The Impact of Anti-Money Laundering Regulations on Small and Medium-Sized Enterprises' Access to Credit: A Case Study of the UK

By
Csenge Sótér

Submitted to Central European University - Private University
Department of Undergraduate Studies

In partial fulfilment of the requirements for the degree of Bachelor of Arts of Philosophy, Politics, and Economics

Supervisor: Tomy Lee

Vienna, Austria
2025

Copyright Notice

[1]

For bibliographic and reference purposes this thesis should be referred to as: Sótér, C. 2025. The Impact of Anti-Money Laundering Regulations on Small and Medium-Sized Enterprises' Access to Credit: A Case Study of the UK. BA thesis, Department of Undergraduate Studies, Central European University, Vienna.

[1] Icon by Font Awesome.

Author's declaration

I, the undersigned, **Csenge Sótér**, candidate for the BA degree in Philosophy, Politics and Economics declare herewith that the present thesis titled "The Impact of Anti-Money Laundering Regulations on Small and Medium-Sized Enterprises' Access to Credit: A Case Study of the UK" is exclusively my own work, based on my research and only such external information as properly credited in notes and bibliography. I declare that no unidentified and illegitimate use was made of the work of others, and no part of the thesis infringes on any person's or institution's copyright.

I also declare that no part of the thesis has been submitted in this form to any other institution of higher education for an academic degree.

Vienna, 23 May 2025

Csenge Sótér

Abstract

This thesis investigates the impact of the UK's 2017 anti-money laundering regulations (AMLD4) on the credit-seeking behavior of small- and medium-sized enterprises (SMEs). Using firm-level data from the UK SME Finance Monitor (2014-2019), the study employs a difference-in-differences (DiD) approach with both dynamic and pooled specifications to compare loan and commercial mortgage application behavior between micro/small and medium-sized firms before and after the policy implementation. Contrary to the initial hypothesis and existing literature, results suggest that micro and small firms were slightly more likely to apply for loans after AMLD4, while medium-sized firms' applications relatively declined. However, application rates decreased across all firm sizes over the observed years, indicating a broader downward trend in SME credit demand. The study acknowledges the potential influence of Brexit, AMLD5, and macroeconomic uncertainty, which were excluded from the empirical analysis but are considered in the discussion. Findings reveal that while AMLD4 may not have disproportionately discouraged smaller firms, overall SME loan application behavior is extremely complex, and influenced by regulatory, economic, and behavioral factors. The thesis also highlights methodological limitations, such as survey gaps and sample imbalance, and concludes with policy recommendations to support SME access to finance while maintaining effective AML oversight.

Table of Contents

List of Figures:

List of Tables:

List of Equations:

1. Introduction

Small and Medium Sized Enterprises (SMEs) form a critical part of national economic growth in all OECD countries, as they are responsible for the employment of a large section of the labor force and for fostering innovation (OECD 2025). The United Kingdom (UK) is no exception to these global trends. In 2024, SMEs accounted for 99.8% of all private sector businesses and employed 60% of the labor force (UK Government 2024). Therefore, it is essential to create and uphold an economic environment where SMEs do not just survive but have the ability to expand and grow. To guarantee this, their success largely depends on access to external finance, particularly traditional bank lending, which remains their primary source of funding despite the recent rise in alternative financing options (Brown, Liñares-Zegarra, and Wilson 2022).

Despite their importance, SMEs in the UK rarely secure external finance. Between Q1 and Q3 of 2024, only 1.5% of SMEs applied for bank loans in the UK, a strong contrast to an application rate of close to 20% in the Eurozone (Department for Business & Trade and HM Treasury 2025). Differences in regulatory environments, more specifically the increasing costs, and requirements arising from anti-money laundering (AML) regulations, may be a contributing factor to this disparity.

Following the 2008 financial crisis, stricter regulations were introduced for financial institutions to avoid a similar collapse in the future (Durner and Shetret 2015). Among these policies are AML regulations, which have gained much attention in recent years from policymakers and academic researchers as they expanded in their scope and intensity (Khelil, Khlif, and Achek 2023). AML

regulations aim to maintain the integrity of the financial system, economic growth, and stability by reducing financial crime (European Commission 2024).

While achieving these goals is vital, their unintended consequences, such as imposing significant compliance costs on financial institutions have raised concerns. Banks might pass these on to borrowers, through higher fees, stricter lending criteria or even reducing access to financial services for certain clients (Durner and Shetret 2015). This change can result in a more challenging or costly lending process, especially for smaller market participants due to their unfamiliarity with navigating complex financial procedures. The UK transposed the EU's 4th AML Directive (AMLD4), with "The Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017." This regulation, is considered an important and remarkable evolution of the UK's previous AML regulations, as it created significant changes, including heavy compliance burdens for regulated entities (Karolos Seeger and Andrew H.W. Lee 2017).

Substantial research has focused on how AML regulations affect financial institutions in general, especially in terms of compliance costs and risk aversion (Durner and Shetret 2015; UK Finance 2021). A growing body of literature has examined the financing constraints faced by SMEs, with studies attributing borrower discouragement to firm-level characteristics, macroeconomic conditions and banking factors (Mac an Bhaird, Vidal, and Lucey 2016; Freel et al. 2012). While some studies address regulatory complexity as a factor influencing SMEs' financial behavior (Mac an Bhaird, Vidal, and Lucey 2016), the role of specific regulatory changes, such as AML regulations, has not been explicitly examined as a barrier to SME credit access, particularly in the UK context. Thus, there is a need for empirical analysis that isolates the effect of AML regulations on SME lending in the UK to understand how these firms behave following the introduction of stricter AML regulations.

Therefore, this thesis investigates the impact of AML regulations on SME access to finance in the UK, using the implementation of the "The Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017" as a case study. Consequently, the study aims to answer the following sub-questions: **1. "Did the UK AML regulations introduced in 2017 impact micro and small firms relatively more than medium-sized firms?"** and **2. "Has the implementation of UK AML regulations in 2017 impacted SME loan application behavior?"**

The following hypotheses are tested: 1. SMEs, especially micro and small enterprises, are more likely to be discouraged from applying for credit due to increased compliance requirements and regulatory complexity, relative to medium-sized firms; and 2. the transposition of AMLD4 led to a decline in SME loan and mortgage application rates due to borrower discouragement and supply-side exclusion.

The empirical analysis relies on quarterly, firm-level data covering several years from the UK SME Finance Monitor (BVA BDRC 2024). The study uses a difference-in-differences (DiD) design to estimate the treatment effect of AMLD4 on SME loan and mortgage application behavior across firm types. Dynamic specifications and pooled regressions are estimated with both Ordinary Least Squares (OLS) and logit models to test the robustness of results. My results indicate that micro- and small-sized firms were slightly more likely to apply after AMLD4 implementation, relative to medium-sized firms. However, all SME loan applications significantly declined over the observed years. It is important to note that several major developments followed the 2017 AML reforms, including Brexit, the transposition of the EU's Fifth AML Directive, and the COVID-19 pandemic. These events caused either a change in the AML regulation frameworks or economic disruptions, which may have affected SME lending behavior independently. These developments are excluded

from the empirical analysis to maintain focus on AMLD4, but they are acknowledged when interpreting the results.

The remainder of this thesis is structured into 6 sections. Section 2 presents institutional and regulatory background, highlighting the importance of SMEs and establishing the AML regulatory framework in the UK. Section 3 reviews the existing literature on SME discouragement trends (Section 3.1) and the impact of AML compliance burden on financial institutions (Section 3.2). Section 4 outlines the research methodology, including data processing, difference-in-differences design, and diagnostics checks. Section 5 presents the empirical results and discusses their implications and limitations. Section 6 concludes with a summary of the key findings and recommendations for future research.

2. Context

To analyze the impact of AML regulations on SME lending in the UK, it is essential to first establish the policy and economic context. This section begins by outlining the threats of money laundering, followed by a discussion of the evolution of AML regulations in the UK. Then, it discusses the increasing complexity and cost of regulatory compliance and concludes with an overview of the economic importance of SMEs in the UK.

2.1 The UK's AML Challenge: Motivation and Response

Money laundering poses a significant social and economic threat to the global economy, including the UK. The National Crime Agency highlights that money laundering facilitates the vast majority of organized crime in the country, posing a significant threat to jeopardizing not just financial stability but also national security (National Crime Agency 2025). As it is a criminal activity, there are no exact measures of its severity in the UK; however, it is estimated that its effect is several hundred billion pounds each year (National Crime Agency 2025).

The UK's anti-money laundering framework has developed significantly in the past decades, as a response to the 2008 financial crisis, rapid globalization, and technological advancements amplifying the scale and threats associated with money laundering (Durner and Shetret 2015; Financial Crime Academy 2025). Most of its policies are based on international standards and the transposition of EU Directives. International authorities recognize that the UK "has a well-developed and robust regime to effectively combat money laundering and terrorist financing," while noting that supervision needs to be improved, and financial intelligence units require more resources. (Financial Action Task Forces 2022)

Before the UK left the European Union (EU), the country was required to transpose EU Directives, including those aiming to eliminate money laundering threats. The two most significant EU Directives regarding AML regulations in the previous decade were the 4th and 5th Anti-Money Laundering Directives. On 25 June 2015, the "4th Anti-Money Laundering Directive (Directive (EU) 2015/849)" (AMLD4) entered into force, and it was amended by the "5th Anti-Money Laundering Directive (Directive (EU) 2018/843)" (AMLD5), which took effect on 9 July 2018 (European Commission 2024). The UK transposed AMLD4 with the related regulations coming into force on 26th June 2017 and subsequently updated them numerous times. The most significant changes were when AMLD5 was transposed on 10 January 2020, and when the transition period following Brexit ended on 31st December 2020 (HM Revenue & Customs 2025; Financial Conduct Authority 2023). Following Brexit, the content of the regulations did not change significantly, but references to the EU were removed, and the country no longer needed to comply with EU guidelines. Consequently, the Financial Conduct Authority (FCA) became the main supervisory authority for financial institutions in the UK. (HM Revenue & Customs 2025) These regulatory shifts introduced numerous new compliance obligations for financial institutions, which significantly raised the cost and complexity of banking operations.

2.2 The Compliance Burden on Financial Institutions

The transposition of AMLD4 into UK law significantly expanded the scope of existing AML regulations. The key regulatory elements include stricter customer due diligence (CDD), comprehensive record-keeping of transactions, the reporting of suspicious activity, personal training, compliance with sanctions, and the implementation of a risk-based approach (Davies 2023). The CDD procedure involves the Know Your Customer (KYC) checks and the collection of beneficial ownership information, which aim to verify the legitimacy of clients, and they must

be followed by continuous monitoring throughout the business relationship. Moreover, financial institutions need to maintain large compliance and audit departments to avoid strict penalties for violations (Durner and Shetret 2015).

As a result, financial institutions need to allocate substantial funds to ensure compliance with AML regulations. LexisNexis and Oxford Economics report that banks and FinTechs in the UK spent £38.4 billion in 2023 on ensuring compliance with AML regulations while noting that these costs keep increasing rapidly year-to-year (Oxford Economics 2024).

2.3 The UK SMEs and Their Access to Finance

SMEs are defined in the UK as firms that "1. must employ fewer than 250 staff; 2. have less than or equal to £44 million in annual turnover or a balance sheet total of less than or equal to £38 million" (UK Government 2024). In addition, ownership status must be also taken into account. Businesses can be classified as independent, linked, or substantially connected; consequently, the calculation of their staff, annual turnover, and balance sheet changes. (UK Government 2025) Since the UK left the EU, the definition has been updated; however, no significant changes have been made.

The UK Government also recognizes that SMEs contribute considerably to the country's GDP, and employment, while also fostering innovation, being active in local communities, and promoting diversity (Department for Business & Trade and HM Treasury 2025). The Department for Business & Trade and HM Treasury underlined that accessing financing is essential for SMEs for business investment, growth, and innovation; therefore, it is a core policy issue (Department for Business & Trade and HM Treasury 2025).

Given the SMEs' critical role in economic output and employment, even a small reduction in credit availability can have significant consequences for long-term growth. And while AML regulations are essential for preventing financial crimes, their indirect consequences might limit the legitimate financial needs of SMEs. This thesis explores how these competing policy goals have intersected, particularly following the regulatory changes in 2017.

3. Literature Review

This section reviews the existing literature that underlines the relationship between AML regulations and SME access to external finance. It distinguishes between the demand-side constraints, such as borrower discouragement, and supply-side dynamics, particularly how banks respond to rising compliance costs. The aim is to assess how existing research explains the potential unintended consequences of AML regulations for SMEs and to identify where further investigation is needed to support the focus of this thesis.

3.1 SME Discouragement

To understand how AML compliance costs might influence SME access to credit, it is necessary to first examine the broader issue of borrower discouragement. Two key studies, by Freel et al. (2012) and Mac an Bhaird, Vidal, and Lucey (2016), provide a foundation for analyzing how firm-specific characteristics, macroeconomic factors, banking industry characteristics, and regulatory complexities shape SMEs' willingness to seek external finance.

Borrower discouragement, a phenomenon where businesses choose not to apply for loans due to fear of rejection, is a significant constraint SMEs face. Freel et al. (2012) found that SMEs in the UK are twice as likely to be discouraged from applying for a loan than to experience actual rejection. The authors identify two main causes: information asymmetry and application costs, which include both financial and psychological costs (Freel et al. 2012). Mac an Bhaird, Vidal, and Lucey (2016) expand this analysis and investigate borrower discouragement among SMEs in nine Eurozone countries. They establish that many firms engage in self-selection due to their fear of possible application rejection and identify numerous factors intensifying this phenomenon (Mac an Bhaird, Vidal, and Lucey 2016).

Both papers emphasize the role of firms' age and size in borrower discouragement (Mac an Bhaird, Vidal, and Lucey 2016; Freel et al. 2012). They argue that one of the most defining problems for SMEs seeking external financing is information asymmetry, which larger and older SMEs can more easily overcome. They typically have greater assets, longer credit history, and an established relationship with their banks, which reduces their perceived risk. (Mac an Bhaird, Vidal, and Lucey 2016; Freel et al. 2012). These findings are directly relevant for my analysis, as they help explain why smaller firms may be more sensitive to changes in regulatory environment, such as increased AML compliance costs.

In contrast, smaller and younger firms usually do not have these advantages, face relatively higher application costs, and are more likely to believe they will be rejected, which can result in self-exclusion (Mac an Bhaird, Vidal, and Lucey 2016). Mac an Bhaird, Vidal, and Lucey (2016) also establish that firms' size plays a more important role than age in borrower discouragement, indicating that application costs place a relatively higher burden on smaller firms. This is particularly important for my research, as I investigate whether AML compliance costs worsen borrower discouragement, especially for smaller firms. As these costs increase, banks may impose stricter requirements and charge higher fees. Thus, I hypothesize that AML compliance costs have a stronger negative effect on bank lending to micro- and small-sized enterprises than to medium-sized firms.

Mac an Bhaird, Vidal, and Lucey (2016) also assert that a less concentrated banking system, where competition is higher and banking relationships are weaker, correlates with higher borrower discouragement. However, the UK can be considered a highly concentrated market, especially when it comes to SME banking. The four largest banks in the UK (Barclays, HSBC, Lloyds Banking Group, and Royal Bank of Scotland) provide almost 90% of SME loans by volume in the

country (Sally Percy 2025). As UK SMEs also value long-standing banking relationships (Mac an Bhaird, Vidal, and Lucey 2016), this factor is unlikely to explain borrower discouragement and is therefore not included in the empirical analysis.

Another key finding from Mac an Bhaird, Vidal, and Lucey (2016) is that higher regulatory quality results in increased borrower discouragement. While better regulation helps reduce moral hazard and adverse selection by screening out less credit-worthy borrowers (Mac an Bhaird, Vidal, and Lucey 2016), too rigid and complex regulatory environments may discourage even 'good' borrowers. Recent data supports this concern: in 2024, 36% of SME businesses believed that securing finance was challenging, and almost 80% asserted that they preferred slower growth to avoid borrowing (BVA BDRC 2025). These findings suggest that stricter regulatory frameworks, such as AML requirements, may unintentionally discourage even credit-worthy borrowers, as they may perceive the lending process as too costly or complex.

While existing literature primarily attributes borrower discouragement to firm-level characteristics, macroeconomic, and banking factors, it does not explicitly examine how AML regulations influence credit access among SMEs. This thesis aims to address this gap by examining whether recent AML regulations, especially AMLD4, have disproportionately affected SME access to finance in the UK.

3.2 Impact of AML Compliance on Financial Institutions

In 2024, fewer than half of all SME funding applications were successful, with smaller firms facing a higher likelihood of rejection (BVA BDRC 2025). This limited access to credit highlights the need to consider not only borrower behavior, but also supply-side constraints, particularly, how financial institutions change their lending behavior under increasing regulatory pressure.

Following the 2008 financial crisis, governments responded to public criticism of regulatory failure by strengthening oversight, including introducing more stringent AML regulations (Durner and Shetret 2015). Durner and Shetret (2015) argue that these measures increased compliance costs and fines for violations, resulting in banks adopting "de-risking" strategies. Instead of effectively managing risks, banks began scaling back on their risk appetite and reevaluated their client base based on profitability (Durner and Shetret 2015; UK Finance 2021). This shift has important implications for SME access to finance, as they are often considered as a risky and low-profit-yielding client base (Mac an Bhaird, Vidal, and Lucey 2016).

The UK Finance (2021), representing over 300 financial institutions, similarly highlights that financial institutions increasingly assess clients not just based on credit worthiness but also based on costs of compliance. For low-return clients, the cost of compliance may exceed the expected revenues, making them an unattractive client base for financial institutions (UK Finance 2021). This risk reassessment of client profitability is central to how AML compliance indirectly affects SMEs' access to financial services.

Smaller firms are often viewed as riskier due to shorter credit histories and limited collateral (Mac an Bhaird, Vidal, and Lucey 2016), and they are less able to compensate for banks' rising compliance costs through larger loan volumes. Consequently, banks may avoid lending to SME clients, leading to reduced credit availability or more expensive services. Thus, "de-risking" worsens the administrative burdens and perceived possibility of rejection SMEs face, further reinforcing borrower discouragement. This interaction between institutional "de-risking" and borrower discouragement forms a key focus of my analysis.

Existing literature has acknowledged the broader consequences of regulatory compliance and its effects on numerous market participants, but it has largely overlooked the specific effects on

SMEs' access to external funding. Thus, this thesis aims to assess whether AML compliance costs have disproportionately constrained lending to SMEs in the UK.

Therefore, it is hypothesized that the rising compliance costs led to a decline in SME credit demand due to borrower discouragement, which is exacerbated by the consequences of "de-risking". Furthermore, these trends may have a stronger negative impact on lending to micro- and small-sized enterprises. These hypotheses are explored using the empirical methods in the analysis that follows.

4. Methodology

To understand how tighter AML regulation affected SMEs' access to finance in the UK, more specifically, whether the likelihood of micro- and small-sized enterprises applying for bank loans and mortgages changed relative to medium-sized enterprises after AMLD4 entered into force, the following methods will be used. The analysis uses a difference-in-differences (DiD) framework with both dynamic and pooled specifications. Both, an Ordinary Least Squares (OLS) model and a Logit model are used to estimate the regulatory effect while controlling for firm characteristics.

4.1 Data Source and Preprocessing

The analysis is based on data from the Small- and Medium-Sized Enterprise (SME) Finance Monitor, 2011–2023, collected by BVA BDRC and accessed via the UK Data Service (BDRC Continental 2024). The SME Finance Monitor conducts nationally representative quarterly surveys of UK SMEs and includes detailed information on firm size, sector, region, demographics, and financial behavior, including loan and commercial mortgage applications. The SME Finance Monitor provides independent and reliable data, often used by the UK Government. (BVA BDRC 2024)

For this study, only data from Q3 2014 to Q2 2019 are used to focus on periods immediately before and after the policy implementation (June 2017). It is essential to note that responses to two crucial survey questions; loan and mortgage applications, are not available for any of the quarters in 2017. This creates a gap between the pre- and post-treatment periods, which must be taken into consideration when interpreting the results. Therefore, 2016 Q4 is used as the final pre-treatment quarter, and the post-treatment period begins in 2018 Q1, even though the policy took effect on

26th June 2017. I created dummy variables for the policy periods, where it takes the value of 1 if the loan application happened between 2018 Q1 and 2019 Q2.

Due to structural changes in the survey across waves, variables had to be standardized. Key variables were mapped to consistent definitions between the two periods. Notably, loan and commercial mortgage applications were reconstructed and converted into binary indicators. Thus, 'loan_applied' is the primary variable of interest, and it equals 1 if the firm applied for a new loan or commercial mortgage in the past 12 months. It is important to note that SMEs also use other types of external financing, mainly overdrafts (BVA BDRC 2019), but they are excluded from the analysis due to their differing risk characteristics, as they might qualify for simplified customer due diligence processes under Regulation 37 of the "Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017 " (UK Government 2017, Regulation 37).

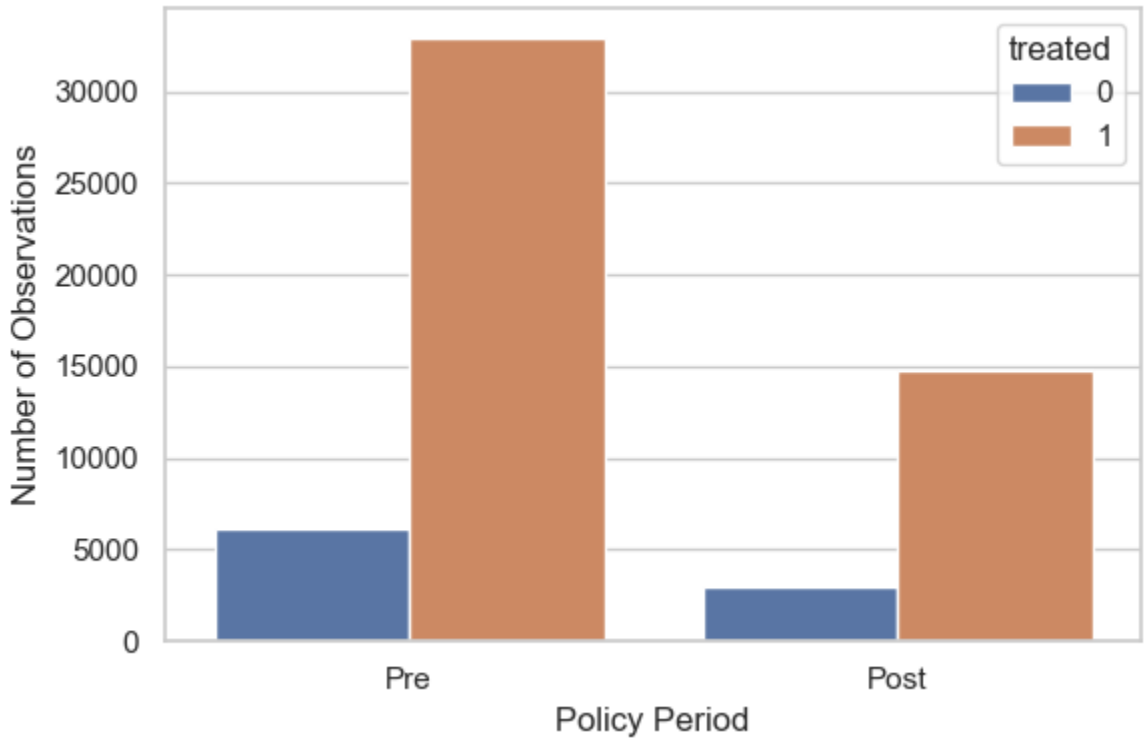
The key control variables were turnover, risk factor, and employment category. Turnover represents the annual turnover from the previous financial year and was converted from categorical variables to numeric midpoints to use as a continuous control variable. Sample providers contributed the risk ratings (BVA BDRC 2025), which were converted into a numeric scale (1-4), where 1 stands for minimal risk and 4 means above average risk. The firm size was originally reported as categorical variables, which I mapped into Micro, Small, and Medium groups according to UK SME business definitions (UK Government 2025); thus, new categorical variables were created. The treatment group is constrained to Micro and Small groups (fewer than 50 employees), while the control group is the Medium group (50 and 249 employees).

Quarter identifiers were extracted from the 'dwave' string variable and set into a standardized 'grouped_quarter' format. Moreover, Q1 and Q2 of 2019 were combined into a single period

(2019_H1) due to limited observations. All employment categories and quarter dummies were included as fixed effects in the regression models.

Throughout the data cleaning process, firms missing responses to these questions were dropped from the dataset to ensure a more robust result. The final dataset consists of 56,752 firm-quarter observations, covering the period Q3 2014 to Q2 2019, excluding all four quarters in 2017. The treatment group has 47,622 observations and the control group has 9,130 observations. Figure 4.1 shows the number of firms in both groups pre- and post-policy period.

Figure 4.1: Sample Size by Treatment and Time Period



Note: The treated group (1) includes micro and small businesses, while the non-treated group (0) includes medium and large firms.

4.2 Estimation

To estimate the effect of "The Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017" on SMEs' loan and mortgage applications, this study employs a difference-in-differences (DiD) approach using both dynamic and pooled specifications.

Firstly, the dynamic DiD model is estimated by interacting the treatment indicator with all quarter dummies. This specification captures the quarter-by-quarter evolution of treatment effects relative to the benchmark quarter, 2016_Q4. This allows for checking pre-treatment trends, which is essential for evaluating the validity of the parallel trends assumption.

Equation 4.1: Dynamic DiD Model

$$applied\_loan_{i,t} = \beta_0 + \sum_{q \neq 2016\_Q4} \beta_q (Treated_i \times Quarter_{q,t}) + \gamma_1 Turnover_{i,t} + \gamma_2 Risk_{i,t} + \sum_k \delta_k Quarter_{k,t} + \sum_j \lambda_j Employment_{i,j} + u_{i,t}$$

Secondly, the pooled DiD model is used to analyze the average treatment effect in the post-policy implementation period by interacting the 'treated' dummy with the 'post_amld4' policy indicator. This specification allows for a single treatment estimate across all post-policy implementation quarters.

Equation 4.2: Pooled DiD Model

$$applied\_loan_{i,t} = \beta_0 + \beta_1(Treated_i \times Post_t) + \beta_2 Treated_i + \beta_3 Post_t + \gamma_1 Turnover_{i,t} + \gamma_2 Risk_{i,t} + \sum_k \delta_k Quarter_{k,t} + \sum_j \lambda_j Employment_{i,j} + u_{i,t}$$

In both models, control variables are included to adjust for firm-level differences. These are turnover, risk rating, and employment categories. In addition, quarter fixed effects are also added to control for factors affecting all firms equally over time (such as Brexit or macroeconomic trends.)

The key identifying assumption is that, in the absence of AMLD4, the treatment and control groups would have experienced parallel trends in loan application rates. This assumption is evaluated by examining the pre-treatment coefficients in the dynamic model. If no significant pre-policy differences are found, it can also be assumed that firms did not change their loan-seeking behavior in anticipation of AMLD4 enforcement.

Both Ordinary Least Squares (OLS) and Logit models are used to estimate effects. In this case, the OLS model is called a Linear Probability Model (LPM), as the dependent variable is binary (Wooldridge 2009). The Logit Model is used to address some of the limitations of LPM by using nonlinear functions and guaranteeing that the predicted probabilities fall between 0 and 1 (Wooldridge 2009). The average marginal effects (AMEs) are used to interpret the pooled Logit model in probability terms.

The expected direction of the policy effect is negative. Increased AML compliance burdens introduce additional documentation and requirements, which are likely to affect smaller firms more

due to their size and resource constraints. Thus, I expect that micro and small firms will become less likely to apply for bank loans and commercial mortgages after AMLD4 implementation, relative to medium-sized firms.

4.3 Diagnostic Checks

Standard errors are heteroskedasticity-robust using HC3 correction. Multicollinearity is assessed using Variance Inflation Factors (VIF), ensuring that no independent variable's VIF exceeds the threshold of 10. In addition, the performance of the Logit models was evaluated via Brier scores, ROC-AUC, and classification metrics at optimal thresholds.

5. Results and Discussion

This section presents the main empirical findings of the study. It begins with descriptive statistics on loan and mortgage behavior by firm size, followed by the results from both dynamic and pooled DiD models using OLS and Logit estimators. These findings are then interpreted, with attention to both statistical significance and broader economic and legal developments.

5.1 Descriptive Statistics

Table 5.1 and Figure 5.1 show loan application rates and they reveal a gradual decline in loan application rates over time for all SMEs. This suggests the possibility that more stringent AML regulations can lead to lower credit demand. For most quarters, treated firms (Micro and Small) displayed higher loan and mortgage application rates than the control group (Medium-sized firms). In addition, the pre-policy trends seem roughly parallel, but in some periods the treated groups have higher application rates.

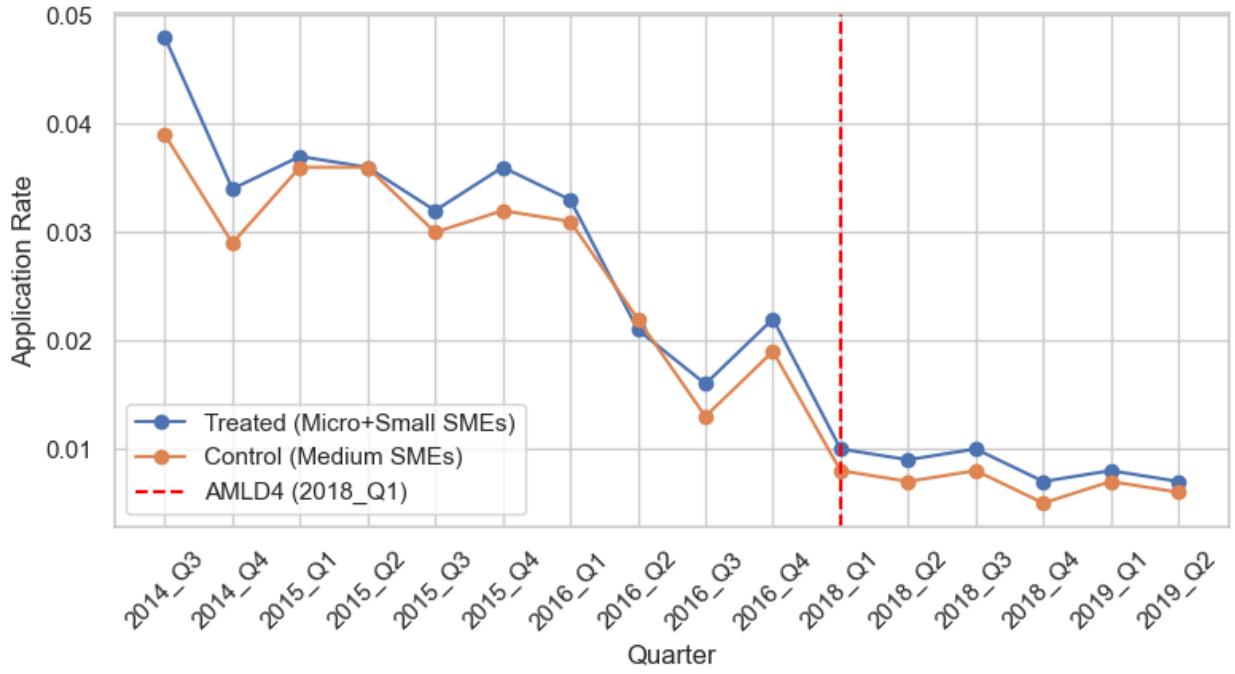
Table 5.1: Quarterly SME Loan and Commercial Mortgage Rate Applications by Firm Size

Quarter	Total Apps	Total Firms	Rate (%)	Micro+Small Apps	Micro+Small Rate (%)	Medium Apps	Medium Rate (%)
2014_Q3	192	4052	4.74	150	4.39	42	6.6
2014_Q4	133	4032	3.30	104	3.02	29	4.91
2015_Q1	157	4107	3.82	142	4.09	15	2.37
2015_Q2	153	4204	3.64	126	3.56	27	4.06
2015_Q3	133	4068	3.27	115	3.33	18	2.91
2015_Q4	147	4078	3.6	113	3.28	34	5.33
2016_Q1	120	3612	3.32	93	3.10	27	4.41
2016_Q2	74	3636	2.04	67	2.2	7	1.19
2016_Q3	58	3731	1.55	48	1.54	10	1.62
2016_Q4	75	3573	2.10	63	2.12	12	2.0

2018_Q1	19	3266	0.58	19	0.70	0	0.00
2018_Q2	14	3249	0.43	13	0.49	1	0.16
2018_Q3	17	3042	0.56	16	0.63	1	0.20
2018_Q4	12	2750	0.44	11	0.47	1	0.23
2019_Q1	13	2529	0.51	11	0.51	2	0.54
2019_Q2	11	2823	0.39	11	0.46	0	0.00

Notes: The table reports the number of new SME loan and commercial mortgage applications by quarter. Application rates are expressed as percentages.

Figure 5.1: Loan Application Rate Over Time: Treated and Control SMEs



5.2 Dynamic DiD: Quarterly Effects

To capture the quarter-specific treatment effects, a dynamic DiD model was used using both OLS and Logit specifications.

5.2.1 OLS Results

Figure 5.2: Dynamic DiD (OLS) – Coefficients of Treated × Quarter (Relative to 2016_Q4)

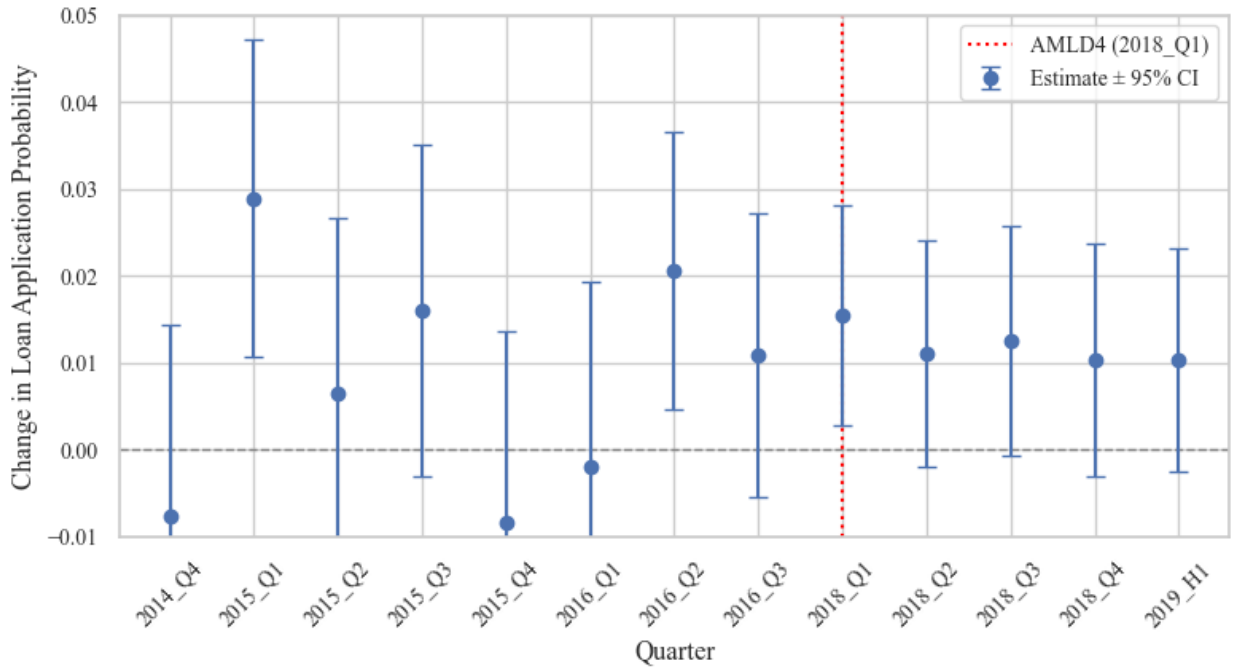


Figure 5.2 displays the estimated coefficients for treated × quarter and their confidence intervals at 95% from the LPM. The horizontal line at 0 means that there is no difference from the benchmark period (2016_Q4). This model also tests for parallel trends assumption. 2015_Q1 and 2016_Q2 show statistically significant positive effects, implying that treated firms were more likely to apply for loans in those quarters than in 2016_Q4. The estimates for other quarters were not significant. These small, fluctuating differences suggest some variation but no major pre-trends in the dataset. In the periods after the policy implementation, only 2018_Q1 is significant at the 5% level. 2018_Q1's coefficient is 0.0154, meaning that there is a 1.5%-point increase in loan application probability for treated firms relative to the baseline. Moreover, 2018_Q2 and 2018_Q3 are significant at the 10% level and 2018_Q4 and 2019_H1 are close to being significant at the

10% level. These periods' coefficients fall between 1 and 1.3%, indicating positive but statistically insignificant differences.

5.2.2 Logit results

Figure 5.3: Dynamic DiD (Logit) – Marginal Effects of Treated × Quarter (Relative to 2016_Q4)

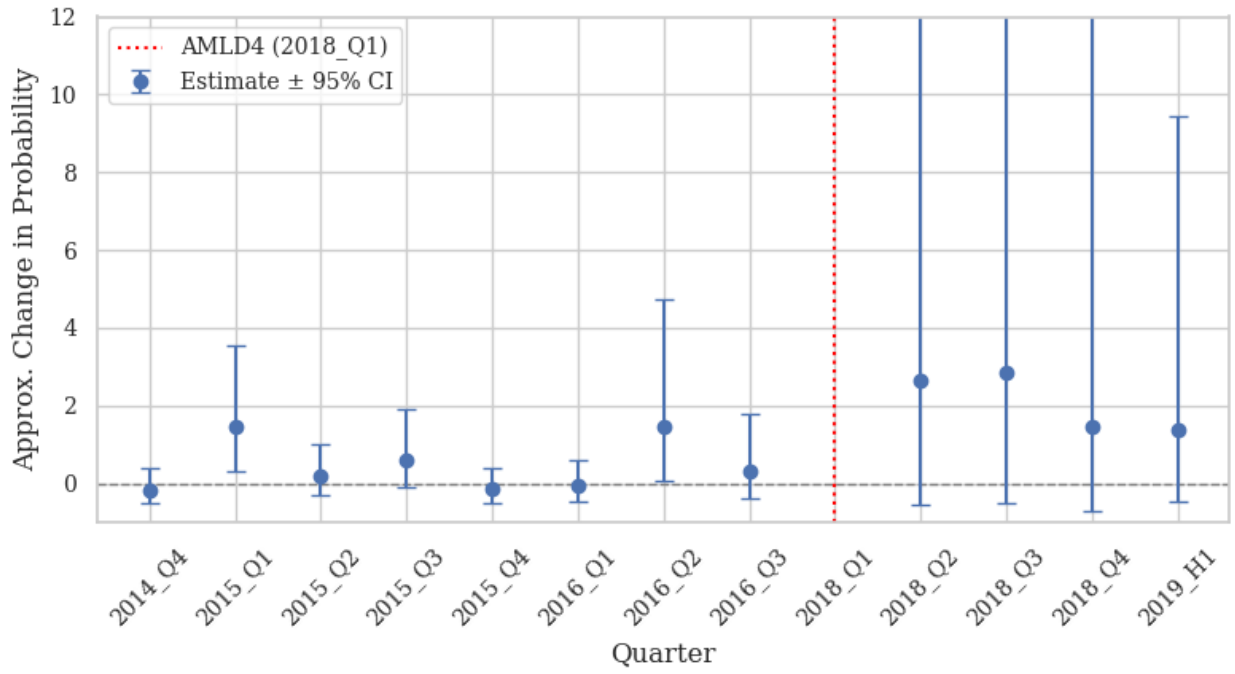


Figure 5.3 displays the estimated marginal effects for the treated × quarter interactions. This means the approximate percentage change in odds of loan or mortgage application for the treated group. This model mirrors the OLS results. '2015_Q1' and '2016_Q2' are positive and significant at 5%, while other pre-treatment periods are statistically insignificant.

Post-policy implementation, only '2018_Q1' was significant, but the result is notably large and thus implausible. The estimated marginal effect for 'treated × 2018_Q1' is approximately 1.9×10^{14}, which cannot be interpreted. This value is caused by the fact that no medium-sized firm reported applying for a loan or mortgage in '2018_Q1'. The other post-treatment periods are

statistically insignificant but show positive marginal effects. The wide confidence intervals in Figure 5.3 are most likely caused by the smaller sample size after 2017. These suggest positive but imprecisely estimated increases in the odds of applying for a loan or a mortgage among the treated SMEs.

5.3 Pooled Results

Table 5.2: Pooled Difference-in-Difference Estimates of AMLD4 Impact

Variable	**OLS Coefficient**	**Logit Marginal Effect**
treated_post	0.0055**	0.0271**
	[0.0027]	[0.0106]

Notes: The table reports estimates from pooled DiD regressions where the dependent variable is a binary indicator for applying for a bank loan or commercial mortgage in the past 12 months. OLS estimates are coefficients from a linear probability model with heteroskedasticity-robust (HC3) standard errors. Logit marginal effects represent average changes in probability.
*** p<0.05*

A pooled DiD model was used to estimate the average treatment effect of AMLD4 across all post-policy periods. For the LPM, the coefficient of 'treated_post' is 0.0055 and is significant at the 5% level. This value indicates a 0.55%-point increase in the probability of loan or mortgage application among treated firms relative to the control group, after AMLD4's implementation. In the pooled logit model, the coefficient of 'treated_post' is 1.1966 and it is significant at the 5% level. I also computed the Average Marginal Effect (AME) to improve interpretation (Wooldridge 2009), and it gives a value of 0.0271, while also being significant at the 5% level. This coefficient means that treated firms were approximately 2.7% -point more likely to apply for a new loan or mortgage following AMLD4 implementation.

These findings provide evidence of a small but statistically significant increase in loan and mortgage application rates among micro- and small-sized firms. Moreover, the results are relatively consistent across LPM and Logit models.

5.4 Diagnostic and Robustness Checks

It is useful to assess whether multicollinearity is present in the dataset. Variance Inflation Factor (VIF) is used to check whether there is a high correlation between the independent variables (Wooldridge 2009). For all models, the VIF values of the variables are below 10, which is a commonly used threshold (Wooldridge 2009). While numerous variables have VIFs between 5 and 10, this is expected for quarter dummies and interaction terms, as these variables often capture overlapping time effect or artificial combination of predictors. Therefore, multicollinearity is not a major concern for these models. The pooled OLS produces a ROC-AUC value of 0.5927, indicating weak ability to separate firms that applied from those that did not, and a Brier score of 0.0309, reflecting moderate accuracy in the predicted probabilities. The pooled Logit model performs better, with a higher ROC-AUC of 0.6935 and a lower Brier score of 0.0226, suggesting that it distinguishes between firms more effectively and estimates probabilities more reliably. However, the classification report raises concerns. Only approximately 2.34% of firms applied for a loan or a mortgage, which strongly limits the classification performance. The imbalanced dependent variable leads both models to produce a recall and precision of 0 for the loan applicant class. This means that none of the actual applications were identified (recall = 0), and none of the firms predicted as applied were correct (precision = 0), highlighting the models' inability to capture rare events.

5.5 Discussion

5.5.1 Interpretation of Main Findings

This study investigates the impact of AMLD4 on SME access to finance in the UK, for which loan and commercial mortgage applications were used as proxies. The first sub-question explores whether AMLD4 impacted micro and small firms more than medium-sized firms. The empirical findings indicate that the micro and small firms were more likely to apply for loans and mortgages relative to medium-sized firms after the policy change.

This small but statistically significant and consistent treatment effect is contradictory to my initial hypothesis and the existing literature reviewed, which emphasize that compliance-related burdens affect smaller firms more due to their limited financial resources and administrative abilities. A possible explanation for these results is that medium-sized firms were underrepresented in the sample and used other types of financing options. According to SME Finance Monitor reports, medium-sized firms were actually more likely to apply and use external finance in comparison to smaller SMEs, in 2018, which was the first post-policy year (BVA BDRC 2019). However, most of these were automatic renewals of overdrafts (BVA BDRC 2019), which are excluded from my empirical analysis. As they are automatically renewed, it would be challenging to determine when the original application happened; in addition, overdrafts may be subject to less stringent AML compliance requirements due to lower risk characteristics (UK Government 2017, Regulation 37). Consequently, the observed loan application rates may underestimate their actual credit use, and this may also reflect their greater reliance on financial products less affected by AML regulations. Furthermore, medium-sized firms also considered more financing options and took more preparatory steps before applying, such as having an informal conversation with their banks or

seeking professional advice (BVA BDRC 2019), which reflects a more strategic approach to borrowing by evaluating which funding option would be the most appropriate for their needs. Another possible explanation is that micro and small firms responded to the policy change by applying for loans more actively. They might have feared even stricter regulations and enforcement, resulting in greater screening barriers for them in the future. If this is the case, this positive treatment effect does not imply better access or reduced compliance-related burdens.

The second sub-question assesses whether AMLD4 affected overall SME loan and commercial mortgage application behavior. Descriptive statistics show a clear and significant downward trend across all firm sizes over the observed period. Therefore, even though micro and small firms had relatively higher application rates after AMLD4 implementation, the overall rate of applications decreased substantially. This suggests that the policy did not increase credit-seeking behavior for certain firms but coincided with a general decline in the already low demand for external finance. Thus, while AMLD4 most likely did not play a huge role in the declining loan applications, SMEs' low demand for credit remains a significant issue.

5.5.2 Contextualizing the Results

To better interpret the empirical findings, it is essential to consider the broader SME financing trends in the UK. The SME Finance Monitor publishes yearly reports on SMEs' financial behavior, which offers a valuable perspective. In 2018, the first full year following AMLD4 implementation, nearly half of the firms were "permanent non-borrowers", meaning they had no recent or planned borrowing events (BVA BDRC 2019). While 36% of firms used some type of external finance, this value is almost identical to 2017 (BVA BDRC 2019), suggesting AMLD4 did not lead to an increase in applications. Moreover, only 4% reported a need for funding, and ultimately, only around 2% of all SMEs applied for external finance (BVA BDRC 2019). Among them, nearly 30%

of bank loan applications were rejected (BVA BDRC 2019), pointing to possible supply-side constraints in SME lending.

These patterns align with the trends observed in my empirical analysis, which also showed extremely low application rates for both treatment and control groups. This reinforces the idea that limited credit-seeking behavior among SMEs may be a long-term structural trend, rather than a direct result of AMLD4 alone.

In addition, 2% of SMEs were classified as "would-be seekers" of finance, which are the firms that needed funding but chose not to apply for some reason (BVA BDRC 2019). While this is a small share, it is relevant, considering that only about 2% of firms applied for external finance in total (BVA BDRC 2019). The two most cited reasons were the process (mostly the cost) of borrowing, and borrower discouragement, while the economic climate was also often mentioned (BVA BDRC 2019). These demand-side constraints are relevant for interpreting the results. While AMLD4 might have increased the perceived burden of applying, the broader economic and political context also likely contributed to reduced application behavior.

Several broader developments, such as the progress of Brexit negotiations, economic uncertainty, and the transposition of AMLD5 were excluded from the empirical analysis to isolate the effects of AMLD4. However, they may have still contributed to the observed trends. For example, the Brexit-related uncertainty could have decreased investment confidence and further reduced demand for credit across all firms. Thus, while AMLD4 may have contributed to the decline in loan application rates, it likely interacted with numerous other factors.

Overall, the findings suggest that if AMLD4 had any negative effects, it did not disproportionately reduce micro and small firms' applications compared to medium-sized firms. The decline in loan

applications appears to reflect broader behavioral and market trends; thus, it is not possible to attribute the decrease in credit demand solely to AML regulations.

5.5.3 Limitations

While this empirical study offers valuable insights into the relationship between AML regulations and SME lending behavior in the UK, eight limitations should be acknowledged, as they influence the interpretation of these results and highlight opportunities for further research.

First, the data comes from the SME Finance Monitor, which relies on a self-reported survey. This might lead to biased results, because firms may misreport information about their business, especially about their finances, either intentionally or accidentally. However, the survey is widely used and considered reliable, so the uncertainty regarding self-reporting should not be a significant issue (BVA BDRC 2024).

Second, the dataset lacks answers to the core questions about loan and commercial mortgage applications for all quarters in 2017. This created a gap between the last pre-policy quarter (2016_Q4) and the first post-policy quarter (2018_Q1). This was addressed methodologically by excluding 2017 and redefining the treatment period. Regardless, it was not possible to study whether there was an immediate shift in loan application trends immediately after AMLD4 implementation; thus, limiting the model's precision.

Third, I assume that medium-sized enterprises are less affected by the regulation, as it is easier for them to absorb compliance-related costs in comparison to micro and small firms. However, AMLD4, just like every AML regulation, applies to all businesses. Therefore, the empirical analysis only measures the relative effect and not the overall impact of this regulation.

Fourth, the dependent variable only considers whether a firm applied for a loan or commercial mortgage. It does not capture the outcome of the application, whether it was successful or rejected. As a result, the study does not account for possibly reduced access to financial services, but only for application behavior.

Fifth, while the models attempt to account for differences using fixed effects and control variables, some pre-treatment coefficients are statistically significant in the dynamic DiD models. This suggests a possible deviation from the parallel-trends assumption, which weakens the validity of interpreting post-treatment estimates as causal effects of AMLD4.

Sixth, a key limitation is that models do not observe direct compliance costs, such as the amount of time and money spent by banks. Without direct compliance costs, it is difficult to establish that the change in application behavior was caused by AMLD4 and not by other economic factors.

Seventh, macroeconomic variables such as GDP growth, inflation, unemployment rate, interest rates, and Brexit-related uncertainty could all impact loan and mortgage application rates and they were not directly controlled for in this analysis. However, quarter fixed effects were included to control for time-specific shock. Regardless, this may limit the validity of the results.

Lastly, the two main concerns are the rarity of the dependent variable and the imbalance between the group sizes. In the whole dataset, only 2.34% of SMEs applied for a loan or commercial mortgage. The application rate is even lower after the AMLD4 implementation, as from 2018_Q1 onward, only 0.49% of the firms reported an application. In addition, there is also a significant imbalance in group sizes, since medium-sized firms are significantly underrepresented, especially post-policy period; in two quarters no medium-sized firms applied for a loan or mortgage. As a

result, there is an extreme class imbalance, which reduces the statistical power of the models and limits classification accuracy. This also raises concerns about the generalizability of the findings.

6. Conclusion

This thesis examined whether the transposition of AMLD4 into UK law in 2017 affected the borrowing behavior of SMEs, with a particular focus on loan and commercial mortgage applications. The study used both dynamic and pooled DiD frameworks and relied on SME Finance Monitor data to compare micro- and small-sized firms with medium-sized enterprises. The goal was to assess whether stricter AML regulations created a disproportionate burden for smaller businesses, potentially limiting their ability and willingness to seek external finance.

The results showed a small but statistically significant increase in the likelihood of loan and commercial mortgage applications among micro and small firms following AMLD4, relative to medium-sized firms. These results contradict the initial hypotheses and existing literature, which predicted that smaller firms would be disproportionately negatively affected by increased compliance costs due to their limited financial and administrative capacity. These results could imply a behavioral response among smaller SMEs, which feared even stricter regulations in the future, rather than improved credit access. However, it is important to highlight that medium-sized businesses were underrepresented in the sample, and they were actually more likely to use financial products (mainly automatically renewed overdrafts) (BVA BDRC 2019), but those were excluded from the empirical analysis because they were less impacted by AML regulations. Medium-sized firms also tend to take more preparatory steps before applying for credit, which reflects a more strategic approach to borrowing (BVA BDRC 2019).

Despite this relative increase, descriptive trends demonstrated a clear decline in application rate across all SME sizes throughout the observed period, suggesting that AMLD4 coincided with a broader decline in credit demand. Therefore, while this regulation does not seem to have

disproportionately reduced credit applications from smaller firms, it may have contributed to the overall decrease in external finance-seeking behavior, along with other factors, such as the economic climate and Brexit-related uncertainty (BVA BDRC 2019).

The analysis is limited by numerous constraints. For example, missing quarters, low application rates, inability to observe application outcomes, and direct compliance costs make it difficult to interpret the results as causal. However, the findings highlight the complexity of SME behavior. Compliance burdens may not directly reduced applications, but the broader regulatory and economic environment may still discourage SMEs from credit seeking.

This study contributed to the existing literature by examining how AMLD4 affected SME loan and commercial mortgage applications in the UK. While previous research often treats regulatory complexity as a general constraint for SMEs, this empirical analysis used firm-level survey data to more directly assess the effects of stricter AML regulations. The findings suggest that smaller firms may not be as negatively affected as expected, offering new insights into the debate about SME financial constraints.

The results have important implications for policymakers. While AML regulations are crucial in tackling financial crime, they may unintentionally influence how businesses seek credit. Since SME financial behavior is complex and influenced by many external factors, policymakers should aim to increase credit demand by improving access to financial products and minimizing unnecessary barriers. More proportionate compliance systems, in addition to support and financial guidance, could help ensure that AML regulations do not negatively impact financial inclusion and small business growth.

Despite its limitations, this study offers valuable insight into the relationship between AML regulations and SME financial behavior in the UK. Future research could expand on these findings by including longer timeframes, macroeconomic controls, direct measures of compliance costs, and lending data from financial institutions. Such changes could further clarify how tightened regulatory environments shape SME access to finance and how policy can better balance crime prevention with economic inclusion.

Bibliography:

BDRC Continental. 2024. “Small- and Medium-Sized Enterprise Finance Monitor, 2011–2023.” Data Collection. https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=6888: UK Data Service. https://doi.org/10.5255/UKDA-SN-6888-26.

Brown, Ross, José M. Liñares-Zegarra, and John O.S. Wilson. 2022. “Innovation and Borrower Discouragement in SMEs.” *Small Business Economics* 59 (4): 1489–1517. https://doi.org/10.1007/s11187-021-00587-1.

BVA BDRC. 2019. “SME Finance Monitor Q4 2018.” Independent Research Report. SME Finance Monitor. London: BVA BDRC. https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=6888.

BVA BDRC. 2024. “SME Finance Monitor.” Company Website. BVA BDRC. 2024. https://www.bva-bdrc.com/sme-finance-monitor/.

BVA BDRC. 2025. “SME Finance Monitor Q4 2024.” SME Finance Monitor. London: BVA BDRC. https://www.bva-bdrc.com/sme-finance-monitor/.

Davies, Natalie. 2023. “A Complete Guide to Anti-Money Laundering (AML) Regulations in the UK.” *NorthRow* (blog). March 20, 2023. https://www.northrow.com/blog/anti-money-laundering-regulations-guide.

Department for Business & Trade and HM Treasury. 2025. “Small Business Access to Finance.” Call for Evidence. London: UK Government. https://www.gov.uk/government/calls-for-evidence/small-business-access-to-finance/small-business-access-to-finance.

Durner, Tracey, and Liat Shetret. 2015. “Understanding Bank De-Risking and Its Effects on Financial Inclusion.” Research Report. New York: Global Center on Cooperative Security. https://globalcenter.org/resource/understanding-bank-de-risking-and-its-effects-on-financial-inclusion/.

European Commission. 2024. “Anti-Money Laundering and Countering the Financing of Terrorism at EU Level.” Official EU Website. European Commission – Finance. 2024. https://finance.ec.europa.eu/financial-crime/anti-money-laundering-and-countering-financing-terrorism-eu-level_en.

Financial Action Task Forces. 2022. “FATF: United Kingdom.” Organisation Website. FATF. 2022. https://www.fatf-gafi.org/en/countries/detail/united-kingdom.html.

Financial Conduct Authority. 2023. “Money Laundering Regulations.” FCA. February 21, 2023. https://www.fca.org.uk/firms/financial-crime/money-laundering-regulations.

Financial Crime Academy. 2025. “The Evolution Of AML Compliance: Confronting The Globalization Impact.” *Financial Crime Academy* (blog). March 19, 2025. https://financialcrimeacademy.org/impact-of-globalization-on-aml-compliance/.

Freel, Mark, Sara Carter, Stephen Tagg, and Colin Mason. 2012. “The Latent Demand for Bank Debt: Characterizing ‘Discouraged Borrowers.’” *Small Business Economics* 38 (4): 399–418. https://doi.org/10.1007/s11187-010-9283-6.

HM Revenue & Customs. 2025. “ECSH21075 - Amendments to Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017 (MLR 2017).” Government Website. GOV.UK. April 29, 2025. https://www.gov.uk/hmrc-internal-manuals/economic-crime-supervision-handbook/ecsh21075.

Karolos Seeger and Andrew H.W. Lee. 2017. “Client Update: UK Implements New AntiMoney Laundering Rules.” Law Firm. Debevoise & Plimpton. June 27, 2017.

https://www.debevoise.com/insights/publications/2017/06/uk-implements-new-anti-money-laundering-rules.
Khelil, Imen, Hichem Khlif, and Imen Achek. 2023. “The Economic Consequences of Money Laundering: A Review of Empirical Literature.” *Journal of Money Laundering Control* 27 (5): 901–16. https://doi.org/10.1108/JMLC-09-2023-0143.
Mac an Bhaird, Ciarán, Javier Sanchez Vidal, and Brian Lucey. 2016. “Discouraged Borrowers: Evidence for Eurozone SMEs.” *Journal of International Financial Markets, Institutions and Money* 44 (September):46–55. https://doi.org/10.1016/j.intfin.2016.04.009.
National Crime Agency. 2025. “Money Laundering and Illicit Finance.” National Crime Agency. April 29, 2025. https://www.nationalcrimeagency.gov.uk/what-we-do/crime-threats/money-laundering-and-illicit-finance.
OECD. 2025. “SMEs and Entrepreneurship.” OECD. 2025. https://www.oecd.org/en/topics/smes-and-entrepreneurship.html.
Oxford Economics. 2024. “The True Cost of Compliance.” Research and Analysis. London: Oxford Economics. https://www.oxfordeconomics.com/resource/the-true-cost-of-compliance/.
Sally Percy. 2025. “Big Four Banks Still Dominate SME Business Account Market.” The Association of Corporate Treasurers (ACT). 2025. https://www.treasurers.org/hub/treasurer-magazine/big-four-banks-still-dominate-sme-business-account-market.
UK Finance. 2021. “UK Finance Response to the HM Treasury Call for Evidence Review of the UK’s Anti Money Laundering/Counter Terrorist Financing Regime.” Consultation Response. London: UK Finance. https://www.ukfinance.org.uk/policy-and-guidance/consultation-responses/uk-finance-response-hm-treasury-call-evidence-review-uks.
UK Government. 2017. “The Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017.” UK Government Legal Database. Legislation.Gov.Uk. King’s Printer of Acts of Parliament. June 22, 2017. https://www.legislation.gov.uk/uksi/2017/692.
UK Government. 2024. “Business Population Estimates for the UK and Regions 2024: Statistical Release.” GOV.UK. October 3, 2024. https://www.gov.uk/government/statistics/business-population-estimates-2024/business-population-estimates-for-the-uk-and-regions-2024-statistical-release.
UK Government. 2025. “Supplementary Information: Small and Medium-Sized Enterprises Definition.” UK Government Legal Database. GOV.UK. April 11, 2025. https://www.gov.uk/government/publications/procurement-act-2023-short-guides/supplementary-information-small-and-medium-sized-enterprises-definition-html.
Wooldridge, Jeffrey M. 2009. *Introductory Econometrics: A Modern Approach*. 4th ed. Mason, OH: South Western, Cengage Learning.