conditions using market risk and stock market conditions.	Market Risk Difference between 3month Sterling LIBOR and 3month T-Bill rate	Negative	n/a	n/a
Stock Market Quarterly change in FTSE 100		Positive	n/a	n/a	

^a Additional discussion on governance is available in the Appendix A. ^b We describe ‘Recession’ as two consecutive quarters of negative GDP, which ends after following two consecutive quarters of positive GDP. This is a quantitative approach that is widely used in Europe (Blackstone 2011), as opposed to the qualitative approach of the US. ‘Expansion’ is the period following the end of a recession until the peak GDP is reached.

3.3. Methodology

We use Tobit regression³, which is a type of statistical model that censors the dependent variable. This can occur individually on the left (also known as below) or right (also known as above), and if required, left and right censoring can occur within one test to bound the values within a certain range. For our tests, we only left censor at 0% (Equation (1)), which is a common approach undertaken by past UK repurchase-specific studies, such as [Burns et al. \(2015\)](#) and [Cesari and Ozkan \(2015\)](#). For the dependent variable, we opt for [Cesari and Ozkan's \(2015\)](#) approach of using repurchase value relative to market capitalisation, as opposed to [Burns et al.'s \(2015\)](#) usage of repurchase value relative to total assets. This was undertaken due to the regulatory restriction of 15% outstanding equity on open market repurchases, which is better reflected by scaling repurchases against market valuation. This is also the reason why we do not find the necessity of right-censoring our model.

$$\begin{aligned}
 \text{REP}_{i,y} = & \beta_1 \text{Cash}_{i,y-1} + \beta_2 \text{Cash}^2_{i,y-1} + \beta_3 \text{EPS}_{i,y-1} + \beta_4 \text{M/BRatio}_{i,y-1} + \beta_5 \text{M/BRatio}^2_{i,y-1} \\
 & + \beta_6 \text{Size}_{i,y-1} + \beta_7 \text{Size}^2_{i,y-1} + \beta_8 \text{Dividend}_{i,y-1} + \beta_9 \text{Dividend}^2_{i,y-1} \\
 & + \beta_{10} \text{DebtRatio}_{i,y-1} + \beta_{11} \text{DebtRatio}^2_{i,y-1} + \beta_{12} \text{Taxation}_{i,y-1} + \beta_{13} \text{Taxation}^2_{i,y-1} \\
 & + \beta_{14} \text{Board}_{i,y-1} + \beta_{15} \text{Board}^2_{i,y-1} + \beta_{16} \text{ROA}_{i,y-1} + \beta_{17} \text{ROA}^2_{i,y-1} \\
 & + \beta_{18} \text{NetProfit}_{i,y-1} + \beta_{19} \text{NetProfit}^2_{i,y-1} + \beta_{20} \text{Expansion}_{i,y-1} + \beta_{21} \text{Recession}_{i,y-1} \\
 & + \beta_{22} \text{MarketRisk}_{i,y-1} + \beta_{23} \text{StockMarket}_{i,y-1} + \varepsilon_{i,y}
 \end{aligned} \tag{1}$$

where, $\text{REP}_{i,y}$ is the ratio of the repurchase announcement value to the market capitalisation of firm i in year $y = 1985, 1986, \dots, 2014$, and $\varepsilon_{i,y}$ is the vector of error terms. We summarise the control variables' description and the expected influences in [Table 3](#).

Robustness Testing

(i) Determinants of Repurchase Value

The Probit regression uses a binary dependent variable (0 or 1) and allows for computing the marginal effects that indicate the probability of the dependent variable changing values given a one-unit change in the independent variable. However, this regression has a variant known as Fractional Probit Regression, where the dependent variables are normalised between 0 and 1, meaning they can take any value within this range. The marginal effects indicate the probability of fractional change in value due to a one-unit change in the independent variable. Thus, in order to ensure the stability of the results of the determinants of repurchase size (Equation (1)), we undertake Fractional Probit regression to find the determinants of the repurchase value (Equation (2)). This will thus verify the results from Equation (1) using a different methodological approach.

$$\begin{aligned}
 E[\text{REP}_{i,y}] = & \phi(\beta_1 \text{Cash}_{i,y-1} + \beta_2 \text{Cash}^2_{i,y-1} + \beta_3 \text{EPS}_{i,y-1} + \beta_4 \text{M/BRatio}_{i,y-1} + \beta_5 \text{M/BRatio}^2_{i,y-1} \\
 & + \beta_6 \text{Size}_{i,y-1} + \beta_7 \text{Size}^2_{i,y-1} + \beta_8 \text{Dividend}_{i,y-1} + \beta_9 \text{Dividend}^2_{i,y-1} \\
 & + \beta_{10} \text{DebtRatio}_{i,y-1} + \beta_{11} \text{DebtRatio}^2_{i,y-1} + \beta_{12} \text{Taxation}_{i,y-1} + \beta_{13} \text{Taxation}^2_{i,y-1} \\
 & + \beta_{14} \text{Board}_{i,y-1} + \beta_{15} \text{Board}^2_{i,y-1} + \beta_{16} \text{ROA}_{i,y-1} + \beta_{17} \text{ROA}^2_{i,y-1} \\
 & + \beta_{18} \text{NetProfit}_{i,y-1} + \beta_{19} \text{NetProfit}^2_{i,y-1} + \beta_{20} \text{Expansion}_{i,y-1} + \beta_{21} \text{Recession}_{i,y-1} \\
 & + \beta_{22} \text{MarketRisk}_{i,y-1} + \beta_{23} \text{StockMarket}_{i,y-1} + \varepsilon_{i,y})
 \end{aligned} \tag{2}$$

where $E[\text{REP}_{i,y}]$ is the ratio of the repurchase announcement value to the market capitalisation normalised between 0 and 1 of firm i in year $y = 1985, 1986, \dots, 2014$, ϕ is the standard cumulative normal, and $\varepsilon_{i,y}$ is the vector of error terms. We summarise the control variables' description and the expected influences in [Table 3](#).

(ii) Leamer's Global Sensitivity Analysis

For additional reliability of the empirical results, we further undertake another robustness test, the global sensitivity analysis advocated by [Leamer \(1985\)](#). This warrants continually altering the testing environment to see how sensitive the outputs are, thus revealing their reliability, which essentially requires sequentially dropping (i) each repur-

chase announcement, (ii) each year, (iii) separating firms based on their operational sector, financial v/s non-financial institution, and (iv) dropping each control variable. Thus, these criteria will be applied to the Tobit regression (Equation (1)), and the outputs will highlight if the multiple variations in the test environment alter the initial findings.

4. Results

4.1. Summary Statistics

The summary statistics of the control variables are presented in Table 4, and the Mann–Whitney Rank Sum test results, which are used to check the real difference in the variables across repurchase size-specific quartiles, are available in Table 5. The sample’s average Cash is similar to that seen in a cross-sectional timeframe 1997–2006 (Andriosopoulos and Lasfer 2015); thus, firms show a consistent attitude towards solvency during a repurchase payout. The patterns of Cash and Dividend are complementary as both see a negative relationship with repurchase size; firms of the 1st (4th) quartile have the highest (lowest) level of excess cash and dividend distribution. Thus, if firms have low levels of solvency when a repurchase is in consideration, they lower the dividend payouts to avoid cash flow deficiency. EPS reveals that firms of the 1st (4th) quartile are the least (most) to witness negative earnings, and this is consistent with British managers stating that adjusting EPS is the second most popular repurchase motive (Dhanani 2016). M/B Ratio and repurchase size have a linear negative relationship, as the most (least) overvalued firms fall in the 1st (4th) quartile, and the sample’s average is equivalent to the country’s average (2) between 1979–2015 (Keimling 2016). Thus, this reveals that a typical repurchasing firm is not greatly overvalued compared to the aggregate market.

Table 4. Summary statistics of the control variables.

	Mean	Std. Dev.	Minimum	Maximum
Panel I: Firm Specific Variables				
Cash				
1st Quartile	0.131	0.167	−0.427	0.976
2nd Quartile	0.100	0.213	−1.281	0.580
3rd Quartile	0.105	0.151	−0.439	0.585
4th Quartile	0.084	0.181	−0.806	0.584
All Repurchases	0.105	0.180	−1.281	0.976
EPS				
1st Quartile	0.033	0.180	0.000	1.000
2nd Quartile	0.100	0.300	0.000	1.000
3rd Quartile	0.167	0.375	0.000	1.000
4th Quartile	0.200	0.400	0.000	1.000
All Repurchases	0.125	0.331	0.000	1.000
M/B Ratio				
1st Quartile	3.564	5.087	0.115	27.327
2nd Quartile	2.708	2.745	0.169	19.765
3rd Quartile	1.930	2.156	0.014	14.143
4th Quartile	0.789	12.299	−112.243	18.544
All Repurchases	2.248	6.926	−112.243	27.327
Size				
1st Quartile	12.842	2.559	7.530	19.520
2nd Quartile	13.463	2.784	8.143	19.038
3rd Quartile	12.934	2.262	8.799	18.905
4th Quartile	12.539	2.556	4.057	19.273
All Repurchases	12.945	2.558	4.057	19.520

Table 4. Cont.

	Mean	Std. Dev.	Minimum	Maximum
Dividend				
1st Quartile	0.563	0.586	0.000	3.847
2nd Quartile	0.370	0.556	−2.537	2.571
3rd Quartile	0.382	0.889	−2.695	5.677
4th Quartile	0.350	1.589	−6.979	9.112
All Repurchases	0.416	0.996	−6.979	9.112
Debt Ratio				
1st Quartile	0.395	0.242	0.005	0.959
2nd Quartile	0.467	0.219	0.023	0.956
3rd Quartile	0.362	0.231	0.002	0.941
4th Quartile	0.382	0.280	0.006	1.052
All Repurchases	0.402	0.246	0.002	1.052
Board				
1st Quartile	0.540	0.266	0.054	1.000
2nd Quartile	0.511	0.174	0.200	1.000
3rd Quartile	0.561	0.225	0.200	1.000
4th Quartile	0.591	0.247	0.166	1.000
All Repurchases	0.551	0.231	0.054	1.000
ROA				
1st Quartile	0.354	0.441	−0.585	2.401
2nd Quartile	0.358	0.332	−0.410	1.386
3rd Quartile	0.320	0.493	−0.754	3.583
4th Quartile	0.296	0.414	−0.959	1.668
All Repurchases	0.332	0.423	−0.959	3.583
Net Profit				
1st Quartile	4.297	1.357	0.000	7.051
2nd Quartile	4.237	1.801	0.000	6.964
3rd Quartile	3.822	1.952	0.000	6.692
4th Quartile	3.455	2.011	0.000	7.158
All Repurchases	3.952	1.823	0.000	7.158
Panel II: Country Specific Variables				
Taxation	0.702	0.265	0.375	1.700
Expansion	0.730	0.444	0.000	1.000
Recession	0.044	0.206	0.000	1.000
Market Risk	0.004	0.001	0.0009	0.009
Stock Market	0.005	0.026	−0.105	0.063

Firm Size and repurchase size show a disproportionate relationship; firms of the 2nd (4th) quartile are the largest (smallest). The results thus highlight the erstwhile discussed contradictions in the British literature, showing that firm size motivates repurchases, which contrasts with the seminal viewpoint and the general implications of asymmetric information. The average Debt Ratio across the quartiles is also disproportionate, as firms of the 2nd (3rd) quartile are the most (least) leveraged. Similar fashioned disproportionateness is further visible with the variable Board; firms of the 2nd (4th) quartile are the least (most) independent. The disparity is attributable to the governance code's excessive flexibility (ecoDa 2015), which gives firms discretionary powers for board composition as it only restricts large-cap firms to have at least 50% independent directors (OECD 2017). This impact is further supported by the fact that the average UK firm (Guest 2008) is less independent than that in the US (Boone et al. 2007), 41% v/s 70%. However, since the sample's average is 55%, it is revealed that a repurchasing firm in Britain is more monitored than the average firm. The profitability ratios, ROA and Net Profit, generally reduce across the quartiles;

firms of the 1st (4th) quartile are amongst the most (least) profitable. The consistent pattern of less profitable firms opting for a larger-sized repurchase is consistent with the pattern seen with EPS.

Table 5. Mann–Whitney Rank Sum Test.

	Quartile Pair					
	Q1:Q2	Q1:Q3	Q1:Q4	Q2:Q3	Q2:Q4	Q3:Q4
Cash	−0.186 (0.852)	0.608 (0.543)	2.536 ** (0.011)	0.639 (0.522)	2.472 ** (0.013)	1.981 ** (0.047)
EPS	−1.552 (0.120)	−1.788 * (0.073)	−4.512 *** (0.000)	−0.254 (0.799)	−3.266 *** (0.001)	−3.038 *** (0.002)
M/B Ratio	0.533 (0.601)	0.127 (0.898)	2.150 ** (0.031)	−0.692 (0.488)	2.234 ** (0.025)	2.529 ** (0.011)
Size	−0.910 (0.362)	−0.536 (0.591)	0.067 (0.946)	0.162 (0.871)	1.076 (0.282)	0.619 (0.535)
Dividend	1.129 (0.259)	2.928 *** (0.003)	4.569 *** (0.000)	1.760 * (0.078)	3.662 *** (0.000)	2.326 ** (0.020)
Debt Ratio	−0.893 (0.372)	−1.132 (0.257)	1.558 (0.119)	−0.403 (0.686)	2.395 ** (0.016)	2.556 *** (0.010)
Board	0.691 (0.429)	0.271 (0.786)	−3.351 *** (0.000)	−0.754 (0.450)	−4.831 *** (0.000)	−4.309 *** (0.000)
ROA	−0.783 (0.433)	−0.563 (0.573)	1.807 * (0.070)	0.363 (0.717)	2.791 *** (0.005)	2.277 ** (0.022)
Net Profit	−0.072 (0.943)	0.153 (0.878)	2.459 ** (0.013)	0.079 (0.937)	2.408 ** (0.016)	2.213 ** (0.026)

Superscripts indicate statistical significance at the 0.10 (*), 0.05 (**) and 0.01 (***) percent levels, and *p*-values are stated in the parentheses.

Taxation finds that over the 30-year (1985–2014) period, dividends are, on average, 30% tax-friendlier than repurchases; however, the results in Figure 2 reveal that the ratio has been periodically incrementing, with a peak of 1.90 being reached in 2017 after the research’s cut-off year (2014). The continual growth in repurchase’s economic efficiency can thus induce an increased repurchase weighting in corporate payout policy, especially given the earlier discussed evidence of rising repurchase popularity independent of dividend distribution. Repurchases are more popular during business cycle Expansion than Recession, as 73% are witnessed during a business cycle upswing as opposed to 4.40% during a crisis. The average Market Risk is not grave, which complements the modest Stock Market performance.

The Rank Sum results reveal a pattern across repurchasing firms. Initially, it is seen that Size is the only factor that is not different across the quartiles. Additionally, no variable is absolutely different on a statistical level, and the greatest difference is seen with Dividend as it is significant for five of the six quartile pairs. In terms of aggregate quartile-level patterns, the greatest of differences is seen between firms in the uppermost quartile (Q4) and those in the remainder quartiles. Against Q1, all but Size and Debt Ratio are statistically different, and against quartiles Q2 and Q3, all but Size are statistically different. The upper quartile essentially consists of firms that repurchase the maximum possible shares, thus revealing that they are strongly different from any group of firms that consists of those intending to repurchase less than the maximum permitted via the open market route. Further, there is less difference between firms in quartiles Q3 and Q2 compared to between those in quartiles Q3 and Q1. Thus, this reveals that firms around the median level are relatively more similar. However, we see no significant difference with any variable between firms in quartiles Q2 and Q1, which reveals that the bottom 50% of the firms are most similar. Overall, a general pattern is discerned that as a firm increases the repurchase size their

characteristics also tend to see an increase in difference against those that are not increasing the sizes.

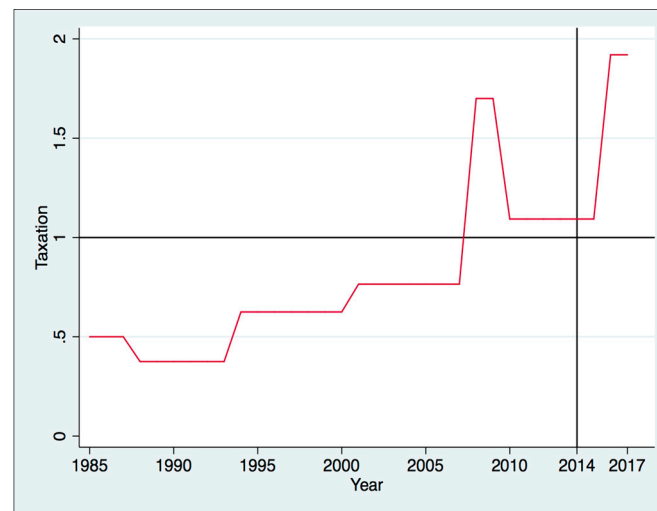


Figure 2. Taxation variable (1985–2017).

4.2. Determinants of Repurchase Size

In Table 6, we present the coefficients of the censored Tobit regression undertaken to find the determinants of repurchase size. In Panel I, we focus on the primary influencers (motivational hypotheses and board independence), which is undertaken by forming a base of the top three repurchase motives that were stated by British managers in Dhanani's (2016) survey; these are excess cash distribution, adjusting EPS and signalling stock undervaluation. In Models I through III, these three hypotheses are individually tested; thereof, in Models IV through IX, we hold the proxies of these hypotheses as the base and sequentially add the remaining proxies in each model, and in Model X, the proxies of the seven hypotheses and board independence are tested together. The results in Panel II focus on the influences of firm-level profitability and macrofinancial conditions by taking all of the proxies of the primary influencers (motivational hypotheses and board independence) as the base. Thereof, in Models I through III, we undertake the testing of the influence of profitability; in Models IV through VI, we test the influence of aggregate macrofinancial indicators; in Models VII through IX, we test the influence of macrofinancial indicators that represent individual components of the business cycle; and in Model X, all of the profitability and macrofinancial proxies are tested together alongside the primary influencers (motivational hypotheses and board independence).

Cash has a consistent positive influence, confirming the presence of the excess cash distribution motive, which is aligned with past empirical results (Lee and Suh 2011; Burns et al. 2015). However, Cash² remains insignificant; thus, if firms are in possession of surplus cash, they are only inclined towards increasing repurchase size. Moving to the other two base motives, we see that EPS has a strong positive influence, indicating the presence of the adjusting EPS motive in determining repurchase size. This is consistent with our expectations, the Dhanani (2016) survey and also similar to the managerial attitude seen in the US (Almeida et al. 2016). Such tactics positively influence the stock performance of repurchase undertaking firms (Li and Swanson 2016). Further, the M/B Ratio has a negative influence, indicating that the signalling stock undervaluation motive influences the size of a repurchase, while the M/B Ratio² is also consistently negative. Given the absolute negative influences of both control variables, the influencing pattern asserts that the signalling stock undervaluation motive is a strong determinant of repurchase size. These findings, in totality, are thus highly consistent with Dhanani's (2016) survey of British managers.

Table 6. Determinants of repurchase size.

Panel I: Primary Influencers (Motivational Hypotheses and Board Independence)										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Cash	−0.021 (−1.59)			0.030 * (1.90)	0.031 ** (1.98)	0.028 * (1.74)	0.034 ** (2.16)	0.030 * (1.93)	0.032 ** (2.05)	0.030 * (1.85)
Cash ²	−0.013 (−0.65)			−0.005 (−0.28)	−0.003 (−0.16)	−0.003 (−0.20)	−0.002 (−0.14)	−0.006 (−0.33)	0.002 (0.11)	0.001 (0.06)
EPS		0.031 *** (4.37)		0.039 *** (4.61)	0.040 *** (4.63)	0.036 *** (3.76)	0.038 *** (4.52)	0.039 *** (4.62)	0.039 *** (4.67)	0.036 *** (3.76)
M/B Ratio			−0.002 *** (−3.81)	−0.002 *** (−3.79)	−0.002 *** (−3.85)	−0.002 *** (−3.70)	−0.002 *** (−4.04)	−0.002 *** (−3.79)	−0.002 *** (−4.16)	−0.002 *** (−4.03)
M/B Ratio ²			−0.0001 *** (−2.69)	−0.0001 *** (−2.71)	−0.0001 *** (−2.78)	−0.0001 *** (−2.63)	−0.0001 *** (−3.21)	−0.0001 *** (−2.70)	−0.0001 *** (−3.05)	−0.0001 *** (−3.22)
Size					−0.002 (−0.36)					0.001 (0.23)
Size ²					0.0001 (0.44)					−0.0001 (−0.31)
Dividend						−0.001 (−0.47)				−0.001 (−0.33)
Dividend ²						0.0007 * (1.76)				0.0007 * (1.82)
Debt Ratio							−0.059 * (−1.85)			−0.076 ** (−2.09)
Debt Ratio ²							0.076 ** (2.22)			0.087 ** (2.31)
Taxation								−0.014 (−0.36)		−0.037 (−0.94)
Taxation ²								0.007 (0.41)		0.017 (0.88)
Board									0.157 *** (3.13)	0.170 *** (3.18)
Board ²									−0.117 *** (−3.01)	−0.133 *** (−3.20)
Constant	0.101 *** (34.71)	0.095 *** (37.91)	0.104 *** (36.60)	0.097 *** (27.64)	0.109 ** (2.35)	0.097 *** (24.53)	0.104 *** (14.50)	0.103 *** (5.77)	0.052 *** (3.55)	0.072 (1.39)
LR Chi ²	2.87	18.61	14.84	36.21	36.72	39.62	41.77	36.40	45.94	55.97
Pseudo R ²	−0.002	−0.015	−0.012	−0.030	−0.036	−0.033	−0.034	−0.030	−0.038	−0.046

Table 6. Cont.

Panel II: Primary Influencers (Motivational Hypotheses and Board Independence), Profitability Ratios and Macrofinancial Indicators										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Cash	0.034 ** (2.05)	0.024 (1.41)	0.029 (1.64)	0.029 * (1.82)	0.030 * (1.83)	0.029 * (1.78)	0.030 * (1.86)	0.030 * (1.83)	0.030 * (1.84)	0.029 * (1.66)
Cash ²	−0.011 (−0.53)	−0.010 (−0.47)	−0.020 (−0.88)	0.0005 (0.03)	0.001 (0.07)	0.001 (0.07)	0.001 (0.07)	0.001 (0.06)	0.001 (0.07)	−0.019 (−0.82)
EPS	0.027 ** (2.35)	0.036 (1.23)	0.028 (0.32)	0.035 *** (3.63)	0.036 *** (3.76)	0.035 *** (3.68)	0.036 *** (3.76)	0.036 *** (3.78)	0.036 *** (3.78)	0.025 (0.82)
M/B Ratio	−0.002 *** (−3.72)	−0.002 *** (−4.22)	−0.002 *** (−3.84)	−0.002 *** (−3.98)	−0.002 *** (−4.03)	−0.002 *** (−4.00)	−0.002 *** (−4.04)	−0.002 *** (−4.03)	−0.002 *** (−4.04)	−0.002 *** (−3.74)
M/B Ratio ²	−0.0001 *** (−2.94)	−0.0001 *** (−3.46)	−0.0001 *** (−3.13)	−0.0001 *** (−3.11)	−0.0001 *** (−3.23)	−0.0001 *** (−3.12)	−0.0001 *** (−3.23)	−0.0001 *** (−3.26)	−0.0001 *** (−3.27)	−0.0001 *** (−2.99)
Size	0.0006 (0.09)	−0.002 (−0.33)	−0.003 (−0.38)	0.001 (0.22)	0.001 (0.22)	0.001 (0.17)	0.001 (0.21)	0.001 (0.17)	0.001 (0.15)	−0.003 (−0.39)
Size ²	−0.0001 (−0.15)	−0.0001 (−0.21)	−0.0001 (−0.09)	−0.0001 (−0.28)	−0.0001 (−0.29)	−0.0001 (−0.23)	−0.0001 (−0.29)	−0.0001 (−0.25)	−0.0001 (−0.23)	0.0001 (0.00)
Dividend	−0.003 (−0.92)	−0.0008 (−0.29)	−0.003 (−0.93)	0.001 (−0.44)	−0.0009 (−0.31)	−0.001 (−0.37)	−0.001 (−0.35)	0.0001 (−0.33)	−0.0009 (−0.34)	−0.003 (−1.03)
Dividend ²	0.001 ** (2.29)	0.0008 ** (2.04)	0.001 ** (2.39)	0.0008 * (1.93)	0.0007 * (1.81)	0.0008* (1.91)	0.0007 * (1.82)	0.0007 * (1.85)	0.0007 * (1.85)	0.001 ** (2.46)
Debt Ratio	−0.079 ** (−2.15)	−0.079 ** (−2.16)	−0.083 ** (−2.26)	−0.074 ** (−2.03)	−0.076 ** (−2.08)	−0.073 ** (−2.02)	−0.075 ** (−2.07)	−0.076 ** (−2.09)	−0.075 ** (−2.07)	−0.081 ** (−2.19)
Debt Ratio ²	0.087 ** (2.30)	0.098 ** (2.53)	0.099 ** (2.51)	0.082 ** (2.19)	0.087 ** (2.31)	0.081 ** (2.16)	0.087 ** (2.31)	0.087 ** (2.33)	0.087 ** (2.32)	0.093 ** (2.35)
Taxation	−0.037 (−0.93)	−0.041 (−1.03)	−0.041 (−1.02)	−0.022 (−0.54)	−0.041 (−0.93)	−0.032 (−0.75)	−0.051 (−0.95)	−0.036 (−0.91)	−0.050 (−0.93)	−0.038 (−0.66)
Taxation ²	0.016 (0.87)	0.018 (0.96)	0.018 (0.95)	0.007 (0.37)	0.019 (0.87)	0.013 (0.61)	0.023 (0.90)	0.015 (0.82)	0.022 (0.86)	0.015 (0.52)
Board	0.174 *** (3.24)	0.171 *** (3.19)	0.172 *** (3.22)	0.161 *** (3.00)	0.170 *** (3.16)	0.158 *** (2.95)	0.171 *** (3.19)	0.171 *** (3.20)	0.172 *** (3.21)	0.162 *** (3.02)
Board ²	−0.135 *** (−3.25)	−0.133 *** (−3.20)	−0.134 *** (−3.22)	−0.126 *** (−3.02)	−0.133 *** (−3.18)	−0.123 *** (−2.95)	−0.134 *** (−3.21)	−0.134 *** (−3.22)	−0.135 *** (−3.23)	−0.126 *** (−3.00)
ROA	−0.020 (−1.42)		−0.020 (−1.45)							−0.021 (−1.53)

Table 6. Cont.

Panel II: Primary Influencers (Motivational Hypotheses and Board Independence), Profitability Ratios and Macrofinancial Indicators										
ROA ²	0.009 (1.63)		0.008 (1.45)							0.008 (1.50)
Net Profit		0.0004 (0.06)	0.0006 (0.09)							0.0001 (0.01)
Net Profit ²		0.003 (0.92)	0.003 (0.79)							0.003 (0.70)
Expansion				−0.009 * (−1.83)		−0.010 * (−1.93)				−0.010 * (−1.80)
Recession					−0.002 (−0.20)	−0.008 (−0.64)				−0.007 (−0.53)
Market Risk							−0.582 (−0.38)		−0.590 (−0.38)	−0.195 (−0.13)
Stock Market								−0.070 (−0.81)	−0.070 (−0.81)	−0.054 (−0.63)
Constant	0.078 (1.53)	0.088 * (1.67)	0.094 * (1.77)	0.076 (1.48)	0.074 (1.40)	0.084 (1.60)	0.080 (1.43)	0.074 (1.45)	0.083 (1.48)	0.107 * (1.83)
LR Chi ²	58.63	57.66	59.90	59.31	56.01	59.73	56.11	56.62	56.77	63.82
Pseudo R ²	−0.048	−0.048	−0.049	−0.049	−0.046	−0.049	−0.046	−0.047	−0.047	−0.052

Superscripts indicate statistical significance at the 0.10 (*), 0.05 (**) and 0.01 (***) percent levels, and t-statistics are stated in the parenthesis.

The insignificance of Dividend rejects the influence of the dividend substitution motive in determining repurchase size; however, Dividend² has a positive influence. Thus, these findings are consistent with past UK literature, concluding that repurchases complement dividend distribution rather than being their replacements (Ferris et al. 2006; Denis and Osobov 2008; Burns et al. 2015). The presence of the capital restructuring motive as a determinant of repurchase size is visible from the negative influence of Debt Ratio, which is consistent with past literature (Lee and Suh 2011; Burns et al. 2015; Cesari and Ozkan 2015). This implies that managers tend to increase the size of repurchases when the overall debt exposure is low, highlighting the significance of the payout's ability to alter the debt/equity split. However, the positive influence of Debt Ratio² indicates that the capital restructuring motive has an opposing influence on the size of repurchases, which is consistent with Geiler and Renneboog (2015) and thus helps prove this paper's novel contribution that leverage has a U-shaped influence on managerial decision regarding repurchase size. This contrasting pattern is supported by extant evidence. British firms have shown swiftness in gaining an optimal leverage position (Dang 2013), and repurchases are an efficient mechanism of its attainment, while Andriosopoulos and Lasfer (2015) find that the market reaction to a repurchase announcement witnesses a positive impact when the firm is highly leveraged. We can also imply that even if the company is highly leveraged, if the shareholders are in favour of a repurchase, then managerial have the latitude to skew the debt/equity split and still witness positive market reception. Thus, a highly versatile influence of leverage is visible that can take any direction based on firm-specific circumstances. This is an important finding since, despite the capital restructuring hypothesis being a popular motive, managerial can, by consulting with shareholders, make an opposing decision and still witness a positive outcome.

Corresponding to our expectations, Board has a positive influence. Thus, upon combining this with the result of Cash, British managers have been demonstrated to remain consistent with the seminal view that diverting excess cash towards repurchases ensures managerial discipline by averting them from agent-centric decisions (Jensen and Meckling 1976; Easterbrook 1984; Jensen 1986). Furthermore, consistent with expectations, Board² has a negative influence. Thus, the inverted U-shaped influence of board independence is a new contribution to the literature, and the existing literature are in support of this contribution. The negative influence of Board² is consistent with the negative relationship between board independence and overall firm-level performance in the UK (Hsu and Wu 2014), which is supported by the country's institutional environment. The UK's governance code is largely voluntary, and the board structure is influenced by firm-specific benefits, such as economic prosperity (Raheja 2005), which is a stronger influencer than CEO performance (Guest 2008).

Thus, independent directors play a significant role during the repurchase decision-making process. Their presence cannot be treated as complacent enough to simply go along with the managerial opinions. Rather, it is clear that independent directors have progressed into being active participants within the corporate structure and shifted from their past mindset of complacency and acting as advisers as opposed to monitors (Franks et al. 2001; Ozkan 2007). This exemplifies and bolsters their stronger position and growing influence within the corporate structure. Further, it is logical to expect that due to corporate diversity, there will never be absolute approval or disapproval of repurchases by independent directors. This form of payout has strong implications, such as large cash outlay, inconsistency in frequency compared to dividends, and reduction in outstanding share volume that would impact debt/equity split and ownership concentration.

Finally, consistent insignificance is seen with Size, Size², Taxation and Taxation². Thus, the signalling information asymmetry motive does not influence repurchase size, either linearly or non-linearly, which is inconsistent with past studies finding that a firm's size has a positive influence on the managerial repurchase decision-making (Benhamouda and Watson 2010; Andriosopoulos and Hoque 2013; Sonika et al. 2014). Similarly, the tax preferential motive also does not influence repurchase size, linearly or non-linearly, which

is consistent with past literature, revealing that taxation on repurchases has no bearing on the payout decision making (Oswald and Young 2004; Geiler and Renneboog 2015).

Thus, we establish that over the 30-year tested period, signalling stock undervaluation was the primary determinant of repurchase size; this is an important finding. Although the coefficients of Cash and EPS have more impact on an economic level, Cash² is insignificant while the M/B Ratio² influence direction is identical to M/B Ratio, and the level of significance of EPS is relatively less. The managerial attitude is thus similar to that seen in the US, where stock undervaluation increments repurchase success (Bonaime et al. 2014), and the signalling undervaluation motive is highly popular among American managers (Baker et al. 2003; Brav et al. 2005). Fields (2016) interviewed 44 directors serving on boards of 96 PLCs that held a combined market valuation of USD 2.7trn, and they concluded that the signalling stock undervaluation motive is a keystone to a repurchase programme, irrelevant of any other motive that may be present. Thus, the motive perhaps held the 3rd rank in the UK only during the years of Dhanani's (2016)' survey (2003–2007), which is understandable since, at the time, the economy was in an upswing, and undervaluation during such periods becomes unlikely, but in the long-term, it is substantiated as remaining essential in determining repurchase size.

The influences of ROA, ROA², Net Profit and Net Profit² are consistently insignificant. The inability of profitability to impact the size of a repurchase is consistent with Cesari and Ozkan (2015). Insignificant influences are seen with Market Risk, Stock Market and Recession; however, Expansion has a negative influence, contradicting our expectations. The pattern reveals a managerial tendency to maximize repurchase size during times of less prosperity, not particularly during a period that is recessionary but during economic compression when stock prices begin to fall unnecessarily due to macro-adjustments. This conclusion is consistent with the results of EPS, M/B Ratio and M/B Ratio². Hence, the combination of testing the additional influencers bolsters the conclusion that the motivational hypotheses and board independence are the key determinants of repurchase size in the UK.

Thus, we have strong evidence to accept the alternative hypothesis, H₁1: primary influencers determine the size of a repurchase, and equally strong evidence to accept the null hypothesis, H₂0 = profitability does not determine the size of a repurchase. The findings also supports accepting the alternative hypothesis, H₃1 = Macrofinancial conditions determine the size of a repurchase.

4.3. Robustness Testing

(i) Determinants of Repurchase Value

The robustness tests used to determine the influencers behind the managerial selection of repurchase values are reported in Table 7. The influences of Debt Ratio, Debt Ratio², Board and Board² remain consistent with the initial results, revealing a U-shaped influence of leverage and an inverted U-shaped influence of board independence. Furthermore, Size, Size², Taxation and Taxation² each have a statistically insignificant influence, which is consistent with the initial results. An anomaly is seen with the dividend substitution motive. The positive influence of Dividend² is consistent with the initial results, but the sparingly negative influence seen with Dividend remains inconsistent; however, the contradictory pattern is not too strong.

Table 7. Robustness check: determinants of repurchase value.

Panel I: Coefficients										
Panel IA: Primary Influencers (Motivational Hypotheses and Board Independence)										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Cash	−0.387 (−1.56)			0.639 ** (2.30)	0.678 ** (2.32)	0.502* (1.77)	0.754 *** (2.57)	0.658 ** (2.31)	0.686 ** (2.42)	0.575 * (1.86)
Cash ²	−0.223 (−0.69)			−0.170 (−0.69)	−0.126 (−0.49)	−0.124 (−0.50)	−0.116 (−0.44)	−0.198 (−0.78)	−0.030 (−0.12)	−0.044 (−0.15)
EPS		0.656 *** (4.18)		0.873 *** (5.14)	0.894 *** (5.10)	0.646 *** (3.13)	0.891 *** (5.10)	0.879 *** (5.18)	0.886 *** (4.79)	0.666 *** (2.99)
M/B Ratio			−0.046 (−1.54)	−0.045 *** (−3.39)	−0.047 *** (−3.42)	−0.042 *** (−3.27)	−0.051 *** (−3.68)	−0.045 *** (−3.38)	−0.049 *** (−3.61)	−0.048 *** (−3.49)
M/B Ratio ²			0.0001 (0.01)	−0.0002 (−1.45)	−0.0002 (−1.49)	−0.0001 (−1.57)	−0.0003 ** (−2.01)	−0.0001 (−1.42)	−0.0002 * (−1.64)	−0.0003 ** (−2.21)
Size					−0.038 (−0.26)					0.062 (0.38)
Size ²					0.001 (0.34)					−0.002 (−0.47)
Dividend						−0.216 (−1.41)				−0.210 (−1.39)
Dividend ²						0.059 * (1.83)				0.057 * (1.88)
Debt Ratio							−1.196 * (−1.69)			−1.435 ** (−1.83)
Debt Ratio ²							1.553 ** (2.13)			1.717 ** (2.12)
Taxation								−0.285 (−0.39)		−0.760 (−1.01)
Taxation ²								0.162 (0.47)		0.347 (1.01)
Board									2.818 *** (2.88)	3.029 *** (2.93)
Board ²									−2.103 *** (−2.65)	−2.362 *** (−2.82)
Constant	0.462 *** (8.30)	0.341 *** (7.48)	0.529 *** (7.24)	0.378 *** (5.80)	0.547 (0.57)	0.345 *** (4.78)	0.520 *** (3.08)	0.485 (1.43)	−0.424 (−1.50)	−0.126 (−0.11)
WALD Chi ²	2.53	17.47	11.76	46.73	44.44	44.77	55.87	46.78	49.10	63.77
Pseudo R ²	0.002	0.018	0.013	0.034	0.034	0.041	0.039	0.034	0.041	0.054

Table 7. Cont.

Panel IB: Primary Influencers (Motivational Hypotheses and Board Independence), Profitability Ratios and Macrofinancial Indicators										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Cash	0.724 ** (2.19)	0.364 (1.02)	0.479 (1.29)	0.560 * (1.80)	0.575 * (1.85)	0.553* (1.77)	0.577 ** (1.86)	0.565 * (1.83)	0.568 * (1.84)	0.493 (1.31)
Cash ²	-0.441 (-1.28)	-0.187 (-0.55)	-0.580 (-1.62)	-0.055 (-0.19)	-0.044 (-0.15)	-0.043 (-0.15)	-0.038 (-0.13)	-0.043 (-0.15)	-0.038 (-0.13)	-0.547 (-1.49)
EPS	0.383 (1.39)	1.207 (1.42)	0.923 (1.12)	0.637 *** (2.88)	0.665 *** (2.97)	0.645 *** (2.90)	0.658 *** (2.93)	0.669 *** (3.03)	0.661 *** (2.98)	0.809 (0.96)
M/B Ratio	-0.043 *** (-3.19)	-0.053 *** (-3.55)	-0.050 *** (-3.29)	-0.047 *** (-3.45)	-0.048 *** (-3.50)	-0.048 *** (-3.47)	-0.048 *** (-3.51)	-0.048 *** (-3.50)	-0.048 *** (-3.52)	-0.048 *** (-3.37)
M/B Ratio ²	-0.0002 * (-1.93)	-0.0003 (-1.46)	-0.0002 (-1.31)	-0.0002 ** (-2.05)	-0.0003 ** (-2.21)	-0.0002 ** (-2.05)	-0.0003 ** (-2.23)	-0.0003 ** (-2.28)	-0.0003 ** (-2.31)	-0.0002 (-1.62)
Size	0.047 (0.30)	-0.024 (-0.13)	-0.046 (-0.26)	0.066 (0.39)	0.062 (0.38)	0.061 (0.37)	0.058 (0.45)	0.053 (0.33)	0.049 (0.30)	-0.040 (-0.22)
Size ²	-0.002 (-0.37)	-0.002 (-0.37)	-0.001 (-0.30)	-0.002 (-0.47)	-0.002 (-0.47)	-0.002 (-0.44)	-0.002 (-0.44)	-0.002 (-0.42)	-0.002 (-0.40)	-0.001 (-0.23)
Dividend	-0.300 * (-1.83)	-0.232 * (-1.66)	-0.358 ** (-2.21)	-0.218 (-1.45)	-0.210 (-1.38)	-0.212 (-1.42)	-0.216 (-1.43)	-0.209 (-1.40)	-0.215 (-1.44)	-0.363 ** (-2.25)
Dividend ²	0.071 ** (2.20)	0.070 ** (2.18)	0.088 ** (2.51)	0.058 * (1.95)	0.057 * (1.87)	0.057 * (1.94)	0.058 * (1.91)	0.058 * (1.92)	0.059 * (1.95)	0.086 *** (2.56)
Debt Ratio	-1.594 ** (-2.08)	-1.463 * (-1.97)	-1.668 ** (-2.18)	-1.382 * (-1.77)	-1.435 * (-1.83)	-1.378 * (-1.76)	-1.420 * (-1.81)	-1.437 * (-1.85)	-1.422 * (-1.82)	-1.607 ** (-2.11)
Debt Ratio ²	1.803 ** (2.29)	1.871 ** (2.29)	2.043 ** (2.53)	1.606 ** (1.98)	1.718 ** (2.12)	1.593 ** (1.96)	1.710 ** (2.11)	1.731 ** (2.15)	1.724 ** (2.14)	1.908 ** (2.37)
Taxation	-0.805 (-1.06)	-0.885 (-1.17)	-0.947 (-1.25)	-0.430 (-0.56)	-0.754 (-0.91)	-0.562 (-0.68)	-1.133 (-1.18)	-0.742 (-0.99)	-1.116 (-1.16)	-0.970 (-0.96)
Taxation ²	0.367 (1.05)	0.389 (1.13)	0.419 (1.20)	0.147 (0.42)	0.344 (0.89)	0.219 (0.57)	0.532 (1.17)	0.327 (0.95)	0.513 (1.13)	0.399 (0.82)
Board	3.014 *** (2.93)	2.972 *** (2.87)	2.920 *** (2.83)	2.860 *** (2.75)	3.030 *** (2.94)	2.824 *** (2.72)	3.058 *** (2.96)	3.042 *** (2.94)	3.072 *** (2.97)	2.774 *** (2.66)
Board ²	-2.336 *** (-2.80)	-2.301 *** (-2.74)	-2.239 *** (-2.67)	-2.221 *** (-2.64)	-2.362 *** (-2.82)	-2.190 *** (-2.61)	-2.379 *** (-2.84)	-2.367 *** (-2.83)	-2.385 *** (-2.85)	-2.108 ** (-2.51)
ROA	-0.694 * (-1.83)		-0.718 * (-1.92)							-0.738 * (-1.93)
ROA ²	0.293 * (1.81)		0.272 * (1.71)							0.278 * (1.70)
Net Profit		0.151 (0.74)	0.164 (0.82)							0.140 (0.70)
Net Profit ²		0.008 (0.08)	0.016 (0.14)							0.010 (0.10)

Table 7. Cont.

Panel IB: Primary Influencers (Motivational Hypotheses and Board Independence), Profitability Ratios and Macrofinancial Indicators										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Expansion				−0.192 ** (−2.01)		−0.202 ** (−2.06)				−0.180 * (−1.82)
Recession					0.004 (0.02)	−0.108 (−0.48)				−0.114 (−0.50)
Market Risk							−16.000 (−0.56)		−16.032 (−0.56)	−9.576 (−0.34)
Stock Market								−1.373 (−0.75)	−1.375 (−0.75)	−1.203 (−0.67)
Constant	0.074 (0.07)	0.241 (0.20)	0.512 (0.44)	−0.090 (−0.08)	−0.130 (−0.11)	0.008 (0.01)	0.113 (0.09)	−0.065 (−0.06)	0.174 (0.14)	0.771 (0.60)
WALD Chi ²	64.19	57.68	59.97	66.59	63.79	66.48	64.40	66.75	67.34	66.35
Pseudo R ²	0.058	0.055	0.059	0.056	0.054	0.057	0.054	0.054	0.055	0.062
Panel II: Marginal Effects										
Panel IIA: Primary Influencers (Motivational Hypotheses and Board Independence)										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Cash	−0.141 (−1.57)			0.226 ** (2.31)	0.239 ** (2.33)	0.176 * (1.77)	0.264 *** (2.58)	0.232 ** (2.32)	0.241 ** (2.43)	0.199 * (1.86)
Cash ²	−0.081 (−0.69)			−0.060 (−0.69)	−0.044 (−0.49)	−0.043 (−0.50)	−0.040 (−0.44)	−0.070 (−0.78)	−0.010 (−0.12)	−0.015 (−0.15)
EPS		0.236 *** (4.31)		0.308 *** (5.27)	0.315 *** (5.23)	0.227 *** (3.15)	0.313 *** (5.18)	0.210 *** (5.31)	0.311 *** (4.92)	0.230 *** (3.00)
M/B Ratio			−0.016 (−1.56)	−0.016 *** (−3.44)	−0.016 *** (−3.47)	−0.014 *** (−3.32)	−0.018 *** (−3.73)	−0.015 *** (−3.43)	−0.017 *** (−3.67)	−0.016 *** (−3.54)
M/B Ratio ²			0.0001 (0.01)	−0.0001 (−1.46)	−0.0001 (−1.50)	−0.0001 (−1.58)	−0.0001 ** (−2.03)	−0.0001 (−1.43)	−0.0001 * (−1.66)	−0.0001 ** (−2.23)
Size					−0.013 (−0.26)					0.021 (0.38)
Size ²					0.0001 (0.34)					−0.001 (−0.47)
Dividend						−0.076 (−1.42)				−0.072 (−1.39)
Dividend ²						0.020 * (1.85)				0.020 * (1.89)
Debt Ratio							−0.420 * (−1.71)			−0.497 * (−1.85)

Table 7. Cont.

Panel IIA: Primary Influencers (Motivational Hypotheses and Board Independence)										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Debt Ratio ²							0.545 ** (2.15)			0.595 ** (2.15)
Taxation								−0.100 (−0.39)		−0.263 (−1.01)
Taxation ²								0.057 (0.47)		0.120 (1.01)
Board									0.988 *** (2.90)	1.050 *** (2.97)
Board ²									−0.737 *** (−2.67)	−0.818 *** (−2.85)

Panel IIB: Primary Influencers (Motivational Hypotheses and Board Independence), Profitability Ratios and Macrofinancial Indicators										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Cash	0.250 ** (2.20)	0.126 (1.02)	0.165 (1.29)	0.193 * (1.80)	0.199 * (1.85)	0.191 * (1.77)	0.200 * (1.87)	0.195 * (1.83)	0.196 * (1.84)	0.169 (1.31)
Cash ²	−0.152 (−1.29)	−0.064 (−0.55)	−0.199 (−1.62)	−0.019 (−0.19)	−0.015 (−0.15)	−0.014 (−0.15)	−0.013 (−0.13)	−0.015 (−0.15)	−0.013 (−0.13)	−0.187 (−1.50)
EPS	0.132 (1.40)	0.417 (1.43)	0.317 (1.12)	0.220 *** (2.90)	0.230 *** (2.99)	0.222 *** (2.92)	0.228 *** (2.95)	0.231 *** (3.05)	0.229 *** (2.99)	0.277 (0.97)
M/B Ratio	−0.014 *** (−3.23)	−0.018 *** (−3.59)	−0.017 *** (−3.33)	−0.016 *** (−3.49)	−0.016 *** (−3.54)	−0.016 *** (−3.52)	−0.016 *** (−3.55)	−0.016 *** (−3.55)	−0.016 *** (−3.57)	−0.016 *** (−3.41)
M/B Ratio ²	−0.0001 * (−1.95)	−0.0001 (−1.47)	−0.0001 (−1.31)	−0.0001 ** (−2.07)	−0.001 ** (−2.23)	−0.0001 ** (−2.07)	−0.0001 ** (−2.26)	−0.0001 ** (−2.31)	−0.0001 ** (−2.33)	−0.0001 (−1.63)
Size	0.016 (0.30)	−0.008 (−0.13)	−0.016 (−0.26)	0.022 (0.39)	0.021 (0.38)	0.021 (0.37)	0.020 (0.35)	0.018 (0.33)	0.016 (0.30)	−0.013 (−0.22)
Size ²	−0.0007 (−0.37)	−0.0007 (−0.37)	−0.0006 (−0.30)	−0.001 (−0.47)	−0.001 (−0.47)	−0.0001 (−0.44)	−0.0009 (−0.44)	−0.0009 (−0.42)	−0.0008 (−0.40)	−0.0004 (−0.23)
Dividend	−0.103 * (−1.84)	−0.080 * (−1.67)	−0.123 ** (−2.22)	−0.075 (−1.46)	−0.072 (−1.39)	−0.073 (−1.42)	−0.074 (−1.44)	−0.072 (−1.40)	−0.074 (−1.45)	−0.124 ** (−2.26)
Dividend ²	0.024 ** (2.21)	0.024 ** (2.20)	0.030 ** (2.53)	0.020 ** (1.97)	0.020 * (1.89)	0.019 * (1.95)	0.020 * (1.92)	0.020 * (1.93)	0.020 ** (1.96)	0.029 *** (2.58)
Debt Ratio	−0.550 ** (−2.11)	−0.505 * (−1.90)	−0.574 ** (−2.21)	−0.477* (−1.79)	−0.497 * (−1.85)	−0.476 * (−1.78)	−0.492 * (−1.83)	−0.497 * (−1.87)	−0.492 * (−1.84)	−0.551 ** (−2.14)
Debt Ratio ²	0.622 ** (2.32)	0.646 ** (2.33)	0.703 *** (2.58)	0.555 ** (2.00)	0.595 ** (2.14)	0.550 ** (1.98)	0.592 ** (2.14)	0.599 ** (2.18)	0.596 ** (2.17)	0.654 *** (2.40)
Taxation	−0.278 (−1.07)	−0.306 (−1.18)	−0.326 (−1.25)	−0.148 (−0.56)	−0.261 (−0.92)	−0.194 (−0.68)	−0.392 (−1.18)	−0.257 (−0.99)	−0.386 (−1.16)	−0.332 (−0.96)
Taxation ²	0.126 (1.06)	0.134 (1.13)	0.144 (1.20)	0.051 (0.42)	0.119 (0.90)	0.075 (0.57)	0.184 (1.17)	0.113 (0.95)	0.177 (1.13)	0.137 (0.83)

Table 7. Cont.

Panel IIB: Primary Influencers (Motivational Hypotheses and Board Independence), Profitability Ratios and Macrofinancial Indicators										
	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Board	1.041 *** (2.96)	1.027 *** (2.90)	1.005 *** (2.86)	0.988 *** (2.78)	1.050 *** (2.97)	0.975 *** (2.75)	1.059 *** (3.00)	1.053 *** (2.98)	1.063 *** (3.01)	0.951 *** (2.69)
Board ²	−0.806 *** (−2.83)	−0.795 *** (−2.77)	−0.771 *** (−2.70)	−0.767 *** (−2.67)	−0.818 *** (−2.85)	−0.756 *** (−2.63)	−0.824 *** (−2.87)	−0.819 *** (−2.86)	−0.825 *** (−2.88)	−0.723 ** (−2.53)
ROA	−0.239 * (−1.84)		−0.247* (−1.92)							−0.253 * (−1.94)
ROA ²	0.101 * (1.82)		0.093* (1.72)							0.095 * (1.70)
Net Profit		0.052 (0.74)	0.056 (0.83)							0.048 (0.70)
Net Profit ²		0.002 (0.08)	0.005 (0.14)							0.003 (0.10)
Expansion				−0.066 ** (−2.02)		−0.069** (−2.07)				−0.062 * (−1.82)
Recession					0.001 (0.02)	−0.037 (−0.48)				−0.039 (−0.50)
Market Risk							−5.543 (−0.56)		−5.548 (−0.56)	−3.285 (−0.34)
Stock Market								−0.475 (−0.75)	−0.475 (−0.76)	−0.412 (−0.67)

Superscripts indicate statistical significance at the 0.10 (*), 0.05 (**) and 0.01 (***) percent levels, and z-statistics are stated in the parenthesis.

Regarding profitability, we see that, unlike the initial results, ROA has a negative influence and ROA² has a positive influence. However, the ratios conflict with our expectations, which causes an anomalous revelation that is understandable by looking at the entirety of the results. The incrementing of repurchase value during periods of increased profitability is coherent with the positive influence of Cash, while the inverse influence is consistent with the positive influence of EPS and the negative influence of Expansion. This posits the diversion of resources towards dividend distribution since a business cycle upswing brings firm-level prosperity, which seminal studies have found is better communicable via dividends (John and Williams 1985; Bernheim 1991); the assertion is further supported by the positive influence of Dividend². Thus, during periods of prosperity following economic compression, firms tend to prefer dividends for communicating specific information. The influences of Net Profit and Net Profit² are insignificant, which is identical to the initial results. Further, the negative influence of Expansion, and the insignificant influences of Recession, Market Risk and Stock Market remain consistent with the initial results.

(ii) Leamer’s Global Sensitivity Analysis

Leamer’s (1985) criteria are applied to the determinants of repurchase size’s empirical setup that included all of the 23 tested control variables (Table 7, Panel II, Model X). Thus, the testing results in a loop of 414 regressions⁴, and their summary statistics are reported in Table 8. The analysis focuses on statistically significant variables, which amount to 10 control variables. We find that seven of the variables are consistent with the initial results, Cash, Dividend², Debt Ratio, Debt Ratio², Board, Board² and Expansion. While for M/B Ratio, M/B Ratio² and EPS each have one contradictory coefficient. These minimal contradictions exhibit a certain degree of consistency. The negative coefficient of EPS indicates that managers are less prone to increasing repurchase size when earnings are negative, which is consistent with the signalling stock undervaluation motive being a determinant. Similarly, the positive coefficient of M/B Ratio and M/B Ratio² indicate that managers are prone to unethically increase repurchase size when the firm is overvalued, which is consistent with the adjusting EPS motive being a determinant.

Table 8. Robustness check: summary statistics of Leamer regression coefficients.

	Obs.	Mean	Std. Dev.	Min	Max	Positive Coef. (%)	Negative Coef. (%)
Cash	414	0.029	0.003	0.008	0.080	414 (100)	0 (0)
EPS	414	0.025	0.003	−0.012	0.045	413 (99.75)	1 (0.25)
M/B Ratio	414	−0.002	0.0002	−0.006	0.001	1 (0.25)	413 (99.75)
M/B Ratio ²	414	−0.0001	0.0001	−0.0001	0.0001	1 (0.25)	413 (99.75)
Dividend ²	414	0.001	0.0001	0.0004	0.002	414 (100)	0 (0)
Debt Ratio	414	−0.080	0.005	−0.113	−0.0004	0 (0)	414 (100)
Debt Ratio ²	414	0.092	0.005	0.012	0.121	414 (100)	0 (0)
Board	414	0.162	0.010	0.005	0.251	414 (100)	0 (0)
Board ²	414	−0.125	0.008	−0.214	−0.002	0 (0)	414 (100)
Expansion	414	−0.010	0.0004	−0.014	−0.007	0 (0)	414 (100)

Thus, upon combining the fundamentals of the tested proxies, the initial findings, and the findings of the robustness test and then sorting them based on their influence pattern (if U-shaped or inverted U-shaped, which are less desired) and the economic value of the coefficients, a list of the most to least influencing determinants of repurchases size is discernible. The most popular are the signalling stock undervaluation motive, which is followed by the adjusting EPS and excess cash distribution hypotheses. Thus, this reveals their consistency with Dhanani’s (2016), which states these three motives are the top three reasons for repurchasing shares. The only difference is that the order of preference highlighted in the survey is misaligned, which is ignorable as it covers a cross-section timeline (2003–2007) compared to that of this research (1985–2014). The following are the influences of dividend distribution, capital restructuring motive and board independence.

(iii) Summary

In light of the outputs of the robustness tests, in-line with the initial findings we continue to find evidence to accept the alternative hypothesis H_{11} : Primary Influencers determine the size of a repurchase, and the alternative hypothesis H_{31} = Macrofinancial conditions determine the size of a repurchase. With regard to H_2 , we find mild evidence that contradicts the initial findings' indication of accepting the null hypothesis H_{20} = Profitability does not determine the size of a repurchase. Given that this contradiction was not overwhelming and only present in one of the two robustness tests, we can state that there is a possibility that under specific circumstances profitability can have non-linear influences on the decision regarding the size of a repurchase.

5. Conclusions

The motivation for testing the determinants of the size of Britain's open market share repurchases concerned the fluctuating influences of the motivational hypotheses on the decision to undertake repurchases. Thus, this led to an investigation of how influential the hypotheses are in determining the size of repurchases and if their influences are either U-shaped or inverted U-shaped. Furthermore, we theoretically discussed and empirically tested the relationship of repurchases with board independence, and additionally tested the influences of firm-level profitability and macrofinancial environment. Univariate analysis indicates that firm-specific characteristics can be disproportionate across repurchase size, while, as repurchase size increases, the differences between firm-level characteristics between firms also increases; the upper (bottom) 50% of firms are among the least (most) similar. Thus, we now know that when assessing the firms that undertake high-valued share repurchases, it is important to be cautious. The multivariate testing reveals that the most popular motivational hypotheses that determine repurchase size are signalling stock undervaluation, followed by adjusting the EPS and the excess cash distribution hypotheses. These remain consistent with the responses given by British managers in [Dhanani's \(2016\)](#) survey. Overall, the paper has made two key new contributions to the existing literature, that leverage has a U-shaped influence on repurchase size and that board independence has an inverted U-shaped influence.

This paper is highly applicable to British managers in the form of a self-assessment tool for future decision making while also providing support for managing the repurchase–dividend relationship. Additionally, academics can use these findings to further investigations of the motivations for undertaking repurchases, which are also subject to non-linear influences. Thus, this adds a strong complementary perspective to this paper.

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Appendix A

Additional Details on the UK's Corporate Governance

It is arguable that mandatory governance regulations can reduce the significance of independent directors' role in repurchase monitoring since, in the UK, regulations

require large firms to have a board that is at least half independent (OECD 2017). Thus, from a theoretical perspective, it suggests that the larger the firm, the greater the role of independent directors in repurchase monitoring. However, a firm's size has an inverse relationship with asymmetric information; the smaller the firm, the less connected it is with the market, and repurchases are generally considered an excellent tool for signalling asymmetric information (Ikenberry et al. 1995; Lee et al. 2010), while dividends and information asymmetry have shown positive relationships in the UK (Hussainey and Al-Najjar 2011). Therefore, the relationship between board independence and repurchases that this research posits is detached from a firm's size, which is an assertion supported by the existing literature. For instance, Fosu et al. (2016) found that firms with higher growth opportunities witness greater consequences of asymmetric information, which is a trait of small firms since they generally outdo the market, thus supporting their greater use of repurchases to signal information bias. The capital restructuring hypothesis is the fourth leading motive among British managers for repurchasing shares (Dhanani 2016), and its influence in repurchase decision making is supported by the findings of Lee and Suh (2011), Burns et al. (2015) and Cesari and Ozkan (2015), while Rahaman (2011) finds that firm size is inversely related to debt exposure; the smaller the firm, the greater the debt exposure. Thus, if managers of such firms want to further increment their debt component via repurchases, the support of independent directors will help in obtaining shareholder consent. Additionally, Akbar et al. (2016) find that a European firm's size has a positive relationship with governance compliance; however, Pass' (2006) survey finds that only 34% of British firms were in full regulatory compliance; 66% of the managers confess to violations. A follow up analysis by Shrivies and Brennan (2015) found that firm-level compliance did improve; however, non-compliance was still visible. It is presumable that the violated regulations are those that are not overtly noticeable by shareholders and regulatory bodies, and the directives associated with board composition are not included in this category. Thus, independent directors will always be present in monitoring repurchases, regardless of not just firm size but also regulatory violations. However, given that repurchases employ a greater deal of resources than dividends and have a structural effect on the firm's stock volume, while insider owners have shown dividend preference over repurchases (Renneboog and Trojanowski 2011), it is possible that independent directors may, under certain circumstances, deter the actual size of the repurchase.

Notes

- ¹ We only include the initial announcements and not actual transactions since Andriosopoulos and Lasfer (2015) find that they are most informative. Repurchases undertaken through the open market route are tested as they represent a majority of all repurchases (Rau and Vermaelen 2002; Oswald and Young 2004).
- ² The data were obtained using a one-off purchase from Thomson Reuters' via its official vendor Alacra Inc.
- ³ We have considered methods highlighted in Bai et al. (2010), Chow et al. (2017), Cheng et al. (2019) and Gupta et al. (2019), however since our data are an unbalanced panel, we are unable to use tests like Granger Causality to further highlight non-linearity. Thus, we rely on squaring the independent variables to represent non-linearity.
- ⁴ The information regarding t-statistics is available in the Appendix A.

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