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ORIGINAL RESEARCH

Policy uncertainty and real activities manipulation: evidence from Brexit

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Abstract
Brexit exposed the UK to substantial policy uncertainty that could affect the performance and behavior of British firms. We examine the impact of Brexit as an exogenous shock to policy uncertainty on real activities manipulation by British firms. Using several measures of real activities manipulation and a difference-in-differences design, we compare the earnings management of firms most adversely affected by Brexit uncertainty (affected firms) to other firms. Our results indicate that the affected firms exhibit higher real activities manipulation after the Brexit vote and we also find that they demonstrate similarly higher accruals management. Our findings suggesting that policy uncertainty induces the costly practice of real activities manipulation are relevant to various stakeholders including policymakers and financial statements users.

Keywords Brexit · Policy uncertainty · Real activities manipulation · Earnings management

JEL Classification M41

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1 Introduction

On 23 June 2016, Britain decided to leave the European Union (EU). This was not just a political decision, but also a change in the steering of the UK with considerable social and economic implications. However, the direction and magnitude of the likely changes brought upon by Brexit remain contentious. Brexit introduced significant uncertainties for UK businesses concerning global trade, supply chain operations, labor accessibility, and product regulations (Vasilescu and Weir 2023). As Bloom et al. (2019a, b) point out, Brexit created a substantial, widespread and long-standing increase in uncertainty in the UK, which differs from prior uncertainty shocks (e.g., oil prices in 1973, Gulf War I and II, September 11 attacks, etc.) as the majority of uncertainty shocks recede reasonably swiftly and/or are related to an economic recession. Such factors make Brexit a unique uncertainty shock (Bloom et al. 2019a). The policy uncertainty created by Brexit is expected to affect the performance and behavior of British firms. This study examines the impact of Brexit on real activities manipulation (henceforth, RAM) by UK firms.

Firms adjust their decisions as a reaction to external factors (Ghosh and Olsen 2009). There is evidence that firms respond to uncertainty. For instance, there is extensive literature on how uncertainty influences investing decisions (e.g., Pindyck 1993; Julio and Yook 2012) and corporate pay-out policies (Huang et al. 2015). Uncertainty induces earnings variability, which may create incentives for managers to offset the increase by using earnings management (Ghosh and Olsen 2009). There is evidence that firms affected by high uncertainty are engaged in earnings management to reduce earnings volatility (Tung 1979). Furthermore, uncertainty due to the volatility of equity options (Stein and Wang 2016) and policy uncertainty (Yung and Root 2019) are associated with earnings management.

This study examines RAM by British firms in response to the uncertainty brought by Brexit. There is abundant evidence on the negative consequences of RAM (Delshadi et al. 2023). Prior studies suggest that RAM can potentially dampen future cash flows and firm value (Roychowdhury 2006), destroy future profitability (Gunny 2010; Cohen and Zarowin 2010), increase cost of capital (Kim and Sohn 2013), increase borrowing costs (Pappas et al. 2019), reduce earnings quality (Li 2019) and negatively affect credit rating (Ge and Kim 2014). Investigating the impact of Brexit on the costly practice of RAM contributes to the ongoing debate of the implications of Brexit for the UK economy.

To investigate the impact of Brexit, we compare RAM of the UK firms most adversely affected by Brexit (henceforth, affected firms) to other firms during the period of Brexit uncertainty (2016–2018) relative to the period before (2011–2015). We expect to observe higher RAM by affected firms in response to the policy uncertainty brought on by Brexit. Using a difference-in-differences (DID) research design, we find that affected firms exhibit higher RAM during the Brexit uncertainty period, consistent with our expectation. We also examine accruals-based earnings management and find similar results. In additional analysis, we find that our earlier results for RAM and accruals are driven by goods firms with service firms exhibiting weaker results for RAM and lower accruals management during the uncertainty period.

Our study makes the following contributions. First, we contribute to the growing literature on the impact of uncertainty (e.g., Białkowski et al. 2008; Nguyen and Phan 2017; Bonaime et al. 2018) and particularly how uncertainty affects financial reporting (e.g., Ghosh and Olsen 2009; Chen et al. 2013; Stein and Wang 2016; Yung and Root 2019). Much of the literature addresses the economic implications at the country level and devotes less attention to the impact of uncertainty on firm behavior (Yung and Root 2019).

Exceptions include studies investigating the impact of policy uncertainty on capital investment (Gulen and Ion 2016), innovation activities (Bhattacharya et al. 2017), and mergers and acquisitions (Nguyen and Phan 2017). This study extends our knowledge on the impact of uncertainty at the firm level by examining its impact on RAM. The present study thus addresses an important research gap. The few studies examining the relationship between political uncertainty and earnings management (e.g., Yung and Root 2019; Bermpei et al. 2022) do not provide causal evidence. As they state in their paper, Yung and Root (2019, p. 266) provide only evidence of "a robust association between policy uncertainty and earnings management in an international context". Their use of a (anticipatable) news-based uncertainty index does not allow for causal inference. The case is the same with Bermpei et al. (2022) who study the association between policy uncertainty and measures of financial reporting quality in the US. To the contrary, Brexit is arguably an exogenous shock that can be employed to provide stronger evidence of causality. The present study employs a DID research design along with propensity score matching to provide a sound basis for causal inference. We present evidence consistent with a rise in RAM by affected firms during the Brexit uncertainty period. The present study also contributes to the nascent Brexit literature (e.g., Sampson 2017; Davies and Studnicka 2018; Bloom et al. 2018) by showing how British firms have reacted to Brexit by engaging in the value-destroying practice of RAM. Our findings help to inform the current debate about the impact of Brexit on UK businesses.

The remainder of the paper is structured as follows. In Sect. 2, we review prior studies and develop our research hypothesis. In Sect. 3, we discuss the data and research methodology. Section 4 reports the results and, lastly, Sect. 5 concludes the paper.

2 Background and hypothesis development

2.1 Policy uncertainty

An organization is influenced by its external environment, particularly in terms of the economic constraints imposed (Child 1972). These constraints are beyond the control of an organization and thus could result in uncertainty. There is evidence on how uncertainty influences gross domestic product and policy effectiveness (Bloom et al. 2012), business cycles (Bloom et al. 2012; Christiano et al. 2014) and stock market volatility (Bittlingmayer 1998; Bialkowski et al. 2008; Pastor and Veronesi 2012; Fan et al. 2020). Handley and Limao (2017) indicate that uncertainty affects the wealth and well-being of nations. In particular, they provide evidence that lower uncertainty after the World Trade Organization accession in 2001 has reduced prices and increased consumers' income in the US.

While uncertainty about economic outlook has implications at both the country and firm level, much of the literature focuses on economic implications at the country level and pays less attention to the impact of uncertainty on firm behavior (Yung and Root 2019). Ghosh and Olsen (2009) argue that managers adjust their strategies and decisions based on the impact of environmental factors. They suggest that managers have opportunities to strategically react to environmental constraints and manage the inherent uncertainty of their environment.

Prior studies indicate that uncertainty over future policies affects firms. Pastor and Veronesi (2012) model the impact of policy uncertainty on share prices and find that share prices fall after a policy change is introduced by the government. In addition, their findings

suggest that policy changes increase risk premia, and the volatilities and correlations of stock returns. There is extensive evidence that uncertainty negatively affects managers' investment decisions (e.g., Pindyck 1993; Julio and Yook 2012). Bernanke (1983) shows that policy uncertainty worsens economic cycles. He also indicates that firms under uncertainty are faced with a trade-off between the additional returns from early investment and the benefits of more information due to waiting, which influences them to postpone their investment decisions. In the same vein, Gulen and Ion (2016) report a negative association between the level of policy uncertainty and firm level capital investment, suggesting that uncertainty promotes the precautionary postponement of corporate investment. Bhattacharya et al. (2017) provide international evidence that firms reduce their innovation activities during periods of policy uncertainty. Particularly, they indicate that innovation activities significantly decline in the presence of policy uncertainty caused by national elections. Huang et al. (2015) examine the effect of political uncertainty on corporate pay-out policy and find that during periods of high political uncertainty, dividend-paying firms stop dividends and non-payers are less likely to pay, consistent with a precautionary response by managers to uncertainty.

2.2 Brexit as an exogenous shock to policy uncertainty

In the Brexit referendum, both supporters and detractors had valid arguments to support their positions. Against Brexit was the argument that the EU represented the UK's main trade partner with around 50% share of trade. Furthermore, as a member, the UK enjoyed lower costs of trade with other members which brought lower prices to British consumers and higher exports for British firms (Dhingra et al. 2016). Possible benefits of Brexit were freedom from EU regulations (including immigration rules), no EU budget contributions, and new (and potentially more favourable) deals with non-EU countries, while possible costs of Brexit included tariffs on exports to the EU, loss of access to the EU market, negative impact on London's economy, and a decline in investment in the UK (Ramiah et al. 2017). Brexit inevitably means costlier and hence lower trade with the EU (Dhingra et al. 2016) potentially leading to a significant disruption to the UK economy (Armstrong and Portes 2016; Belke and Gros 2017). Furthermore, UK businesses may be exposed to a wide range of uncertainties including the unknown nature of the eventual relationship with the EU and its impact on market access; labour migration and trade regulation; and the timing of transition arrangements (Bloom et al. 2019a). Although some Brexit effects may unfold over the longer term, an immediate impact was observed just after the release of the referendum's outcome, which manifested in a significant depreciation of the British Pound and a large decline in UK stock markets (Yung and Root 2019; Davies and Studnicka 2018). Over the longer term, Sampson (2017) predicts that Brexit will make the UK poorer to the tune of a one to 10% drop in income per capita due to new obstacles to trade, foreign direct investment, and immigration.

Policy uncertainty stems from the announcement of a policy that may be implemented at some point in the future (Faccini and Palombo 2019). Uncertainty over the timing and eventual outcome of leaving the EU were the main drivers of Brexit-induced uncertainty for UK businesses. Forecasted outcomes of Brexit ranged from optimistic to pessimistic

scenarios.[1] Furthermore, the outcome of Brexit remained unclear for a long time. The considerable time lag between the referendum and actually leaving the EU created ongoing policy uncertainty. The distinctive feature of Brexit is timing uncertainty as deadlines for the eventual exit were determined and postponed a number of times (Faccini and Palombo 2019).

In the Brexit referendum, a narrow majority of British people (51.9–48.1%) voted in favor of leaving the EU. The result was a surprise: the outcome was predominantly unexpected, as over the 6 months leading up to the referendum, the chance of the 'remain campaign' winning the referendum was around 70% (Bloom et al. 2019a, b). The victory of the 'leave campaign' was an unpredicted shock to UK businesses which heightened uncertainty of the future (Breinlich et al. 2017). As Bloom (2014) notes, there is limited evidence on the effect of uncertainty due to the difficulty in disentangling the impact of uncertainty from other factors. He adds that using the timing of uncertainty is an effective way to isolate its impact and that this approach works well for unexpected shocks to uncertainty. Consequently, Brexit provides an excellent opportunity to study the impact of an exogeneous shock to policy uncertainty.

2.3 Earnings management in response to policy uncertainty

Limited empirical evidence exists to indicate that uncertainty affects earnings management behavior. As Ghosh and Olsen (2009) point out, uncertainty causes variability in earnings, and thus managers have incentives to reduce this variability through earnings management. Uncertainty is defined as variability in the organization's external environment including its customers, competitors, regulations and labor unions (Tung 1979; Ghosh and Olsen 2009). Empirical findings suggest that firms facing high uncertainty use accruals management to mitigate earnings volatility (Ghosh and Olsen 2009). Stein and Wang (2016) indicate that managerial short-termism and information asymmetry motivate firms to opportunistically transfer earnings from uncertain times to more certain times. Chen et al. (2013) examine how the uncertainty around initial public offerings affects earnings management activities and find that firms with low uncertainty manage their earnings for informative purposes, while firms with high uncertainty manage their earnings opportunistically. Yung and Root (2019) investigate the impact of uncertainty on corporate financial and investing decisions and find that uncertainty is positively associated with earnings management. In particular, they demonstrate that when uncertainty is high, firms heighten earnings management, and when uncertainty is low, firms reduce earnings management.

2.4 Impact of Brexit across UK industries

Uncertainty often has a heterogeneous impact across industries. Based on the premise that some industries are more sensitive to political events, Boutchkova et al. (2012) report that industries more dependent on trade, contract enforcement, and labor, demonstrate greater return volatility when uncertainty is high. Novy and Taylor (2020) show that the impact of uncertainty shocks varies by sectors. Bloom et al. (2019a) report that Brexit has a heterogeneous effect on firms depending on their exposure to Europe—industries more dependent

[1] As Dhingra and Sampson (2016) argue, the UK could follow the way that Norway or Switzerland deals with the EU or just trade under WTO rules. These scenarios have differing implications for the UK economy thus leaving UK businesses under immense uncertainty over the outcome of leaving the EU.

on EU trade experience higher uncertainty. Their survey of UK businesses shows a positive association between CFOs viewing Brexit as an important driver of uncertainty and the level of their company's trade with the EU.[2] Ramiah et al. (2017) examine the impact of Brexit across sectors of the UK economy using abnormal market returns and find that the impact is mixed at a sector level, but report a negative impact on the banking, travel and leisure sectors. Tetlow and Stojanovic (2018) show that while some industries such as clothing manufacturing and high-tech are likely to be adversely affected by leaving the EU, other sectors such as agriculture and food processing may benefit from Brexit. Crowley et al. (2020) report a significant decline in the number of firms exporting from the UK to the EU as a result of policy uncertainty brought by Brexit. This has a more damaging effect on firms with high EU trade. Hill et al. (2019) examine the impact of Brexit uncertainty on UK firms and find that sectors are exposed to the Brexit-related uncertainty to varying degrees. These studies collectively suggest that the impact of Brexit on UK industries varies by their reliance on EU trade. This, in turn, is expected to result in differing impacts on earnings management behaviour across industries. Therefore, we expect to observe higher RAM during the period of Brexit uncertainty by firms more affected by Brexit compared to other firms which forms our research hypothesis (stated in alternative form):

H1. Firms more affected by the policy uncertainty from Brexit will demonstrate higher real activities manipulation during the Brexit uncertainty period than less affected firms.

3 Data and methodology

3.1 Data

We collect the necessary data from DataStream and include all UK firms for the years 2011 through 2018 with available data. The testing period starts in 2011 to ensure that sample firms are not affected by the impact of the 2007–2008 financial crisis or the economic downturn that the UK experienced in 2009. We end our sample period in 2018 as there is evidence that Brexit uncertainty started to decline after 2018 (Bloom et al. 2019a, b). Consistent with prior earnings management studies (e.g., Roychowdhury 2006; Xu 2016; Makarem and Roberts 2020), we exclude firms operating in regulated industries (SIC codes 4400–4999), and banks and financial institutions (SIC codes 6000–6499). Measures of earnings manipulation are run cross-sectionally for every year and industry. Two-digit SIC codes are used to identify industries. We require a minimum of 15 observations for each industry-year group and exclude groups with fewer observations. The final sample contains 4480 firm-year observations representing 803 unique firms.

3.2 Measures of real activities manipulation

Firms negatively affected by Brexit uncertainty are expected to mitigate the impact of policy uncertainty on their earnings through the manipulation of real activities. This can manifest itself in both upward (i.e., income increasing) and downward (i.e., income decreasing)

[2] It should be noted, as Bloom et al. (2019a) indicate, that the positive relationship between EU trade and Brexit uncertainty is not a perfect one. For instance, their results indicate that while the construction industry has trivial trade with the EU, the proportion of the UK construction firms viewing Brexit as an important driver of uncertainty was higher than the overall average.

manipulation of sales or discretionary expenses. Manipulation of sales through methods such as offering aggressive discounts and suboptimal credit terms will result in abnormal cash flows from operations. Firms can also manipulate discretionary expenses to achieve desired earnings by deferring or accelerating discretionary costs including R&D, advertising, and repairs and maintenance.

Following Roychowdhury (2006), RAM is measured using abnormal cash flows from operations, abnormal discretionary expenses, and abnormal change in receivables.[3] The residual from the following model (*ABNCFO*) captures abnormal cash flows from operating activities:

$$\frac{CFO_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{i,t}}{TA_{i,t-1}} + \alpha_3 \frac{\Delta S_{i,t}}{TA_{i,t-1}} + \varepsilon_{i,t}. \quad (1)$$

where $CFO_{i,t}$ is cash flow from operating activities for firm i in year, and S_{it} is net sales/revenue in year t, $\Delta S_{i,t}$ is net sales/revenue in year t minus net sales/revenue in year *t-1*, and TA_{it-1} is total assets in year *t-1*.

The second measure of RAM is abnormal discretionary expenses (*ABNDE*), which is computed as the residual from the following model:

$$\frac{DE_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{i,t-1}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (2)$$

where $DE_{i,t}$ is the sum of selling, general, and administrative expenses; and advertising expenses for firm i in year t.

The final measure of RAM is abnormal change in receivables (*ABNREC*). Manipulation of credit sales would be reflected in an unexpected change in receivables, which is the residual from the following model:

$$\frac{\Delta REC_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{\Delta S_{i,t}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (3)$$

where $\Delta REC_{i,t}$ is receivables in year t minus receivables in year *t-1* for firm i.

To capture both upward and downward manipulation of earnings, we use the absolute value of the above measures in our tests, consistent with prior studies (e.g., Jin et al. 2019; Yung and Root 2019; Ghoul et al. 2020).

3.3 Empirical model

In order to examine the research hypothesis, we compare the RAM of British firms before and after the Brexit vote between firms most adversely affected by Brexit-induced uncertainty (affected firms) and other firms. By doing so, we adopt a difference-in-differences (DID) research design. In studies investigating the impact of policy reforms, DID measures the average impact of treatment by removing unobservable idiosyncratic effects as well as macro effects (Blundell and Costa Dias 2009). The following DID model is used to examine whether affected firms exhibit higher RAM compared to other firms:

[3] In addition to these measures, Roychowdhury (2006) uses abnormal production costs to measure overproduction, where production costs are computed as the sum of change in inventory and cost of goods sold. Due to the fact that a large number of sample firms belong to service sectors in which overproduction is not applicable, abnormal production cost is not used in this study.

$$RAM_{i,t} = \alpha + \beta_1(Brexit_t) + \beta_2(Affected_i) + \beta_3(Brexit_t \times Affected_i) + \beta_4(Controls) + \varepsilon_{i,t} \quad (4)$$

The dependent variable is *RAM*, which denotes the three proxies of RAM (*ABNCFO*, abnormal cash flow from operating activities; *ABNDE*, abnormal discretionary expenditures; and *ABNREC*, abnormal receivables). *Brexit* is an indicator variable that takes the value of one if the observation belongs to 2016 through 2018, and zero otherwise. To be more precise, 30 June 2016 is considered as the cut-off point, which is selected based on evidence that Brexit-induced uncertainty remained high after the 2016 referendum and it started declining in 2019 (Bloom et al. 2019a, b). *Affected* is an indicator variable taking the value of one if the observation belongs to the most adversely affected industries (affected firms), and zero otherwise.

To identify the industries most adversely affected by Brexit uncertainty, we use the range of change in gross value added (GVA) between two scenarios: pessimistic scenario (hard Brexit) and optimistic scenario (soft Brexit) (Dhingra et al. 2017).[4] We assume that the probability of each scenario is 50% and calculate the probability-weighted change in GVA for each industry. Range of GVA change is computed as soft Brexit GVA minus hard Brexit GVA divided by the probability-weighted change in GVA. Industries at or above the median range of GVA change are considered as more affected by Brexit uncertainty and industries below the median change are considered as less affected.[5] *Brexit*×*Affected* is the variable of interest since it captures the Brexit uncertainty period for affected firms. A significant, positive, estimated coefficient for β_3 would provide support for our hypothesis. See Appendix 1 for details of how affected industries are identified.

Our model controls for firm size, performance, growth, capital expenditures, and R&D. *SIZE* is measured using the natural logarithm of the lagged market value of equity. Large firms tend to have lower earnings management because they have more stringent corporate governance mechanisms. *MTB* is measured using the beginning of year market to book ratio. Market to book ratio is included to capture the impact of growth. High growth firms tend to have higher working capital and hence have greater opportunities to manage their earnings (McNichols 2000). *ROA* is measured using net income before extraordinary items divided by beginning of year total assets. Return on assets is used to control for performance since ignoring performance can bias earnings management models and interfere with statistical inferences (Dechow et al. 1995). *CAPEXP* is capital expenditures measured by change in property, plant and equipment divided by total assets. *R&D* is measured using R&D expenditures divided by total assets. It is expected that as a result of uncertainty, both capital expenditures and R&D activities are reduced (Gulen and Ion 2016; Bhattacharya et al. 2017). Finally, year dummies are included in the model to control for year fixed effects. Table 1 defines all variables used in this study.

[4] Note that although at the time of writing, a Brexit deal has been reached by UK and EU officials, hindsight is not used in defining the two scenarios. The two Brexit scenarios are defined based on Dhingra et al. (2017). See Appendix 1 for details.

[5] Dhingra et al. (2017) present GVAs for sectors and define sectors according to the World Input–Output Database (WIOD) industry classification. We convert WIOD sectors into two-digit SIC industries.

Table 1 Variable definitions

Sales	Net sales or revenue
Assets	Total assets
MVE	Market value of equity
NI	Net income before extraordinary items
MTB	Market to book ratio
ROA	Net income before extraordinary items divided by total asset
SIZE	Logarithm of the market value of equity
ABNCFO	Abnormal cash flow from operations which is measured by the estimated residual from the following regression: $\frac{CFO_{it}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{it}}{TA_{i,t-1}} + \alpha_3 \frac{\Delta S_{it}}{TA_{i,t-1}} + \varepsilon_{it}$ where CFO_{it} is cash flow from operating activities in year t for firm i and S_{it} is net sales/revenue in year t, ΔS_{it} is net sales/revenue in year t minus net sales/revenue in year *t-1*; TA_{it-1} is total assets in year *t-1*
ABNDE	Abnormal discretionary expenses which is measured by the estimated residual from the following regression: $\frac{DE_{it}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{i,t-1}}{TA_{i,t-1}} + \varepsilon_{it}$ where DE_{it} is the sum of selling, general, administrative and advertising expenses in year t
ABNREC	Abnormal change in receivables measured by the estimated residual from the following regression: $\frac{\Delta REC_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{t-1}} + \alpha_2 \frac{\Delta S_t}{TA_{t-1}} + \varepsilon_t$
ABNACC	Abnormal accruals using modified Jones model measured by the estimated residual from the following regression: $\frac{TACC_{it}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{\Delta S_{it} - \Delta REC_{it}}{TA_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{TA_{i,t-1}} + \varepsilon_{it}$ where $TACC_{it}$ is earnings minus cash flow from operations in year t,ΔS_{it} is net sales/revenue in year t minus net sales/revenue in year *t-1*; TA_{it-1} is total assets in year *t-1*; PPE_{it} is gross property, plant, and equipment in year t, and ΔREC_{it} is change in receivables in year t minus receivables in year *t-1* and ε_{it} is the residual which is the measure of accruals management
R&D	Research and development expenditures divided by total assets
CAPEXP	Change in property, plant and equipment divided by total assets
Z_Score	Altman's Z-score (Altman 1968) at the beginning of the period
O_Cycle	The length of operating cycle
MS	Market share defined as a firm's sales divided by total sales of its two-digit SIC industry
IOWN	Percentage of institutional ownership
MTR	Marginal tax rate proxied by the effective tax rate
Big_Four	An indicator variable which denotes whether the firm is audited by Big Four auditors
NOA	Net operating assets measured by sum of total equity and total debt minus cash and marketable securities
Brexit	An indicator variable which takes 1 if the observation belongs to the post-Brexit period i.e., June 2016 through 2018 and zero otherwise
Affected	An indicator variable which takes 1 if the observation belongs to industries that are adversely affected by Brexit uncertainty (see Appendix 1 for details)

Table 2 Descriptive statistics for pre- and post-Brexit uncertainty periods

Panel A: Pre-Brexit uncertainty period

	Affected industries (n = 1497)			Other firms (n = 1424)			Whole (n = 2921)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Firm characteristic:									
Sales (£m)	971.39	27.06	3835.72	436.43	33.86	1329.49	730.81	30.04	2939.9
Assets (£m)	1911.21	101.13	6978.65	434.87	44.64	1752.76	1241.14	67.49	5294.59
MVE (£m)	1264.74	88.01	4636.84	567.59	52.18	2431.52	937.02	68.19	3825.26
NI (£m)	81.93	0.24	359.07	27.94	1.34	163.71	57.76	1.02	285.02
Regression variables:									
ABNCFO	0.118	0.068	0.153	0.169	0.089	0.229	0.143	0.078	0.195
ABNDE	0.122	0.060	0.179	0.240	0.143	0.292	0.179	0.095	0.247
ABNREC	0.039	0.019	0.059	0.076	0.034	0.118	0.057	0.025	0.094
ABNAC C	0.111	0.064	0.146	0.124	0.057	0.181	0.117	0.060	0.163
MTB	2.270	1.199	3.807	2.620	1.587	4.204	2.427	1.357	3.992
ROA	−0.103	0.007	0.415	−0.089	0.039	0.460	−0.096	0.027	0.437
SIZE	7.980	7.900	0.991	7.721	7.640	0.934	7.862	7.773	0.982
R&D	0.027	0	0.090	0.055	0	0.124	0.040	0	0.108
CAPEX P	0.076	0.014	0.222	0.031	0.011	0.119	0.054	0.011	0.180
Z_Score	7.153	2.532	18.379	4.932	3.106	13.147	6.035	2.820	16.028
MS	0.032	0.001	0.086	0.031	0.002	0.086	0.032	0.001	0.086
IOWN	36.750	33.950	26.269	35.864	33.360	25.736	36.324	33.770	26.053
MTR	26.803	22.170	30.401	25.901	23.480	23.928	26.204	22.950	26.951
Big_Four	0.563	1	0.496	0.539	1	0.499	0.552	1	0.497
NOA	0.693	1.217	26.350	2.051	0.515	10.776	5.660	0.727	20.089
O_Cycle	546	169	1203	203	111	520	366	134	926

Table 2 (continued)

Panel B: Brexit uncertainty period

	Affected industries (n = 800)			Others (n = 759)			Whole (n = 1559)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Firm characteristic									
Sales (£m)	1115.42	66.92	3957.17	520.29	68.63	1456.01	867.09	67.91	3084.08
Assets (£m)	2272.38	190.35	7540.24	629.89	81.45	2065.97	1536.93	126.60	5822.07
MVE (£m)	1523.91	158.92	4966.98	774.16	128.26	2289.16	1209.82	141.47	4035.27
NI (£m)	103.03	1.95	404.54	25.47	2.59	144.43	68.19	2.29	314.56
Regression variables:									
ABNCFO	0.114	0.058	0.160	0.118	0.067	0.156	0.116	0.064	0.157
ABNDE	0.111	0.045	0.172	0.198	0.126	0.248	0.153	0.082	0.215
ABNREC	0.034	0.018	0.048	0.049	0.024	0.071	0.041	0.020	0.061
ABNACC	0.105	0.053	0.162	0.079	0.042	0.115	0.092	0.048	0.141
MTB	2.470	1.233	4.110	3.162	2.051	3.997	2.797	1.611	4.048
ROA	−0.64	0.023	0.369	−0.044	0.039	0.314	−0.053	0.032	0.336
SIZE	8.191	8.168	0.942	8.089	8.051	0.833	8.144	8.094	0.899
R&D	0.027	0	0.092	0.050	0	0.115	0.038	0	0.104
CAPEXP	0.098	0.024	0.236	0.033	0.011	0.094	0.066	0.015	0.184
Z_Score	5.045	2.290	13.331	5.606	3.156	12.411	5.268	2.799	12.801
MS	0.036	0.003	0.092	0.032	0.002	0.081	0.034	0.003	0.086
I OWN	33.369	30.350	25.368	29.233	24.490	23.262	31.428	27.825	24.406
M TR	26.512	19.470	38.294	24.070	20.760	21.213	25.202	20.010	30.663
Bi g_Four	0.626	1	0.484	0.597	1	0.491	0.612	1	0.487
NOA	7.563	1.264	19.899	2.020	0.611	11.097	4.716	0.850	16.206
O_Cycle	433	157	1079	217	113	504	322	134	844

This table reports the mean, median and standard deviation of some key financial figures and variables used in the regression analysis for the periods before and during the Brexit uncertainty separately for industries most affected and others. All continuous variables are winsorized at 1% tails. All variables are as defined in Table 1

Table 3 Pearson (lower triangle) and spearman (upper triangle) correlations

		1	2	3	4	5	6	7	8	9	10
Panel A: Pre-Brexit uncertainty period											
1	Affected		−0.11***	−0.20***	−0.30***	0.04**	0.13***	−0.13***	−0.12	0.08***	−0.25***
2	ABNCFO	−0.11***		0.31***	0.36***	0.28***	−0.22***	0.17***	−0.09***	0.02	0.18***
3	ABNREC	−0.12***	0.27***		0.26***	0.13***	−0.16***	0.21***	−0.04**	−0.03*	0.17***
4	ABNDE	−0.18***	0.70***	0.18***		0.13***	−0.16***	0.21***	−0.04**	−0.03*	0.17***
5	ABNACC	−0.05***	0.42***	0.06***	0.50***		−0.24***	−0.03*	−0.22***	−0.02	0.01
6	SIZE	0.13***	−0.24***	−0.18***	−0.21***	−0.22***		0.32***	0.42***	0.15***	−0.03*
7	MTB	−0.01	0.02	0.01	0.02	−0.00	0.03		0.17***	0.10***	0.25***
8	ROA	−0.00	−0.15***	−0.01	−0.16***	−0.18***	0.06***	0.03		0.12***	−0.03*
9	CAPEXP	0.03*	0.16***	0.06***	0.30***	−0.00	−0.02	0.01	−0.06***		−0.01
10	R&D	−0.06***	0.17***	0.01	0.25***	0.28***	−0.10***	0.00	−0.34***	0.01	
Panel B: Brexit uncertainty period											
1	Affected		−0.01	−0.12***	−0.30***	0.11***	0.05*	−0.24***	−0.08***	0.11***	−0.26***
2	ABNCFO	0.00		0.22***	0.34***	0.24***	−0.15***	0.13***	−0.03	0.07***	0.14***
3	ABNREC	−0.12***	0.16***		0.20***	0.25***	−0.27***	0.05*	−0.11***	−0.03	0.12***
4	ABNDE	−0.18***	0.51***	0.27***		0.16***	−0.06**	0.34***	−0.02	−0.04	0.20***
5	ABNACC	0.09***	0.36***	0.21***	0.27***		−0.25***	−0.03	−0.20***	−0.02	0.08***
6	SIZE	0.06***	−0.18***	−0.22***	−0.10***	−0.18***		0.34***	0.40***	0.04	−0.04
7	MTB	−0.01	−0.04	0.01	−0.01	−0.01	−0.01		0.20***	0.05**	0.24***
8	ROA	−0.03	−0.49***	−0.04	−0.30***	−0.43***	0.21***	0.20***		0.09***	−0.07***
9	CAPEXP	0.12***	0.04*	0.12***	−0.02	0.05**	−0.03	−0.01	−0.02		−0.09***
10	R&D	−0.10***	0.24***	0.10***	0.27***	0.11***	−0.11***	0.02	−0.23***	−0.04	

This table presents correlations among the variables used in Eq. (5) separately for the pre-Brexit period (n = 2921) and Brexit uncertainty period (n = 1559). Pearson (Spearman) correlation coefficients are presented in the lower (upper) triangle. *, **, *** represent that the coefficient is significant at 10%, 5%, and 1%, respectively

Table 4 Brexit and earnings manipulation

	ABNCFO		ABNDE		ABNREC		ABNACC	
	Coef	t stat.	Coef	t stat.	Coef	t stat.	Coef	t stat.
Brexit	-0.0175	−1.08	−0.0226	−1.20	−0.0181***	−2.83	0.0068	0.46
Affected	−0.0275***	−3.13	−0.0972***	−9.06	−0.0469***	−5.51	0.0047	0.67
Brexit × Affected	**0.0487*** **	**3.80**	**0.0398*** **	**2.80**	**0.0359*** **	**4.66**	**0.0523*** **	**4.29**
SIZE	−0.0412***	−7.49	−0.0345***	−6.76	−0.0242***	−8.33	−0.0404***	−9.76
MTB	0.0000	0.45	0.0001	1.21	0.0000	0.98	−0.0000	−0.26
ROA	−0.0064	−0.88	−0.0059	−0.87	0.0020	1.35	−0.0042	−0.90
CAPEXP	0.0631	1.33	0.0822	1.21	0.0683	1.13	0.0047	0.57
R&D	0.4031***	7.57	0.6067***	5.16	0.0320**	2.21	0.2257**	2.77
Intercept	0.4280***	8.95	0.4426***	9.58	0.2538***	10.09	0.3804***	10.03
Year dummies	Included		Included		Included		Included	
Adj.R^2	12.32%		16.14%		11.60%		7.87%	
Observations	4037		4037		4037		4037	

The table shows the coefficients from the following difference in differences model: $EM_{it} = \alpha + \beta_1(Brexit_t)$ $\beta_2(Affected_i) + \beta_3(Brexit_t \times Affected_i) + \beta_4(Controls) + \varepsilon_t$

The above regression model is run separately for each measure of earnings management i.e., EM denotes absolute values of abnormal cash flow from operations, abnormal discretionary expenses, abnormal change in receivables, and abnormal accruals using modified Jones model. *Controls* include *SIZE, MTB, ROA, CAPEXP*, and *R&D*. t statistics are robust to heteroskedasticity and autocorrelation. *, **, *** represent that the coefficient is significant at 10%, 5%, and 1%, respectively. All variables are defined in Table 1.

4 Results

4.1 Univariate analysis

Table 2 presents sample descriptive statistics for the pre-Brexit period (Panel A, 2011–2015, n = 2921) and the Brexit uncertainty period (Panel B, 2016–2018, n = 1559). Statistics are presented in aggregate and separately for affected firms and other firms. The results indicate that average sales, total assets, market value of equity, and net income of affected firms are higher compared to other firms. Furthermore, these values show a general increase from the pre-Brexit period to the Brexit uncertainty period for both affected and other firms. However, the measure of financial health, *Z_Score*, shows a notable decline in the Brexit uncertainty period for the affected firms. Table 3 presents Pearson (below the diagonal) and Spearman (above the diagonal) correlations for all variables used in the main regression model, separated between the pre-Brexit period (Panel A) and Brexit uncertainty period (Panel B). All correlation coefficients are lower than 0.8 suggesting that multicollinearity is not a problem in our analysis.

4.2 Difference in differences regression results

The results for the main model are presented in Table 4. To test the research hypothesis, Eq. (4) is run separately for each of the measures of RAM (*ABNCFO*, *ABNDE*, and *ABNREC*). The coefficient on the treatment variable (*Affected*) provides the baseline difference between the treatment group of affected firms and the control group of other firms. The

coefficient on the time variable (*Brexit*) indicates no change in RAM from pre-Brexit to the Brexit uncertainty period for two of the three RAM measures. The estimated coefficient for abnormal receivables (*ABNREC*) suggests less management in the Brexit uncertainty period overall. The coefficient on *Affected* in all three models shows that the estimated difference in RAM between affected firms and other firms is negative and significant in the pre-Brexit period. In other words, affected firms were different in terms of RAM even before Brexit. Our DID estimator is the coefficient on *Brexit*×*Affected*, which is the key variable of interest. The estimated coefficient on the interaction term *Brexit*×*Affected* is 0.0487 (p value < 0.01) with abnormal cash flows from operation (*ABNCFO*) as the dependent variable. We find similar coefficient estimates for *Brexit*×*Affected* with the other two RAM measures: 0.0398 (p value < 0.01) for *ABNDE* and 0.0359 (p value < 0.01) for *ABNREC*. In terms of economic significance, our results suggest that in the Brexit uncertainty period, affected firms exhibit approximately 5% of total assets more abnormal cash flows from operation, 4% of total assets more abnormal discretionary expenditures, and 4% more abnormal change in receivables. Overall, the results for the three measures of RAM suggest an increase in RAM from pre-Brexit to the Brexit uncertainty period for affected firms relative to other firms. These results are consistent with our expectation that firms most adversely affected by Brexit-induced policy uncertainty will engage in more RAM than less affected firms. With regards to control variables, the coefficient on *SIZE* is negative and significant while the coefficients on *ROA* and *CAPEXP* are not significant. These findings are comparable to the results reported by Yung and Root (2019).

4.3 Matched (conditional) difference-in-differences

Combining DID with matching can substantially enhance the quality of results, especially in studies investigating the impact of policy reform (Blundell and Costa Dias 2009). Although matching provides a good estimation of the average treatment effect by enhancing the similarity of observations in the treatment and control groups, it cannot address the impact of time-invariant unobservable variables. This issue is addressed by DID design since it removes bias due to unobservable variables. In matched DID, the treatment and control groups are matched on pre-treatment characteristics to ensure that the two groups are similar in those aspects except for the treatment. In this study we use the control variables used in Sect. 4.2. We perform matched DID by generating matched treatment and control groups and comparing the effect of Brexit on RAM between the two groups before and after the Brexit vote. Such a research design enables us to obtain stronger evidence on the role of Brexit uncertainty by providing a sound basis for causal inference. We use kernel matching suggested by Heckman et al. (1998) to match observations in treatment and control groups. This technique uses a weighted average of the control group to create the counterfactual outcome.[6]

Table 5 reports the results of matched DID. The control variables included in Eq. (4) are used for matching. Consistent with expectation, the results indicate that affected firms show positive DID for the three RAM measures and are significantly positive for *ABNCFO* and *ABNREC* (p values < 0.01). In particular, the results indicate that from pre-Brexit to the Brexit uncertainty period, *ABNCFO* increased by 0.6% (from 11.8 to 12.4%) for affected firms while other firms showed a decrease of 4.2% (from 13.8 to 9.6%). Combining these results suggests that policy uncertainty surrounding Brexit increased *ABNCFO* of affected

[6] Untabulated results indicate that not using the weights will not substantially affect our initial inference.

Table 5 Matched difference in differences

	ABNCFO (n = 3873)			ABNDE (n = 3865)			ABNREC (n = 3868)			ABNACC (n = 3883)		
	n	ATE	t stat.	n	ATE	t stat.	n	ATE	t stat.	n	ATE	t stat.
Pre-Brexit:												
Affected (T)	1420	0.118		1427	0.123		1418	0.042		1434	0.112	
Others (C)	1223	0.138		1223	0.202		1223	0.083		1223	0.104	
Diff. (T-C)		−0.019**	−2.44		−0.080***	−8.69		0.041***	-6.06		0.007	1.04
Brexit:												
Affected (T)	694	0.124		694	0.105		694	0.033		694	0.120	
Others (C)	536	0.096		521	0.162		533	0.039		532	0.059	
Diff. (T-C)		0.028**	2.44		−0.057***	4.28		−0.006	0.64		0.061***	5.78
Diff-in-Diff		**0.048*** **	**3.39**		**0.022**	**1.36**		**0.034*** **	**2.89**		**0.053*** **	**4.19**

This table presents the results of matched DID analysis. The bottom line (Diff-in-Diff) are the matched difference in differences estimation results that compare affected firms and other firms. Kernel matching is used to match the firms. *T* and *C* denote treatment and control groups. *ATE* denotes average treatment effect. *, **, *** represent that the coefficient is significant at 10%, 5%, and 1%, respectively

firms by 4.8% compared to other firms. Both affected and other firms show decreases in *ABNDE*, but relative to other firms, affected firms show an increase of 2.2%; however, this relative increase is not significantly different from zero based on traditional levels of confidence. Turning to *ABNREC*, affected firms exhibit 0.9% decrease after the Brexit vote (from 4.2 to 3.3%) while others experienced a decrease of 4.4% (from 8.3 to 3.9%). The difference between affected and other firms in terms of *ABNREC* is positive and significant at 3.4% (p value < 0.01).

Taken together, the results of matched DID are consistent with our initial DID results suggesting that firms most adversely affected by Brexit uncertainty exhibit higher RAM after the Brexit vote compared to other firms. The advantage of our matched DID design is that it allows us to more confidently attribute the relative RAM increase of affected firms to the impact of Brexit policy uncertainty.

4.4 Additional analysis

4.4.1 Brexit and accruals management

RAM reflects opportunism in financial reporting (Hsu and Liao 2023). To more fully understand earnings management behavior, both key types of earnings management (i.e., accruals management and RAM) should be investigated (see Ewert and Wagenhofer 2005; Hamza and Kortas 2019; Baker et al. 2019). Recent evidence indicates that contrary to the evidence of a reduction in accruals management after the Sarbanes–Oxley Act 2002 (Cohen et al. 2008), accruals management has reverted to previous levels (Espahbodi et al. 2022).

As we expect to observe higher RAM by affected firms after Brexit, we similarly believe that affected firms would exhibit higher accruals management relative to other firms. In order to investigate the impact of Brexit uncertainty on accruals management, we use the modified Jones model (Dechow et al. 1995)[7]:

$$\frac{TACC_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{\Delta S_{i,t} - \Delta REC_{i,t}}{TA_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{TA_{i,t-1}} + \varepsilon_{i,t} \tag{5}$$

where $TACC_{i,t}$ is total accruals measured using earnings minus cash flow from operations in for firm i in year t; is receivables in year t minus receivables in year *t-1*; $PPE_{i,t}$ is gross property, plant, and equipment in year t; and $\varepsilon_{i,t}$ is the residual from the regression. The residual represents discretionary accruals and captures accruals management. Our measure for accruals management uses the absolute value of discretionary or abnormal accruals (*ABNACC)*.

Correlation analysis presented in Table 3 indicates that *ABNACC* is positively correlated with all measures of RAM (*ABNCFO*, *ABNDE*, and *ABNREC*) in both the pre-Brexit and Brexit uncertainty periods. The correlation between *ABNACC* and *Affected* is negative and significant for the pre-Brexit period, while it is positive and significant for the Brexit uncertainty period. This is in line with our expectation that affected firms were more engaged in accruals management after the Brexit vote.

We use Eq. (4) to test the impact of Brexit uncertainty on accruals management by replacing RAM with the measure of accruals management (*ABNACC*). The results are

[7] Untabulated results indicate that using the accruals model from Jones (1991) provides consistent results.

presented in the last column of Table 4 and Table 5. Both the multivariate regression results in Table 4 and the matched DID results in Table 5 suggest that affected firms show higher accruals management during the Brexit uncertainty period relative to other firms. Table 5 indicates that affected firms exhibited an increase of 0.8% (from 11.2 to 12%) in accruals management from the pre-Brexit to the Brexit period, while other firms showed a decrease of 4.5% (from 10.4 to 5.9%), which suggests that affected firms have 5.3% higher *ABNACC* compared to others (p value < 0.01). The regression results from Table 4 demonstrate similar findings: the estimated coefficient on $Brexit \times Affected$ is 0.0523 (p value < 0.01) suggesting that after the Brexit vote, affected firms show approximately a 5% increase in *ABNACC* compared to other firms.

The findings for both types of earnings management suggest that affected firms engage in both RAM and accruals management in response to the policy uncertainty brought on by Brexit. Our results are consistent with the evidence provided by Yung and Root (2019) who find a positive association between policy uncertainty and both accruals- and real activities-based earnings management.

4.4.2 Brexit and the costs of earnings management

In this section, we examine the extent to which the change in RAM and accruals earnings management from the pre-Brexit to the Brexit uncertainty period is attributable to changes in the costs of engaging in earnings management. We measure the costs of RAM and accruals management using the models suggested by Zang (2012).[8] In particular, we estimate the following triple DID models:

$$\begin{aligned} RAM_{it} = {} & \beta_0 + \beta_1(Brexit_t) + \beta_2(Affected_i) + \sum \beta_3 RAM\_COST_{i,t} + \sum \beta_4(RAM\_COST_{i,t} \times Brexit_t) \\ & + \sum \beta_5(RAM\_COST_{i,t} \times Affected_i) + \sum \beta_6(RAM\_COST_{i,t} \times Brexit_t \times Affected_i) \\ & + \sum \beta_7 AM\_COST_{i,t} + \sum \beta_8(AM\_COST_{i,t} \times Brexit_t) + \sum \beta_9(AM\_COST_{i,t} \times Affected_i) \\ & + \sum \beta_{10}(AM\_COST_{i,t} \times Brexit_t \times Affected_i) + \sum \beta_{11} Controls + u_{i,t} \end{aligned} \tag{6}$$

$$\begin{aligned} ABNACC_{it} = {} & \gamma_0 + \gamma_1(Brexit_t) + \gamma_2(Affected_i) + \sum \gamma_3 RAM\_COST_{i,t} \\ & + \sum \gamma_4(RAM\_COST_{i,t} \times Brexit_t) \\ & + \sum \gamma_5(RAM\_COST_{i,t} \times Affected_i) \\ & + \sum \gamma_6(RAM\_COST_{i,t} \times Brexit_t \times Affected_i) + \sum \gamma_7 AM\_COST_{i,t} \\ & + \sum \gamma_8(AM\_COST_{i,t} \times Brexit_t) + \sum \gamma_9(AM\_COST_{i,t} \times Affected_i) \\ & + \sum \gamma_3(AM\_COST_{i,t} \times Brexit_t \times Affected_i) + \gamma_6 EXP\_RAM_{i,t} \\ & + \gamma_{10} UNEXP\_RAM_{i,t} + \sum \gamma_{11} Controls + v_{i,t} \end{aligned} \tag{7}$$

where *RAM_COST* measures the costs of engaging in RAM: specifically, market share, financial health, institutional ownership, and the marginal tax rate. Market share of a firm (*MS*) is measured as the ratio of a firm's sales to total industry sales using the two-digit

[8] We adapted the measures suggested by Zang (2012) to fit our setting. For example, she uses a dummy variable denoting whether an observation belongs to pre- or post-Sarbanes Oxley Act (SOX) as a measure of the cost of earnings management, which is not relevant to our setting.

Table 6 Brexit and costs of earnings management

	Real activities manipulation Eq. (6)		Accruals management equation (7)	
	Coef	t stat.	Coef	t stat.
Costs of real activities manipulation:				
Z_Score × Brexit	−0.0061***	−6.25	0.0101	−1.18
Z_Score × Affected	−0.0051***	−4.08	0.0080	1.10
Z_Score × Brexit × Affected	**0.0053*** **	**2.92**	**−0.0092**	**−1.23**
MS × Brexit	−0.0005	−0.01	−0.0519	−1.19
MS × Affected	0.0490	1.38	−0.1276	−1.48
MS × Brexit × Affected	**0.0056**	**0.10**	**0.0335**	**0.63**
IOWN × Brexit	−0.0002	−0.79	0.0004	1.16
IOWN × Affected	−0.0003	−1.18	0.0004	0.75
IOWN × Brexit × Affected	**0.0003**	**0.75**	**−0.0003**	**−0.54**
MTR × Brexit	0.0002	1.51	−0.0002	−0.99
MTR × Affected	−0.0000	−0.05	−0.0001	−0.60
MTR × Brexit × Affected	**−0.0002**	**−1.62**	**0.0002**	**0.78**
Costs of accruals management:				
BIG_FOUR × Brexit	0.0068	0.42	−0.0056	−0.35
BIG_FOUR × Affected	0.0080	0.51	0.0205	−1.18
BIG_FOUR × Brexit × Affected	**0.0010**	**0.04**	**−0.0073**	**−0.33**
NOA × Brexit	−0.0111	−1.43	0.0562**	2.38
NOA × Affected	0.0059	1.56	−0.0066	−1.02
NOA × Brexit × Affected	**0.0094**	**1.22**	**−0.0552****	**−2.49**
O_Cycle × Brexit	−0.0001*	−1.80	0.0000	0.88
O_Cycle × Affected	−0.0000	−0.30	0.0000	1.01
O_Cycle × Brexit × Affected	**0.0001***	**1.88**	**−0.0000**	**−0.23**
Brexit	0.0374*	1.66	0.0819	−1.56
Affected	0.0195	1.10	−0.0144	−0.43
EXP_RAM			1.7949	1.29
UNEXP_RAM			0.2591***	4.19
Intercept	0.2367***	5.04	−0.3089	−0.94
Controls	Included		Included	
Year Indicators	Included		Included	
Adj. R^2 (%)	16.49%		13.40%	
Observations	1959		1959	

This table reports the coefficients from the following equations:

$$\begin{aligned} RAM_{it} =& \beta_0 + \beta_1(Brexit_t) + \beta_2(Affected_i) + \sum \beta_3 RAM\_COST_{it} \\ &+ \sum \beta_4(RAM\_COST_{it} \times Brexit_t) + \sum \beta_5(RAM\_COST_{it} \times Affected_i) \\ &+ \sum \beta_6(RAM\_COST_{it} \times Brexit_t \times Affected_i) + \sum \beta_7 AM\_COST_{it} \\ &+ \sum \beta_8(AM\_COST_{it} \times Brexit_t) + \sum \beta_9(AM\_COST_{it} \times Affected_i) \\ &+ \sum \beta_{10}(AM\_COST_{it} \times Brexit_t \times Affected_i) + \sum \beta_{11} Controls + u_{it} \end{aligned} \quad (6)$$

Table 6 (continued)

$$
\begin{aligned}
ABNACC_{it} =& \gamma_0 + \gamma_1(Brexit_t) + \gamma_2(Affected_i) + \sum \gamma_3 RAM\_COST_{it} \\
&+ \sum \gamma_4(RAM\_COST_{it} \times Brexit_t) + \sum \gamma_5(RAM\_COST_{it} \times Affected_i) \\
&+ \sum \gamma_6(RAM\_COST_{it} \times Brexit_t \times Affected_i) \\
&+ \sum \gamma_7 AM\_COST_{it} + \sum \gamma_8(AM\_COST_{it} \times Brexit_t) \\
&+ \sum \gamma_9(AM\_COST_{it} \times Affected_i) \\
&+ \sum \gamma_3(AM\_COST_{it} \times Brexit_t \times Affected_i) + \gamma_6 EXP\_RAM_{it} \\
&+ \gamma_{10} UNEXP\_RAM_{it} + \sum \gamma_{11} Controls + v_{it}
\end{aligned} \tag{7}
$$

Where RAM_COST denotes the costs of engagement in real activities manipulation which includes market share (MS_{t-1}), financial health (Z_SCORE_{t-1}), institutional ownership ($IOWN_{t-1}$) and marginal tax rate (MTR_t). AM_COST denotes the costs of involvement in accruals management including use of Big Four Auditors (BIG_FOUR_t), net operating assets (NOA_{t-1}) and operating cycle period (OC_{t-1}). RAM_t denotes real activities manipulation measured by abnormal cash flow from operations. In Eqs. (6) and (7), size ($SIZE_t$), growth (MTB_t) and financial performance (ROA_t) are controlled for. EXP_RAM_t denotes the expected level of real activities manipulation measured by the fitted value in Eq. (6) and $UNEXP\_RAM_t$ denotes the unexpected level of real activities manipulation measured by the residual from Eq. (6). For brevity sake, only the interactions involving costs of earnings management are reported. *t* statistics are robust to heteroskedasticity and autocorrelation. *, **, *** represent that the coefficient is significant at 10%, 5%, and 1% level, respectively. All variables are defined in Table 1

SIC code at the beginning of the period. The higher the market share, the lower the cost of engaging in RAM. Financial health is captured by lagged Altman's Z-score (*Z_Score*; Altman 1968) where financially healthier firms are expected to bear lower RAM costs. Institutional ownership (*IOWN*) is measured by the percentage of institutional ownership at the beginning of the period and is expected to curb RAM (e.g., Sakaki et al. 2017). The last measure of RAM cost is marginal tax rate (*MTR*), which is measured by effective tax rate in year *t*. Higher *MTR* and *IOWN* imply higher costs of engaging in RAM.

AM_COST denotes the costs of engaging in accruals management. Our proxies are: the use of a Big-4 auditor (*BIG_FOUR*) and two metrics of accounting flexibility, specifically lagged net operating assets (*NOA*) and lagged operating cycle period (*O_Cycle*). Big-4 auditors increase the cost of accruals management since they are expected to conduct high quality audits, while higher flexibility of accounting systems is expected to decrease the cost of accruals management. In Eqs. (6) and (7), we control for firm size (*SIZE*), growth (*MTB*) and financial performance (*ROA*). The expected (*EXP_RAM*) and unexpected (*UNEXP_RAM*) levels of RAM are included in Eq. (7) as they can affect the level of accruals management. *EXP_RAM* denotes the fitted value from Eq. (6) and *UNEXP_RAM* denotes the residual from Eq. (6).

The results are presented in Table 6. We generally find insignificant results for the triple-difference terms (i.e., the product of *Brexit*, *Affected*, and *RAM_COST* or *AM_COST*). The results for Eq. (6) show that the triple-differences for *MS*, *IOWN*, *MTR*, *BIG_FOUR* and *NOA* are insignificant, while those for *Z-Score* (p value < 0.01) and *O_Cycle* (p value < 0.1) are significant. In Eq. (7), all triple-differences (i.e., *Z-Score*, *MS*, *IOWN*, *MTR*, *BIG_FOUR*, and *O_Cycle*) are insignificant except for *NOA* (p value < 0.05). The interactions between the costs of earnings management and *Affected* indicate that costs are generally not significantly different between affected and other firms. Furthermore, the generally insignificant coefficients on interactions between costs and *Brexit* show that most costs have not changed from the pre-Brexit to the Brexit uncertainty period. Overall, these findings

Table 7 Goods firms vs. service firms

Panel A: Matched Difference in Differences for service firms

	ABNCFO (n = 739)			ABNDE (n = 739)			ABNREC (n = 748)			ABNACC (n = 740)		
	n	ATE	t stat.	n	ATE	t stat.	n	ATE	t stat.	n	ATE	t stat.
Pre-Brexit:												
Affected (T)	378	0.069		385	0.100		385	0.025		380	0.059	
Others (C)	109	0.054		109	0.152		109	0.023		109	0.028	
Diff. (T-C)		0.015*	1.83		−0.052***	−3.67		0.002	0.65		0.031***	6.91
Brexit:												
Affected (T)	203	0.092		199	0.094		200	0.020		197	0.049	
Others (C)	49	0.049		46	0.176		54	0.017		163	0.034	
Diff. (T-C)		0.043***	3.58		−0.083***	3.97		0.003	0.80		0.015***	2.34
Diff-in-Diff		**0.028***	**1.92**		**−0.031**	**1.22**		**0.001**	**0.28**		**−0.016****	**2.12**

Panel B. Matched Difference in Differences for goods firms

	ABNCFO (n = 3087)			ABNDE (n = 3072)			ABNREC (n = 3071)			ABNACC (n = 3068)		
	n	ATE	t stat.	n	ATE	t stat.	n	ATE	t stat.	n	ATE	t stat.
Pre-Brexit:												
Affected (T)	999	0.138		1002	0.126		1005	0.049		998	0.129	
Others (C)	1112	0.153		1112	0.212		1112	0.091		1112	0.118	
Diff. (T-C)		−0.015	−1.49		−0.087***	−7.63		−0.041***	−5.34		0.010	1.14
Brexit:												
Affected (T)	476	0.135		476	0.103		476	0.038		476	0.150	
Others (C)	500	0.099		482	0.163		487	0.043		482	0.062	
Diff. (T-C)		0.037**	2.54		−0.060***	3.59		−0.005	0.41		0.088***	6.56
Diff-in-Diff		**0.052*****	**2.94**		**0.027**	**1.31**		**0.037*****	**2.65**		**0.078*****	**4.79**

This table presents the results of matched DID analysis. The bottom line (Diff-in-Diff) are the matched difference in differences estimation results that compare affected firms and other firms. Kernel matching is used to match the firms. *T* and *C* denote treatment and control groups. *ATE* denotes average treatment effect. *,* *, *** represent that the coefficient is significant at 10%, 5%, and 1%, respectively

collectively suggest that the costs of earnings management have not significantly changed after the Brexit vote, thus they are not likely to have influenced the earnings management behaviors of affected firms versus other firms. Put simply, these findings suggest that earnings management costs do not drive the earlier results thus supporting our hypothesis.

4.4.3 Service firms versus goods firms

Service firms have different mechanisms available to them for managing earnings compared to goods firms. For example, service firms do not generally carry inventory so they cannot manage earnings by overproducing inventory. This section explores whether earnings management behaviors for affected versus other firms differ between service and goods firms. Classification of firms into service or goods firms is based on industry membership and is provided in Appendix 1. Table 7 reports the results of matched DID separately for service and goods firms. The results for goods firms are consistent with the initial findings for the entire sample. In contrast, service firms exhibit some different results. While we find similar, but weaker, results for abnormal cash flows from operation (*ABNCFO*; p value < 0.1), we find insignificant results for abnormal discretionary expenditures (*ABNDE*) and abnormal receivables (*ABNREC*). We note that testing power could be an issue with service firms since they represent less than 20% of our complete sample. In the last column, we find that affected service firms demonstrate lower levels of accruals management post-Brexit relative to other firms, contrary to the results for goods firms and the entire sample. Untabulated results investigating the costs of engaging in earnings management separately for service and goods firms are consistent with our conclusions for the entire sample, specifically that differing costs of earnings management do not drive the results. Overall, these results imply that goods firms react to policy uncertainty with increases in earnings management behavior to a greater extent than service firms.

5 Conclusion

Our study provides evidence of increased earnings management activity by British firms in response to the policy uncertainty brought about by Brexit. Brexit has been the center of political and economic debate in the UK in recent years and has exposed UK firms to immense uncertainty about the future, which in turn influences firms' behaviors and financial reporting choices and outcomes. Using several measures of RAM and a DID research design, we show that firms most adversely affected by Brexit uncertainty demonstrate higher RAM compared to less affected firms. Our results for accruals management demonstrate a similarly consistent relationship. We show that differing costs of earnings management activities do not appear to drive our findings. Additional analysis reveals that goods firms react more strongly to the uncertainty brought by Brexit relative to service firms. Future earnings management studies could further investigate the differences in earnings management activities between service and goods firms.

One caveat of our study is that Brexit is perhaps not the only driver of uncertainty in the UK over the sample period. In addition to domestic drivers, international factors such as threats by US president Trump to breach international agreements may have also contributed to the overall policy uncertainty to which UK firms were exposed (Faccini and Palombo 2019). We do not attempt to isolate the impact of different potential sources of uncertainty and believe that Brexit represents the main source of uncertainty for UK firms

over our sample period. A survey by Bloom et al. (2019a) shows that UK firms reported high degrees of Brexit uncertainty through to two years after the vote. Overall, these findings suggest that Brexit was the main driver of uncertainty in the UK over our study period. Therefore, we believe this possible limitation does not undermine our analysis.

In summary, our study uses Brexit as an uncertainty shock to the British economy to gauge the impact of Brexit-driven policy uncertainty on earnings manipulations by British firms. Our findings indicate that British firms used the costly practice of RAM in response to Brexit, which suggests that policymakers and financial statement users should be vigilant of potential suboptimal financial decisions induced by policy uncertainty.

Appendix 1: Range of change in GVA by World Input–Output Database (WIOD) sectors

WIOD Sectors	Classification	Range of change in GVA
Sectors most affected by Brexit uncertainty:		
Education	Services	−0.59
Agriculture, hunting, forestry and fishing	Goods	−0.24
Mining and quarrying	Goods	−0.53
Construction	Services	−0.6
Textiles and textile products; leather, leather and footwear	Goods	0.27
Wood and products of wood and cork	Goods	−0.46
Pulp, paper, printing and publishing	Goods	−0.57
Chemicals and chemical products	Goods	−0.52
Coke, refined petroleum and nuclear fuel	Goods	−0.46
Rubber and plastics	Goods	−0.54
Other non-metallic mineral	Goods	0
Electrical and optical equipment	Goods	0.40
Transport equipment	Goods	−0.57
Other supporting and auxiliary transport activities; activities of travel agencies	Services	−0.63
Electricity, gas and water supply	Services	−0.62
Retail trade, except of motor vehicles and motorcycles; repair of household goods	Services	−0.63
Real estate activities	Services	−0.6
Health and social work	Services	−0.59
Other sectors:		
Inland transport	Services	−0.67
Food, beverages and tobacco	Goods	−0.67
Basic metals and fabricated metal	Goods	−1.64
Machinery, not elsewhere specified	Goods	−0.67
Manufacturing, not elsewhere specified; recycling	Goods	−0.94
Water transport	Services	−0.64
Air transport	Services	−0.67
Post and telecommunications	Services	−0.74

WIOD Sectors	Classification	Range of change in GVA
Retail sale of fuel; wholesale trade, commission trade, motor vehicles and motorcycles	Services	−0.67
Financial intermediation	Services	−0.76
Hotels and restaurants	Services	−2.00
Renting of machinery and equipment and other business activities	Services	−0.81
Public admin, defence, social security and other public service	Services	−0.71

Notes: This table shows how sectors most adversely affected by Brexit uncertainty are identified using range of change in gross value added (GVA)based on GVA under two scenarios: pessimistic scenario (hard Brexit) and optimistic scenario (soft Brexit) (see Dhingra et al. 2017). Range of change in GVA is computed as soft Brexit GVA minus hard Brexit GVA divided by the probability-weighted change in GVA. Under the soft Brexit scenario, it is assumed that the UK remains in the Single Market and negotiates a deal with zero tariffs while non-tariff barriers increase to 25% of the reducible barriers for the US exporters, and the UK do not fully benefit from additional EU market integration. The hard Brexit scenario assumes that the UK and EU trade under Word Trade Organization rules, non-tariff barriers increase to 75% of the reducible barriers for the US exporters, and the UK do not fully benefit from additional EU market integration. We assume that the probability of each scenario is 50% and calculate the probability-weighted change in GVA. Industries below the median change in GVA are considered as more affected by Brexit uncertainty. We then convert WIOD sectors into two-digit SIC industries.

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