Impact of barriers to trade in banking services: Evidence from the UK

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Abstract

While services are increasingly flowing across borders, little is known about barriers to trade in services. This paper examines their impact by focusing on banking services. Banking services are a key part of financial services - the most traded service globally. We exploit changes in barriers imposed by the European Union (EU) on banks operating in the United Kingdom (UK) due to the UK's withdrawal from the EU, which restricted UK-resident banks from providing services to countries in the European Economic Area (EEA) cross-border or through branches. Banks provide intermediation services, i.e. take deposits and provide loans, and generate income from these services. We study export of these services and the stocks corresponding to these exports. Using cross-country bilateral data from the Bank for International Settlements and confidential bank-level data on UK-resident banks from the Bank of England, we find that the stocks of deposits taken from and loans provided to an average EEA country relative to non-EEA falls after the withdrawal from the EU in January 2021, with some impact appearing after the referendum itself. Moreover, UK-resident banks with higher share of EEA in stocks corresponding to exports before the referendum, see a decline in these stocks of deposits from and loans to EEA due to the referendum, with some increase in stocks with non-EEA. This coincides with increase in trade of UK-resident banks with intragroup entities in the EEA relative to non-EEA. We investigate the channels behind these facts: whether this reflects a relocation of UK activity to maintain access to EEA markets or a move away from EEA markets, by empirically studying how company-groups to which these UK banks belong, respond to the change in barriers through changes in presence (subsidiaries, branches etc.) and activities in the UK, EEA and non-EEA. We build a framework that embeds a multinational structure in a model of banking across borders to rationalise these facts and allow for a counterfactual analysis to quantify the impact of trade barriers on the UK banking sector.

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1 Introduction

Services are increasingly contributing to growth, innovation and employment (OECD 2024). This rising importance is also evident in global trade, with the value and share of services trade steadily increasing (Baldwin et al. 2024). Yet, services are subject to significant trade barriers, which are much higher than those on goods (Benz & Jaax 2020). Little is known about these barriers and their impact on trade in services as well as on the broader economy. Understanding the impact of these barriers is key to guide future trade policies. This paper sheds new light on the impact of barriers to trade in services by studying banking services (financial intermediation services offered by deposit-taking corporations).

This paper investigates how trade barriers affect export of banking services to different trading partners and studies the mechanisms by which banks change their activities in response to these barriers. It uses the United Kingdom's (UK) experience of withdrawing from the European Union (EU) single market and customs union for its empirical analysis. The UK is the world's largest center for cross-border banking. The country's banking sector faced major changes in their access to the European Economic Area (EEA) following the withdrawal.[1] Since then, the UK is treated as a third country by the EU and, as a result, is subject to various new non-tariff barriers. For instance, UK-based banks lost the ability to export banking services to the EEA or serve the EEA through branches via passporting. While such changes are imposed for regulatory reasons, they have consequences for trade in banking services, and the performance of the sector more broadly. Overall, there has been an increase in non-tariff barrier and an incentive for UK-based banks to have a commercial presence in the EEA to access the market. This paper first documents the impact of increased non-tariff barriers on exports of banking services from the UK to the EEA, as well as the heterogeneity of the impact across banks. It provides evidence on the mechanism by which banks respond to the changes. It then builds a framework to rationalise these facts studying how trade barriers affect banks' exports and the structure of the company across countries. This framework enables a counterfactual analysis to quantify the impact of trade barriers on the UK banking sector.

Using cross-country data from the Bank for International Settlements and confidential bank-level data collected by the Bank of England, the paper documents some main facts about the impact of changes in regulations on cross-border banking services. First, the total exports of services, as measured by statistical organisations to calculate Balance of Payments, by UK-resident banks have not been significantly affected by the new trade arrangement between the UK and the EU, but this could be due to how exports of banking services are defined and computed. We instead use data on the stocks of deposits taken and loans provided by UK-resident banks to study intermediation services provided to other countries. We find that there is a significant decline in stocks of deposits taken from and loans provided to non-banking entities in an average EEA country relative to a non-EEA country by UK-resident banks, especially since the new TCA came into effect in January 2021. Moreover, banks that had a higher share of EEA in their stocks related to exports of banking services before the referendum had a lower stock of deposits from and loans to EEA after the referendum, and this was accompanied by an higher stock of deposits from non-EEA countries. Lastly, trade of UK-resident banks with intragroup entities in EEA has increased significantly, relative to trade with intragroup entities in non-EEA since the new trade arrangement has come into effect.

[1] The new regulations faced by UK-based banks for providing banking services to the EU were also applicable for Liechtenstein, Iceland and Norway both before and after UK's withdrawal from the EU.

These facts suggest a change in the way banks provide cross-border services to the EEA. In work in progress, we investigate the mechanism behind the changes – whether it reflects a move away from EEA markets or a change in the way banks provide services to the EEA markets. To that end, we investigate how company-groups to which these UK banks belong, respond to the change in barriers through increasing presence in other countries or changing activities of entities already established in other countries. A model, informed by the empirical evidence (also in progress), helps rationalise the decision of individual banks regarding exporting and establishing commercial presence, as well as in performing counterfactual analysis to determine the impact of this change in export cost on the performance of the sector.

A key objective of this paper is to contribute to our understanding of trade in services and barriers to it. Focusing on banking services is particularly helpful in this. Firstly the sector is key in channeling funds and is a vital part of financial services, which is the most traded service globally (WTO 2019). Secondly, there are substantial barriers placed on it due to regulatory reasons (the Services Trade Restrictiveness Index for the commercial banking sector is above the average of all sector, indicating substantial scope of reduction in barriers (OECD 2023)). Thirdly, measures of exports and the stocks allows us to conceptualise trade in banking services in terms of familiar notions of revenue and quantities used for trade in goods. Changes in barriers to exporting banking services by the UK to the EEA due to UK's withdrawal from the EU after Brexit is an ideal setting for our research question. The banking sector is an important area of comparative advantage for the UK –the financial sector contributes to about 9% of UK GDP and banks account for one-third of employment in the sector (TheCityUK 2023). UK is the world's largest center for cross-border banking, accounting for about 14% of total cross-border bank lending.[2] The EEA is a significant trading partner for the UK, accounting for about one-third of its banking services exports. The degree of integration of the banking sector when UK was a part of the EU makes the new barriers consequential for trade and the performance of the sector, on a whole. The impact of changes in access to the EEA market on the role of UK's financial sector in the world economy and of London as a leading financial center was a big concern before and after the referendum (Cassis 2018).

This paper adds to multiple strands of literature. By conducting an in-depth study of a service and the impact of change in non-tariff barriers, this paper contributes to the literature on trade in services and non-tariff barriers. An expanding literature on this topic studies the role of trade agreements and policies on services trade, such as Borchert et al. (2017), Breinlich et al. (2018), Adarov & Ghodsi (2023), Dhingra et al. (2023).[3] This paper adds to this body of work by studying the changes in barriers to trade in banking services by a partner country group on trade pattern of exporters to different partner countries and entities. Since the paper studies the change in trade barriers due to Brexit, it also contributes to the expanding literature on the consequences of Brexit. While most papers in the topic discussed the potential consequences of UK's withdrawal from the EU after the referendum (Sampson 2017, McMahon 2017, Breinlich et al. 2020, Dhingra & Sampson 2022, Breinlich & Magli 2024), recent work has started looking at the impact of the withdrawal and the new trade agreement between the UK and the EU (Gasiorek & Tamberi 2023, Bhalotia et al. 2024, Freeman et al. 2024). No paper has yet looked into the impact on banking services. In this paper, we look at changes in barriers to banking services, which are besides those incorporated in the trade agreement and provide evidence on the realized impact.

[2]Based on our calculation using Bank for International Settlements (2024).

[3]Francois & Hoekman (2010) provide a review of earlier literature.

With its focus on banking services and the use of bank-level data for empirical analysis, the paper contributes to the literature on trade in banking services and international banking integration. Research in this literature has often focused on cross-border lending (Frost et al. 2017, Hills et al. 2017, Lloyd et al. 2023). Like Kerl & Niepmann (2015), Niepmann (2015, 2023), we focus on trade in banking services, looking at lending as well as deposit-taking by banks, and additionally, at the income generated from these activities. We also add to these works by providing empirical evidence of the impact of changes in barriers to cross-border banking on exports and commercial presence. By studying the expansion of presence of and activities with entities in the same company-group to which banks belong, we bring mechanisms from works on multinational organisations into this literature.[4]

The rest of the paper is divided into five sections. Section 2 describes the change in regulations and barriers to export of banking service and the timeline. Section 3 describes the data and methodology used for the empirical analysis, and Section 4 presents the reduced-form evidence. Section 5 provides a discussion on role of the structure of banks in their response to trade barriers and the mechanism of adjustment. Section 6 provides an outline of the theoretical framework that allows us to quantify the impact of the trade barriers on the banking sector. Section 7 provides a summary of the results so far and the work in progress.

2 Contextual Background

The European Union allows for a single market and customs union for its member countries, which enables free trade. Extending this free trade to the financial sector, the EU passporting system permits banks and financial services companies that are authorised in any EU state to trade freely in any other member country with minimal additional authorisation, based on the assumption that banks and financial services firms authorised anywhere in the EU will have met the same standards, and thus should in effect be treated as if they were locally authorised. This system has been extended to cover the EEA. Banks from countries outside the EEA cannot access the passporting regime. To access passporting rights, these banks can establish a regulated business inside the EEA. Under the provisions of freedom of establishment and freedom to provide services of the Fourth Capital Requirements Directive, a UK-based bank could provide lending and deposit-taking services to entities in other EEA countries either cross-border or by establishing a branch under preferential terms. UK-based banks are not only UK-headquartered banks, but also includes regulated businesses or subsidiaries of banks headquartered in other countries.

The UK was a member of the EU (and its predecessor) for over forty years before voting to leave the Union in a referendum held in June 2016.[5] There was no immediate change in the UK's relationship with the EU or the rest of the world. However, it did shift expectations to reduced openness with the EU and increased policy uncertainty, as the referendum was not backed by any guidance over the timeline of Brexit and the future of UK-EU relations. After multiple debates, dialogues and voting on deals over the next four years, the Withdrawal Agreement that was finally agreed involved UK's exit from the single market and customs union, and trade relationship based on a free trade agreement. UK left the EU on 31 January, 2020, after which it entered a transition period lasting until end of 2020. There were no change in UK-EU trade relation in this transition period. The new UK-EU Trade

[4] Antràs & Yeaple (2014) provide a review of this strand of literature.

[5] The referendum was pledged by the leader of the Conservative Party during the campaign for the election in 2015.

and Cooperation Agreement (TCA) came into effect provisionally on 1 January 2021 and entered into full force on 1 May 2021.

From January 2021, UK was reclassified as a third country by the EU. In the banking sector, UK-based firms are no longer able to provide services in the EEA via passporting, i.e. serve customers across the EU from their home Member State, either through the free provision of (cross-border) services or by establishing local branches under preferential terms (Shalchi 2021). The TCA included few provisions from trade in financial services[6], broadly and did not contain adequate alternate provisions to negate or reduce the impact of the change in passporting. There were no arrangements of equivalence for these services either, where market access is obtained on the principle that countries where firms are based have regimes that are 'equivalent' in outcome. Most core banking activities are not subject to an equivalence regime providing access to the single market (Deslandes et al. 2019), and equivalence falls short of passporting and can be withdrawn at any time. Equivalence has only been provided for UK clearing houses for derivatives transactions.[7] However, the UK has granted equivalence to the EEA in 22 areas of financial services after the end of the transition period. Other initiatives like the Memorandum of Understanding on financial services, which was signed in 2023 and the joint EU-UK Financial Regulatory Forum has facilitated discussion of regulatory patterns, however, there have been no substantial impact on aligning regulations or improving market access. Therefore, UK leaving the EU implied that cross-border provision of banking services depended on national regimes for licensing, reverse solicitation etc., thereby increasing non-tariff barriers to trade. The new requirements the UK-based banks were subject to increased the need to establish commercial presence that are more independent than branches.

Overall, UK's exit from the EU has increased trade barriers for UK-based banks when accessing the EEA market, thereby increasing trade costs, and increased need to establish commercial presence, the cost of which has also increased as branches may not meet necessary requirements. These are the changes that we focus on in this paper.

3 Measurement and Data

3.1 Measuring trade in banking services

Banks provide intermediation services i.e. provide loans and take deposits. These services can be provided to local (or resident) entities as well as to non-residents entities, i.e. cross-border. Banks charge for these services either explicitly, in the form of commissions and fees, or implicitly, in the form of an interest margin. These explicit and implicit charges for cross-border provision of these services measure export. The stocks of deposits taken and loans provided represent the quantity behind these exports. [8] In this way, trade in banking services can be measured, just as trade in goods, through both, revenue generated from trade and quantity traded.

[6]These provisions are common to trade in financial services and cover Market Access, National Treatment and Most Favoured Nation

[7]This was valid till June 2022 but has been extended since. The other area of equivalence has been recognition of a UK Central Securities Depository (CSD) for settlement of (mainly) Irish securities until the end of June 2021.

[8]This idea of trade value and trade volume is a generalisation of Philippon (2015), which discusses provision of financial services, more broadly, domestically.

FISIM: While the explicit charges can be directly charged and reported by banks, the implicit charges are calculated in national accounts and Balance of Payments using an indirect measure, called Financial Intermediation Services Indirectly Measured (FISIM).[9] FISIM uses a reference rate, which represents the pure cost of borrowing funds, eliminating risk premium and excluding any intermediation service. The reference rate is defined as the interest charged for financial intermediation services provided to other financial intermediaries (loans and deposits provided by and to financial intermediaries).[10]

FISIM on loans provided by banks (loan assets for the banks) is the difference between the interests received and the interest cost of funds calculated at the reference rate on stock of loans. FISIM on deposits received by banks (deposit liabilities of the banks) is the difference between the interest payable at the reference rate on the stock of deposits and the actual interest payable to depositors. Note that depositors receive both the monetary interest payable and the service, provided by a deposit-taking corporation, of the amount being held in an account. The depositors accept a lower interest rate than the risk-free reference rate because they use the service provided by the bank. Because of the way the reference rate is defined, FISIM is calculated for deposits taken and loans provided to counterparty entities other than financial intermediaries.[11]

3.2 Data

To measure the cross-border intermediation activity of UK banks, we use data from two different sources: country-level bilateral stocks of loans and deposits from the Bank for International Settlements (BIS)[12] and bank-level income from cross-border activities and stocks of loans and deposits from the Bank of England (henceforth BoE).

Locational Banking Statistics database of the BIS (BIS-LBS): The BIS data contains stocks of deposits taken and loans provided by resident banks (based on location of the banking office) that are internationally active, from or to non-resident counterparties. Deposits include transferable deposits, interbank positions and repurchase agreements. Loans include installment loans, hire-purchase credit, loans to finance trade credit, financial leases and repurchase agreements. Data is reported on an unconsolidated basis.[13,14] The dataset we use, with the required level of granularity, consists of 31 reporting countries and over 200

[9]The FISIM method is defined in Chapter 14 of the European System of Accounts 2010 (European Commission & Eurostat 2021).

[10]Financial intermediaries include deposit-taking monetary financial institutions and other financial intermediaries like special credit and mortgage lenders.

[11]Taking deposits from and providing loans to financial intermediaries is not considered intermediation service.

[12]We also use data on claims (including loans and other assets of resident banks from non-resident entities) and liabilities (including deposits and other liabilities of resident banks to non-resident entities) for robustness.

[13]They include banks intragroup positions with subsidiaries and other legal entities that are part of the same banking group, as well as inter-office positions with their non-resident branches, but they exclude inter-office positions with banks resident branches.

[14]The database contains information for stocks for different currencies, parent country, sector, types of reporting banks etc., however we use the subset for which UK data is available. Therefore, the data we use is deposits and loans (and total liabilities and claims for robustness) reported by all resident banks of any parent nationality, for each reporting country, for transactions in any currency, that are cross-border, split by partner country. The data contains total stocks of deposits from and loans to all sectors of non-resident entities (which include households, governments, non-financial corporations, banks etc.) in the partner country, as well as stocks where the non-resident entities are non-banks.

partner countries. The BIS-LBS capture around 95% of all cross-border banking activity.[15]

Statistical bank-level data from the Bank of England (BoE): We use confidential statistical data collected by the Bank of England from deposit-taking institutions resident in the UK, on their domestic as well as non-resident activities, reported for each partner country. Data is collected through different forms that financial institutions satisfying specific reporting criteria provide information on.[16] This data is the backbone of the UK official data on the banking sector activity, including banking sector trade published by the Office for National Statistics (ONS). The data we use starts from 2014 (the year since the data has been collected consistently) and comprises quarterly information up to the most recent quarter available (quarter 2 of year 2024 for now).

Banks with substantial non-resident activities report stocks of claims and liabilities for each partner country, currency of transaction and sector of the counterparty entity (households, governments, non-financial corporations, deposit-taking corporations in the same company-group, other deposit-taking corporations, or other financial entities).[17] When reporting claims, the banks separately report "loans" which includes loans and advances, finance leases and claims under sale and repurchase agreements, bills and ECGD lending. Reporting liabilities includes "deposits" which sums up sight and time deposit liabilities and liabilities under sale and repurchase agreements. We discuss the coverage of the BoE data on stocks of deposits and loans, and compare it to BIS-LBS in Appendix A.1. The Bank of England data on stocks is similar to that of the UK in the BIS dataset. Banks also report stocks of claims and liabilities corresponding to domestic activities (i.e. where the counterparty entity is a resident of the UK). Stocks of deposits and loans, as defined above, can be obtained for the different sectors of the counterparty entity.[18] We use quarterly information in our analysis.

In addition to information on stocks, UK-resident banks also report income received from cross-border activities to the Bank of England. These are used to measure trade statistics. This information is reported by banks either annually or quarterly, based on criteria stated by the Bank of England.[19] Additionally, some of exports to each partner country is calculated or imputed. Overall, variables on income from exports include:

- Fees and commissions – income from arrangement of loans and advances, current account services, management of portfolio of securities, other financial and non-financial services etc., reported by resident banks for each partner country.
- FISIM – implicit revenue received by banks for lending and deposit-taking services.

[15] Details of the data and coverage are available at: https://data.bis.org/topics/LBS.

[16] Information power of the Bank of England, and the consequences of failure to provide correct information, is specified in The Bank of England Act, 1998.

[17] Banks submit separate forms for claims and liabilities. Banks with an equivalent of £300 million or more of external claims report information on claims, and with an equivalent of £300 million or more of external liabilities report information on liabilities. These thresholds have remained unchanged over the period of analysis.

[18] Stocks related to entities constituting the non-financial sector is reported by banks with substantial resident activities. Banks for which sight and time deposits taken from or loans provided to residents other than monetary financial institutions (banks and building societies) and the public sector exceeds £1 billion report a breakdown of deposits and loans for the non-financial sector. More aggregated stocks of deposits from and loans to resident entities is available for all banks, which is used to allocate stocks to the non-financial sector for banks that do not explicitly report these stocks.

[19] The criteria is that receipts from or payments to non-resident (in the form of income as listed below or profit share in branches/subsidiaries) should exceed a threshold. This threshold was increased substantially in 2020 and reduced in 2024. The threshold is chosen such that the data collected by the Bank of England covers about 90-95% of the total non-resident activity of these receipts or payments.

This variable is calculated using a similar approach to the method discussed above. The reference rate used for calculating this measure is different for sterling and foreign currency. Since the interest received for loans and interest paid for deposits are not reported for partner country, FISIM is calculated on aggregate and then apportioned to different partner countries.[20] We use information on the stocks of loans and deposits for the apportioning, as the stocks are an important component of FISIM.

- Net Spread Earnings (NSE) – income from dealing activities, i.e. difference between price paid by the bank and price in the open market, reported only on aggregate but apportioned to partner countries using the distribution of fees and commissions.
- Intragroup fees and Cost recharges – income from non-resident entities of the same company-group (i.e. intragroup entities) for loans and advances, current account services, investment banking, advisory, brokerage and underwriting etc., as well as other intragroup services and cost recharges of centrally managed services[21], reported for partner country.

These components together constitute exports by banks of intermediation services, other financial services and business services. FISIM as well as some components of fees and commission capture charges from deposit-taking and lending. However, banks do not report fees and commissions and intragroup fees by component for each partner country, but provide a breakdown of the components on aggregate. Appendix A.2 discusses the share of income from intermediation service in total fees and commission. Nevertheless, we use the sum of FISIM and fees and commission as proxies for export of banking service. Moreover, intragroup fees and cost recharges are regarded as business service (instead of financial service) in the UK Balance of Payments. NSE are from provision of financial services and are not related to intermediation services (and therefore will not be included in our analysis). Official Balance of Payments statistics of the UK (ONS Pink Book) suggests that share in total exports by UK monetary financial institutions (MFI)[22] of fees and commissions is 15-25% and of FISIM is 25-30%. Therefore export of deposit-taking and lending services (FISIM and components of fees and commission) constitute a substantial part of export by UK banks.

As described above, FISIM is a calculated variable and its values for partner country is imputed, so we cannot use this variables to investigate the differential impact of Brexit on UK export by partner country. Our analysis focuses on the stocks of loans and deposits. We also use the information on intragroup fees and cost recharges to study how Brexit affected intragroup activity of UK-based banks.

Our bank-level dataset includes information on imports by UK-resident banks as measured by fees and commission paid and payments to other entities of the company group for their services. However, these are only a part of import of banking services as these services could be imported by non-banks in the UK. Our analysis of imports is limited.

We complement the data discussed above with information on ownership, changes in subsidiaries and branches established by the banks in our dataset (or the larger company-group to which they belong), bank-size using the Orbis database, as well as with data on resident activities of UK-resident banks.

[20] This is consistent with the methodology used for official statistics of the UK for FISIM.

[21] Example: reporting entity recharging non-resident entities for purchases like software made by reporting country but used by these other intragroup entities as well

[22] MFIs include deposit taking corporations (or what we refer to as banks), money market funds and central bank.

4 Empirical analysis

Our empirical analysis determines how trade of banking services, defined as intermediation service by UK-resident banks, changed due to UK's decision to leave the EU (i.e. from 2016Q3) and the subsequent changes in barriers to trade when the new trade arrangement between UK and EU came into effect (from 2021Q1). It also aims to provide evidence on the impact of trade barriers on the presence of these banks in the UK and the EEA and the mechanisms by which banks responded to the barriers.

4.1 Exports

As discussed in the previous section, export of deposit-taking and lending services is measured by FISIM and (some components of) fees and commissions. Figure 1 shows how our proxy of exports (sum of Fees and Commissions and FISIM) evolves over time, towards EEA and non-EEA partner countries. The figure suggests no visible impact of the referendum (2016Q3) nor the new trade arrangement (2021Q1) on the differential trends in UK exports to the two country groups. This suggests that the uncertainty after the referendum or the new trade relationship with the EEA, that introduced more trade barriers, has had no effect on exports by UK-resident banks to EEA compared to non-EEA partner countries. The large increase in exports after 2022 is driven by an increase in FISIM, which in turn is due to an increase in interest rates.[23] However, FISIM is an implicit measure, and assumes interest margins are similar across partner countries[24] but total earnings differ and are proportional to the amount of stocks of loans and deposits with the partner country. Due to the method of obtaining this variable, there is no difference in FISIM for EEA and non-EEA as shown in Figure 16 of Appendix A.3. A discussion of total exports by banks is provided in Appendix A.3, with similar inference.

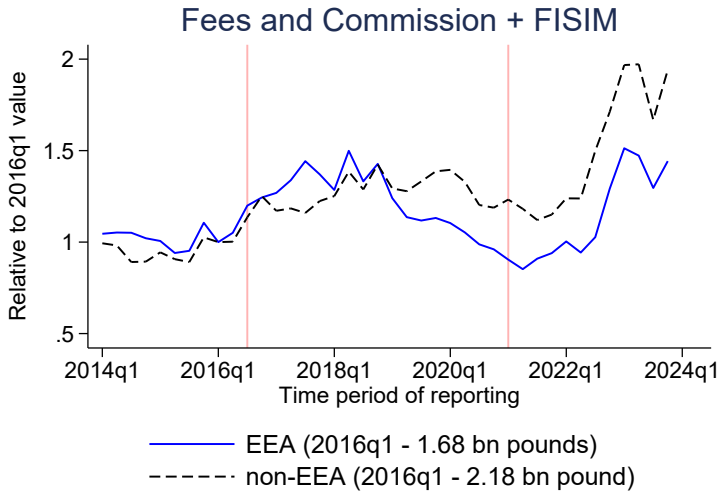


Figure 1: Exports by UK banks (FISIM + Fees and Commissions)

Due to these issues in measuring export, we study the impact of changes in trade barriers on export of banking services, by focusing on the "quantity" of exports i.e. on the stocks of

[23] Interest rates increased as monetary policy responded to high inflation over the period. That led to an increase in the reference rate but as there is an imperfect pass-through from the reference to the actual loan and deposit rates this led to a temporary increase in FISIM.

[24] These only differ across currency, i.e. GBP vs. other currencies.

deposits from and loans to non-residents.

4.2 Stocks of Deposits and Loans

We start by looking at changes in aggregate stocks of deposits taken and loans provided by UK-resident banks, from/to EEA and non-EEA countries, over time due to changes in UK-EU trade relations, using the BIS-LBS data. Figure 2 shows the stocks corresponding to the deposit-taking and lending services exported by the UK, relative to their 2016Q1 value (Appendix A.4 includes the corresponding graph, Figure 17 using the BoE data). The graphs show that the trend in stocks for EEA and non-EEA were similar initially, however, the rise is stocks of deposits is faster for non-EAA than EEA after the referendum (2016Q3). The stock of deposits falls with the new trade barriers (2021Q1). Additionally, loans provided to EEA decreased while that to non-EEA increased a few periods after the referendum.

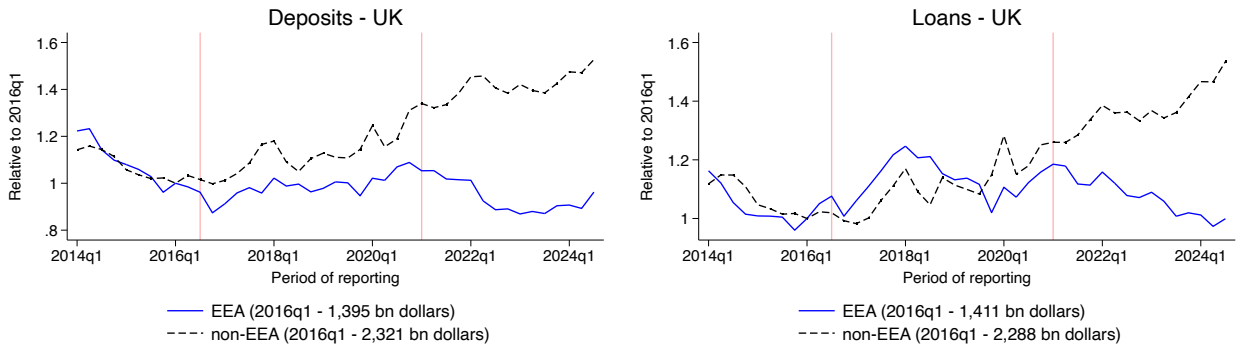


Figure 2: Stocks of Deposits taken and Loans provided by UK (BIS-LBS)

We examine if these changes in stocks are specific to the UK and hence can be driven by change in trade barriers, or if they reflect changes due to shocks that affect the banking sector globally. We run an event-study regression as specified below on deposits and loans (separately), using data from all reporting countries in the BIS-LBS data.

$$ln(stock_{sdt}) = \alpha + \sum_{k=2014Q1}^{2024Q3} \beta_1^k Dum_k_t \times Dum_EEA_d \times Dum_UK_s + \sum_{k=2014Q1}^{2024Q3} \beta_2^k Dum_k_t \times Dum_UK_s + \delta ln(exchange_rate_{st}) + \alpha_{sd} + \alpha_{dt} + \varepsilon_{sdt} \tag{4.1}$$

where s = source, d = destination, t = quarter. $Dum_k_t = \mathbb{1}\{t = k\}$, $Dum_UK_s = \mathbb{1}\{s = UK\}$, $Dum_EEA_d = \mathbb{1}\{d \in EEA\}$, $stock_{sdt} = deposits_stock_{sdt}$ or $loans_stock_{sdt}$. Since the dataset reports stocks in dollars, we include exchange rate of the currency of the exporter with the dollar, as control. We include country-pair fixed effects, as is common in gravity regressions, to focus on changes in exports by country-pair, and partner-time fixed effects to account for time-varying demand shocks. We cluster the standard errors by country-pair.[25]

Figure 3 shows the coefficients β_1^k and β_2^k for the event-study regression on total deposits from and loans to all counterparty entities. It shows change in deposits held and loans

[25] Our results on β_1^k stay the same if we include source-time fixed effects as well.

provided by UK resident banks where the partner country is either in the EEA or not in the EEA, relative to 2016Q2 (which we take as base period) and to other exporters (non-UK). The stock of deposits of UK resident banks taken from an average EEA country falls after the referendum, relative to 2016Q2 and controlling for other exporters' trends. Interestingly, there is also a significant relative increase in deposits that UK resident banks take from a non-EEA country after 2021Q1. We see a similar relative fall in stocks of loans UK resident banks provide to an EEA country, starting a few periods before the new trade arrangement is implemented. There are small increases in lending to a non-EEA country by UK-resident banks compared to other exporting countries, however, these increases are not consistently significant.

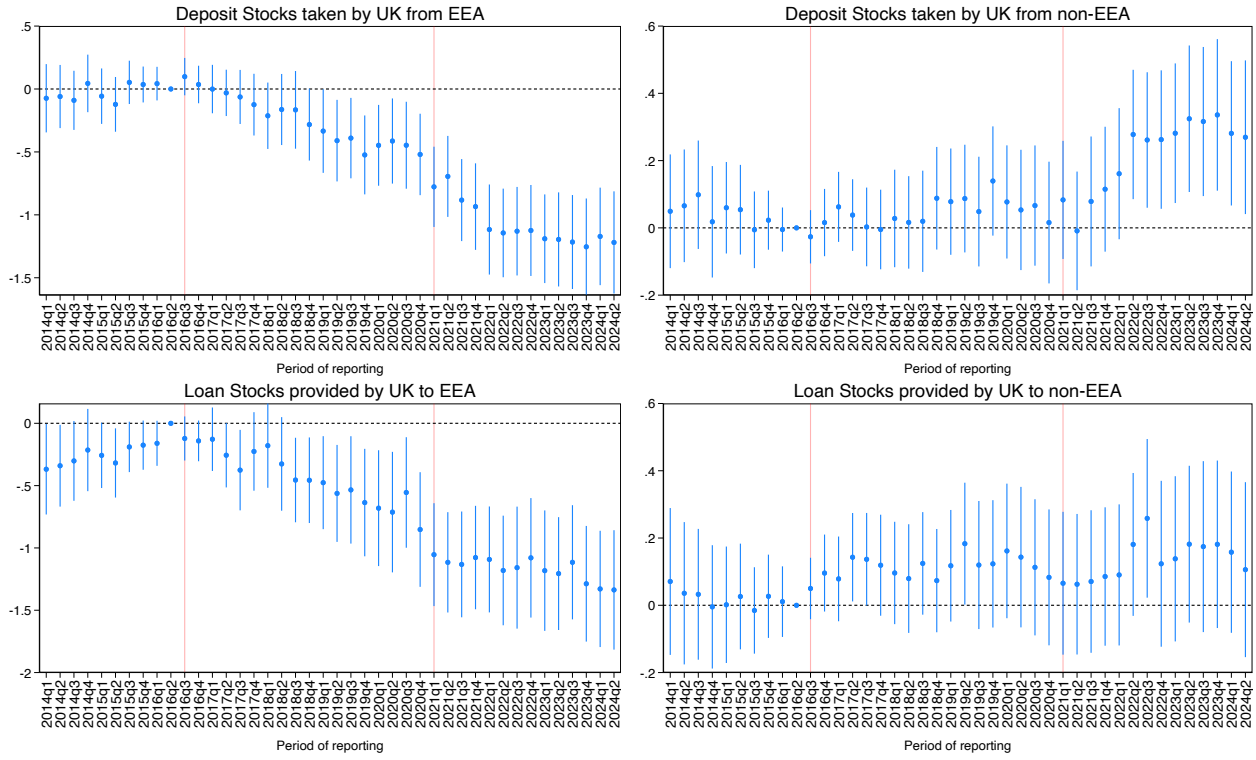


Figure 3: Event Study - Deposits from and Loans to All Entities (BIS-LBS)

As discussed in Section 3, transactions with financial intermediaries may not involve providing a service, and should be excluded for the purpose of our study. The BIS-LBS database contains stocks for export to non-banks[26]. Figure 4 shows the evolutions of stocks of deposits from and loans to non-bank entities in EEA and non-EEA. Similar to the total stocks, deposits from EEA and non-EEA were falling initially, however after the referendum, deposits from non-EEA increase faster than from EEA, and deposits from the EEA start falling after the new trade arrangement between UK and EU comes into effect. Trend in stocks of loans given to EEA and non-EEA diverge a few periods after the referendum, with the stocks for EEA falling.

[26]However, they may still include non-bank financial intermediaries that we cannot exclude in these data.

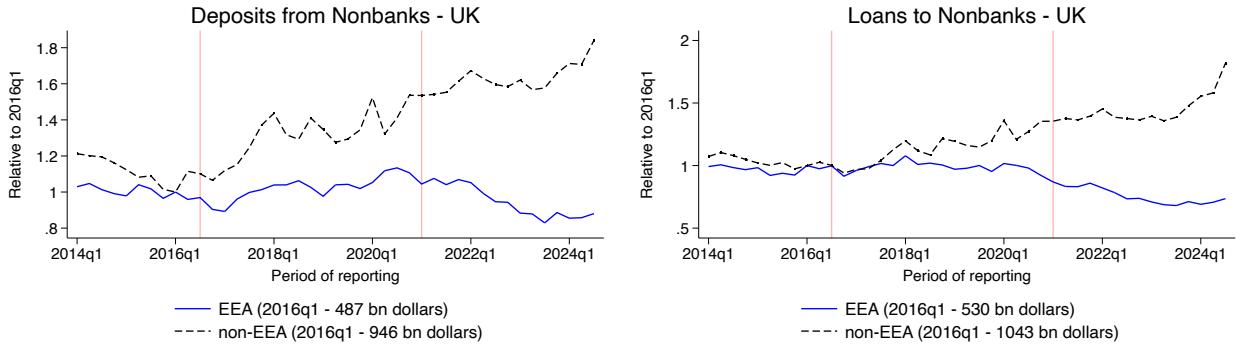


Figure 4: Stocks of Deposits from and Loans to Non-banks by UK (BIS-LBS)

Figure 5 shows the coefficients β_1^k and β_2^k for the event-study regressions on deposits and loans with non-bank counterparties. The quantity of export of deposit-taking services, as measured by stocks of deposits, to non-banking entities in an average EEA country compared to non-EEA country falls significantly after the new trade barriers come into effect in 2021Q1 relative to 2016Q2 and to other exporters (non-UK). We see a similar fall in stocks of loans to non-banks in an EEA country compared to non-EEA country, starting a few periods before the new trade arrangement is implemented. However, and contrasting with the results using total stocks, there is no significant change in deposit-taking and lending to non-banking entities in a non-EEA country by the UK when compared to other exporting countries (barring the fall in deposit from a non-EEA country after the referendum, however this is not consistently statistically significant).

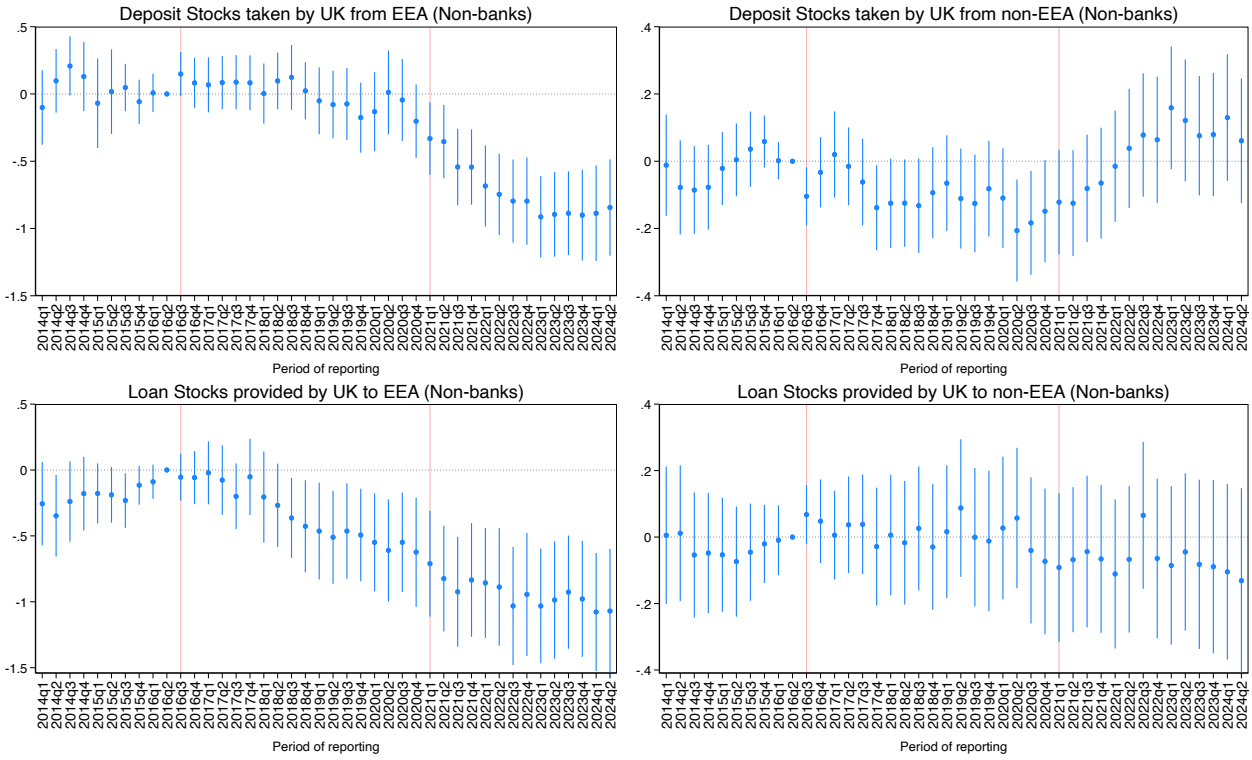


Figure 5: Event Study - Deposits from and Loans to non-banks (BIS-LBS)

The results from the two event studies suggest that stocks of deposits from and loans to

non-banks in an EEA country fell, while the increase in total stocks of deposits from an non-EEA can be driven by deposits from banks (including intragroup positions) in these countries.

The aggregate data, therefore, suggests a fall in stocks of deposits from and loans to EEA countries relative to non-EEA countries by UK banks, despite no difference in the export measures for the two country-groups (as shown in Figure 1). We use the bank-level data to determine how UK-resident banks were impacted by the change in trade relations in banking between UK and EEA, and the role of the characteristics of banks in the impact. In our analysis, we use the stocks of deposits taken from and loans given to non-resident households, non-financial corporation and government, which we henceforth refer to as the non-financial sector. Therefore, in contrast to the BIS data for non-banks, this excludes financial corporations. Ideally, we would have included financial corporations other than financial intermediaries. Despite having data on financial corporations, we are unable to obtain stocks corresponding to financial intermediaries separately and exclude all of the financial sector from our analysis. Due to this, our stocks going forward differ from the stocks corresponding to non-banks in the BIS-LBS.

Figure 6 shows stocks of cross-border deposits from and loans to non-financial sectors of EEA and non-EEA by UK-resident banks, relative to their 2016Q1 values. For deposits, the trends diverge close to the new trade arrangement between UK and EU coming into effect in 2021Q1. For loans, stocks diverge after the referendum.[27] Stocks of both are increasing for non-EEA and decreasing for EEA.[28]

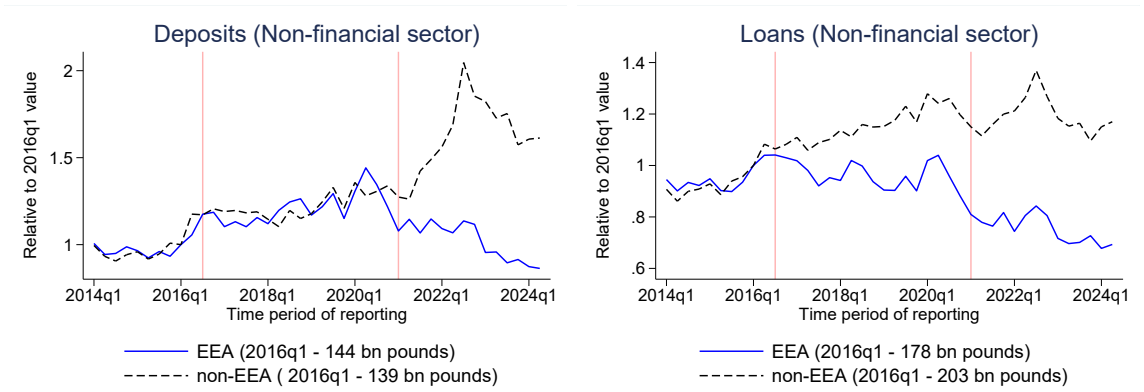


Figure 6: Stocks of Deposits from and Loans to non-financial sector by UK banks (BoE)

These stark trends have considerable volatility from one period to another (partly due to impact on saving and borrowing due to Covid-19 and the fiscal and monetary policies adopted by countries to contain an economic downturn and control subsequent inflation). This warrants a further investigation of the trends. In particular, (i) was there indeed a fall in stocks of exports to EEA and a rise in stocks of exports to non-EEA, indicating how banks adjusted to the trade barriers or were any of these changes due to trends, (ii) were these changes

[27] In addition to the impact of uncertainty and expectation of increased barriers, loans may respond more than deposits before trade barriers come into effect due to the fact that deposit arrangements can be terminated in a shorter time period than loans.

[28] The sharp peak in the graphs for non-EEA in both deposits and loans is due a sharp depreciation of the pound relative to the dollar in 2022Q2. This depreciation was due to fiscal policy measures proposed in the period that were subsequently withdrawn. The exchange rate is relevant for the stocks as stocks of deposits taken and loans provided by UK-resident banks in currencies other than the pound is converted to pounds by banks when reporting this information to the Bank of England.

uniform across all banks or were bank-specific characteristics determining the changes.

The increase in trade barriers and change in terms of market access would have a higher impact on banks that had EEA as a major export destination. We measure the importance of the EEA market in exports of the individual banks as the average of the share of stocks corresponding to exports to EEA in total export stocks, over the eight quarters in 2014 and 2015[29] ($PreEEAExp$). This measure is constructed separately for deposits and loans ($PreEEAExpDep$ and $PreEEAExpLoan$ respectively).

Figure 7 shows the stocks of deposits and loans corresponding to exports to EEA and non-EEA, for banks with below median (low) pre-referendum share of EEA in stocks and those with above median (high) shares, where median of $PreEEAExpDep$ is 41.99% and of $PreEEAExpLoan$ is 41.39% (summary statistics for these average shares is in Table 6 in Appendix A.5). For banks with low pre-referendum share of EEA in stocks corresponding to exports, we see that both deposit and loan stocks for EEA increase after the referendum and fall after trade barriers come into effect, but these changes are small. For these banks, there is an increase in stocks of deposits from non-EEA after 2021Q1. For banks that had high pre-referendum share of EEA in stocks, both deposit and loans stocks for EEA fall substantially. Deposit stocks for non-EEA rise, while loans stocks fall.

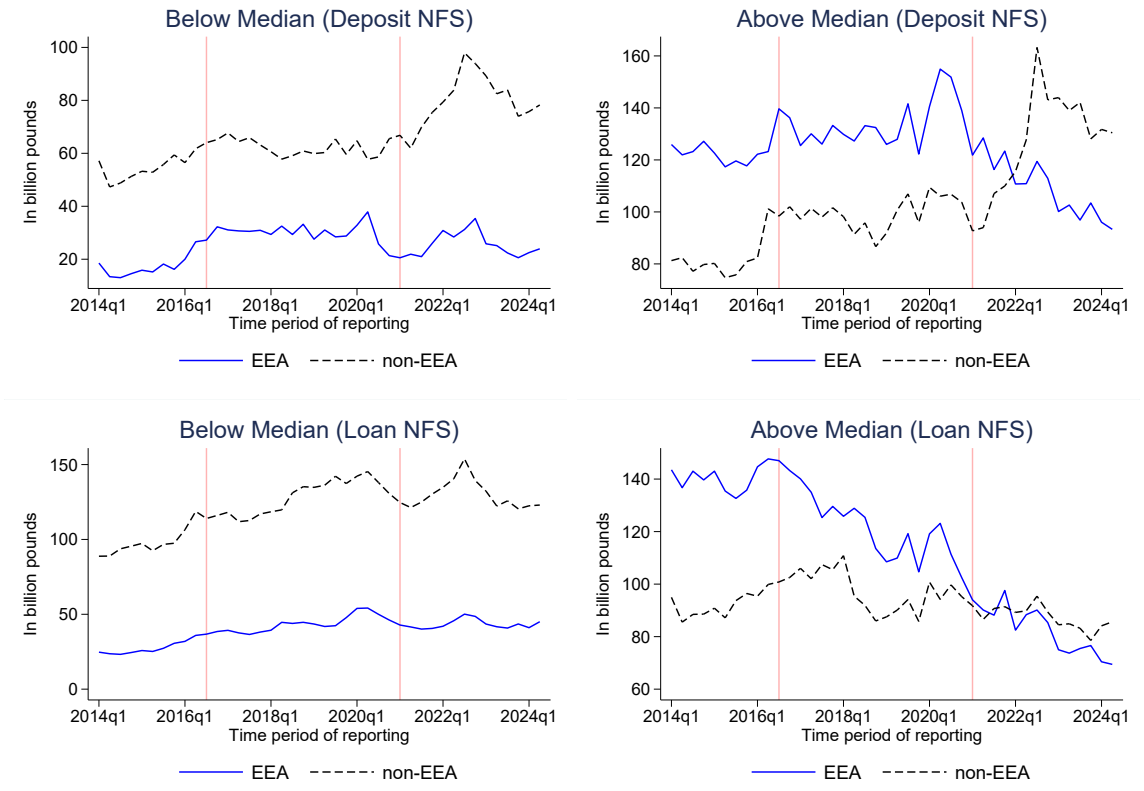


Figure 7: Stocks, by low and high share of EEA in stocks corresponding to exports

To quantify these changes, we run the below regression:

[29]We use this average rather than the first period of our data to include banks that get added to the dataset in the period before the referendum.

$$\ln(stock_{bt}) = \alpha + \beta_1 Dum_PostRefer_t \times PreEEAExp_b + \beta_2 Dum_Post21_t \times PreEEAExp_b + \alpha_b + \alpha_t + \varepsilon_{bt} \quad (4.2)$$

where b = bank, t = quarter, $Dum_PostRefer_t = \mathbb{1}\{t \geqslant 2016Q3\}$, $Dum_Post21_t = \mathbb{1}\{t \geqslant 2021Q1\}$ and $PreEEAExp$ differs for loans and deposits, and is a continuous measure. We include time fixed effects to absorb trends in stocks that are common for all banks, and bank fixed effects to absorb time-invariant bank characteristics. Standard errors are clustered at the bank-level. This regression is run for deposit and loan separately, with the corresponding pre-referendum share of EEA in stock. The dependent variable takes the value of stocks corresponding to EEA, stocks corresponding to non-EEA and total stocks of exports for a bank.

Table 1 shows the output for the regression on deposits. Column 1 shows that banks with a higher share of EEA in stocks of deposit in the pre-referendum period (i.e. a higher share of non-resident deposits coming from EEA) do not take more or less deposits from non-residents either after the referendum or after the trade barriers come into effect. However, banks with higher share of EEA in stocks before the referendum have a lower stock of deposits from the EEA after the referendum and this effect is statistically significant (Column 2). There is no additional effect after 2021. Banks with higher share of EEA in stocks increase deposits taken from non-EEA after the referendum, the same period when they reduce their stocks for EEA (Column 3). Table 1 suggests that banks that provided more deposit-taking service to EEA before the referendum reduced their service to EEA and increased it to non-EEA after the referendum. This suggests an substitution of exports of deposit-taking service among banks that export this service more to the EEA. For lending services (as shown in Table 2), banks with a higher share of EEA in loan stocks before the referendum do not change their stocks of loans on aggregate either after the referendum or after 2021. However, banks with higher initial EEA share in stocks had lower lending to the EEA after the referendum, and reduce it even further after the new trade barriers come into effect (Column 2). We do not observe an export substitution for loans when banks have a higher share of EEA in stock of lending, as the coefficients in Column 3 are insignificant. Tables 7 and 8 in Appendix A.5 shows the output for a similar regression when banks are categorised as having high and low share of EEA in stocks before the referendum, and our conclusions are similar.[30]

	(1) Aggregate (EEA + non-EEA)	(2) EEA	(3) non-EEA
Dum_PostReferxPreEEAExpDep	-0.000	-0.010***	0.008***
	(0.002)	(0.003)	(0.003)
Dum_Post21xPreEEAExpDep	0.001	-0.000	0.005
	(0.003)	(0.005)	(0.005)
Observations	5832	5377	5620
Adjusted R^2	0.806	0.809	0.810

Bank and Time FE. Clustering by bank.

Table 1: Banks' Deposits from EEA and non-EEA - share of EEA in stocks corresponding to exports

[30] Dropping observations for the years 2020 and 2021, years of the Covid-19 pandemic, gives similar results. Using a balanced sample gives similar results.

	(1) Aggregate (EEA + non-EEA)	(2) EEA	(3) non-EEA
Dum_PostReferxPreEEAExpLoan	-0.004	-0.010**	0.003
	(0.003)	(0.004)	(0.003)
Dum_Post21xPreEEAExpLoan	-0.004	-0.008*	-0.000
	(0.005)	(0.004)	(0.004)
Observations	6170	5813	5931
Adjusted R^2	0.767	0.777	0.791

Bank and Time FE. Clustering by bank.

Table 2: Banks' Loans to EEA and non-EEA - share of EEA in stocks corresponding to exports

4.2.1 Stocks for Domestic Activity

After we have documented the impact of increased trade barriers on UK-resident banks activity with non-financial sector of EEA and non-EEA countries, we investigate if there were implications for domestic activities of these banks as well. We combine the stocks corresponding to exports with deposits from and loans to the non-financial sector in the UK. We run the regression Equation 4.2 on total stocks and stocks corresponding to UK-residents to analyse if banks that have a higher share of EEA in stocks of exports reduce their overall deposit taking and lending activity, i.e. shrink in their activity, or if they increase their domestic activity instead.

Table 3 shows the output for the regression for deposits. Banks that have a higher share of EEA in stocks corresponding to exports do not take significantly less deposits from the non-financial sector in the UK (Column 2) either after the referendum or the new trade arrangement coming into effect. In total (including both activity with residents and non-residents), deposit-taking is lower for a UK-resident bank that took more of its deposits from the EEA before the referendum, but this is not statistically significant. For loans (Table 4), UK-resident banks that had a higher share of EEA in its stocks of loans to non-residents, have lower stocks of loans to UK's non-financial sector after the referendum and after the trade barriers come into effect, but these reductions are not statistically significant. However, banks with a higher share of EEA in their lending stocks corresponding to exports see a statistically significant fall in the total loans provided after the referendum (and a further fall due to changes in trade arrangement but this is statistically insignificant). Therefore, the reduced lending of these banks to UK-residents, combined with a lower stock of lending to EEA (as seen in Column 2 of Table 2) leads to reduced lending activity when the importance of EEA in stocks of exports is higher.

	(1) Deposits Total	(2) Deposits UK
Dum_PostReferxPreEEAExpDep	-0.003	-0.002
	(0.002)	(0.003)
Dum_Post21xPreEEAExpDep	-0.001	-0.002
	(0.002)	(0.003)
Observations	6685	6560
Adjusted R^2	0.855	0.905

Table 3: Banks' Deposits from All countries and UK - share of EEA in stocks corresponding to exports

	(1) Loans Total	(2) Loans UK
Dum_PostReferxPreEEAExpLoan	-0.009**	-0.004
	(0.005)	(0.005)
Dum_Post21xPreEEAExpLoan	-0.004	-0.003
	(0.003)	(0.003)
Observations	6686	6601
Adjusted R^2	0.808	0.852

Table 4: Banks' Loans to All countries and UK - share of EEA in stocks corresponding to exports

4.3 Impact on intragroup activities

The new trade arrangement between the UK and the EU restricted UK-resident banks' abilities to provide services cross-border or through branches. To access the EEA markets, the company-group of the UK-resident banks would have to increase their presence in the EEA. To increase presence or to expand capacity of entities of the group already present in the EEA, UK-resident banks may increase their activity with intragroup entities in the EEA. To investigate this, we use intragroup fees and cost recharges (income from non-resident entities of the same company-group for loans and advances, current account services, investment banking, advisory, brokerage and underwriting etc., as well as other intragroup services and cost recharges of centrally managed services) as a proxy.

Since access of EEA-resident banks to the UK market was also affected by the changes in trade policy, there may also be an increase in exports of services by EEA-resident entities to UK-resident intragroup banks. Therefore, we use the fees and recharges paid by UK-resident banks on imports from intragroup entities to study this mechanism, as well.

Figure 8 shows the change in intragroup fees and cost recharges received (exports) and paid (imports) by UK-resident banks from/to EEA and non-EEA, relative to their 2016Q1 values. While exports to EEA and non-EEA followed a similar trend initially, there is a large divergence before the trade barriers come into effect. The divergence in imports of services from intragroup entities in EEA compared to non-EEA occurred close to the referendum.

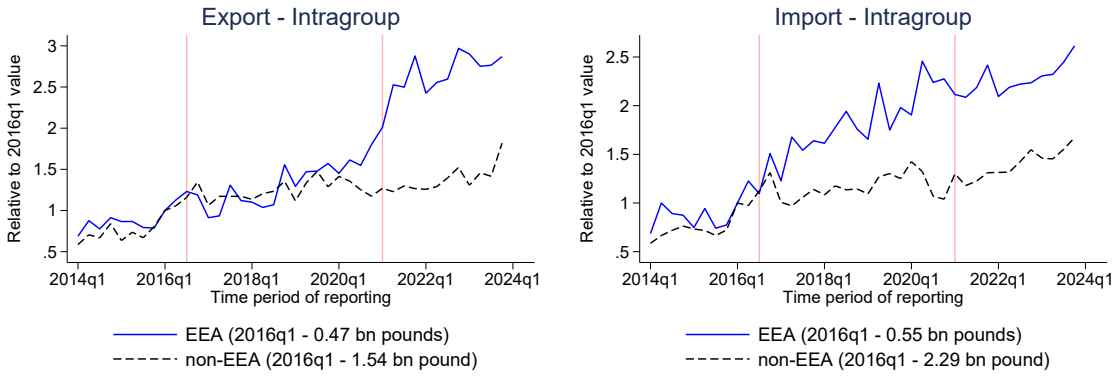


Figure 8: Intragroup trade of UK banks

These two graphs together show that trade of banks with non-EEA changes little as UK's trade relations with the EU changes, but banks trade more with entities within the same company-group in the EEA. This increase is particularly noteworthy given that export of some of the services captured in the variable (like loans and advances, current account

services, investment banking, advisory, brokerage and underwriting etc.) are themselves subject to trade barriers and that these services to non-residents that do not belong to the same company-group in the EEA is falling (as reflected in fall in export to EEA measured by fees and commission in Figure 16). This suggests that, when direct access to markets has reduced due to increased barriers, companies of the reporting banks use intragroup activities.

To quantify this difference in trade with EEA relative to non-EEA after the referendum and the new trade barriers, we run the following regression:

$$\begin{aligned}\ln(intragroup_{bdt}) = \alpha + \beta_1 Dum_PostRefer_t \times Dum_EEA_d \\ +\beta_2 Dum_Post21_t \times Dum_EEA_d + \alpha_{bd} + \alpha_{bt} + \varepsilon_{bdt}\end{aligned} \tag{4.3}$$

Note that d refers to partner country here (destination or importer for the export regression and is source or exporter for the import regression). We include bank-partner fixed effect to control for time-invariant differences in trade of bank b with different partner countries, and bank-time fixed effect to absorb bank-level shocks over time that affect trade with all partner countries. Table 5 shows a significant increase in intragroup fee received from and paid to EEA compared to non-EEA after the trade barriers come into effect. As mentioned in Appendix A.2, we allocate annually reported intragroup fees and cost recharges to each quarter equally in our analysis here.

	(1) Export	(2) Import
Dum_PostReferxDum_EEA	-0.081	0.105
	(0.153)	(0.145)
Dum_Post21xDum_EEA	0.287**	0.219**
	(0.130)	(0.084)
Observations	24608	23142
Adjusted R^2	0.829	0.833

Table 5: Trade with intragroup entities

5 Discussion on the role of structure of banks

UK's withdrawal from the EU restricts exports of banking services by UK-resident banks cross-border or conducting activities through branches, and requires banks to obtain separate authorisations to access the individual countries in the EEA market. These restrictions also apply to EEA-resident banks when accessing the UK market. Our data allows us to analyse the impact on banking units in the UK (we do not study the activity of branches of UK banks located outside the UK). We have documented an overall fall in stocks of deposits from and loans to the non-financial sector in the EEA and rise in stocks corresponding to non-EEA (as in Figure 6), and these trends are largely driven by banks that had a higher share of EEA in stocks of cross-border activity in the pre-referendum period (Figure 7 and Tables 1 and 2). We also see an increase in trade with intragroup entities in the EEA relative to non-EEA (Figure 8 and Table 5). While we gather more evidence on the response of banks to barriers, the question remains - what do these responses indicate about the adjustments made by company-groups of banks (i.e. the companies to which the UK-resident banks belong) as access to EEA market gets more restricted. To this end, we look at the changes in status of UK-resident banks and nationality of the ultimate owner.

UK-resident banks can be one of different types - incorporated in the UK, branches of banks that are incorporated in the EEA or non-EEA (we refer to this as status).[31] Furthermore, these banks can have ultimate owners of different nationalities (UK, EEA or non-EEA). A UK-resident bank could have been established to access the UK market or the EEA market (through passporting) or both before the referendum. Restrictions introduced after withdrawal of the UK from EU will elicit different responses from UK-resident banks, based on the initial objective behind establishing the bank, and the nationality of the ultimate owner. The trade barriers will also influence the structure that company-groups of banks would establish across UK and EEA (i.e. if they would maintain a presence and if so, whether they would have a branch or a separate legal entity like a subsidiary). For instance, a UK-resident bank with a UK ultimate owner may reduce cross-border trade with EEA due to trade barriers but establish a legal entity in the EEA. A UK branch of a company whose ultimate owner has EEA nationality, which was established to benefit from the extensive banking and financial network in London but serve the EEA market cross-border, may either transform to a UK-incorporated entity, with necessary authorisations to serve a specific EEA country or exit altogether. If instead, it was established to serve the UK market, trade with EEA may not have a significant impact. A UK-resident bank with a non-UK, non-EEA ultimate owner may have been established to access the EEA market and due to trade barriers, the company may cease operations in the UK and establish presence in the EEA.

In work in progress, we combine our confidential bank-level data with data from Orbis and publicly available data on type of the UK-resident banks to study this. We divide UK-resident banks into 3 categories - banks incorporated in the UK[32], UK branches of banks incorporated in the EEA (this includes branches operating when passporting was permitted and those with supervisory run-off after the withdrawal[33]), and UK branches of banks incorporated outside the UK or EEA. Figure 9 shows the trends in deposits of UK-resident banks, by their status, relative to the corresponding values in 2016Q1. The divergence in stocks of deposits from EEA and non-EEA that we had observed in Figure 6 is largely driven by banks incorporated in the UK. The graph suggests that these banks may be changing their target market due to increased export barriers to EEA. UK branches of EEA incorporated banks have a much smaller share of its cross-border activity with non-EEA but this activity increases, while deposit taken from EEA falls. However, UK branches of non-EEA incorporated banks are reducing both EEA and non-EEA activity[34], suggesting that these banks may be reducing activity overall.

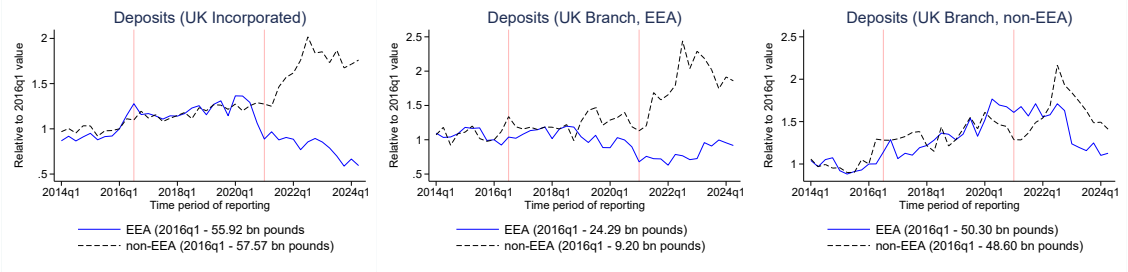


Figure 9: Stocks of Deposits taken by UK-resident banks, by status

[31] Banks incorporated outside the UK or EEA can be authorised to operate a branch in the UK.

[32] These banks could have a UK national ultimate owner, or be a incorporated legal entity of a company of any other nationality

[33] Supervisory Run-Off allows UK branches of EEA banks to wind down their UK regulated activities in an orderly manner.

[34] We note again that the sharp peak in 2022Q3 is driven by a temporary sharp depreciation of the pound

In Figure 10, we see similar trends in stocks of loans provided by UK incorporated banks and UK branches of banks of third countries. In addition to fall in loans to EEA, we see a fall in loans to non-EEA by UK branches of banks incorporated in the EEA.

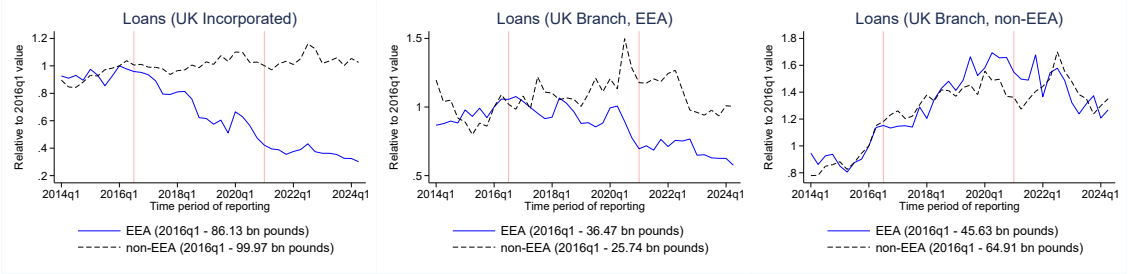


Figure 10: Stocks of Loans provided by UK-resident banks, by status

The graphs look similar if we take a balanced sample of UK-resident banks that appear in our data from 2014Q1 to 2024Q2. Moreover, preliminary evidence suggests that the trends of UK incorporated banks are largely driven by banks with a UK ultimate owner, suggesting that UK-owned banks have been shifting their target market. While these figures provide indications of the adjustments by company groups, as discussed above, we seek to obtain concrete evidence on the mechanism. We combine cross-border activities with domestic activities of UK-resident banks to determine the key market that the bank was established to operate in. Then we track if branches have been transformed to UK-incorporated entities (which involves changes in the names of entities), especially by EEA owned companies, or there has been an exit from the UK market. Lastly, we determine changes made in the structure of the company-group through establishment of branches or subsidiaries, and how this varies by nationality of ultimate owner.

6 Theoretical Framework

The evidence we have provided so far suggests that UK-resident banks changed their cross-border activity in response to the trade barriers and we have discussed the role of banks' characteristics (like incorporation status, nationality) in determining the response. We have shown that banks with a higher share of cross-border activity with EEA respond more to the barriers and further classify UK-resident banks by their target market (domestic, EEA or non-EEA) before the referendum to determine the impact of this classification on changes made by banks. To understand the mechanism, that is based on the banks' characteristics, in greater depth, we build a theoretical framework that embeds the multinational structure in a model of banking across borders à la Kerl & Niepmann (2015) and Niepmann (2023). The model allows us to estimate the impact of the policy change on the performance of UK's banking sector and perform counterfactual analysis. We provide an outline of the model in this draft to introduce elements crucial for the mechanism, postponing the specification of full model for future drafts and presentations.

The world consists of three countries (denoted by i), UK (B), EEA (E), non-EEA (R). Each country is endowed with K_i units of capital and L_i units of labour. Each country has three types of entities - firms (f), depositors (d) and banks (b). Firms produce a homogeneous good using capital and labour. Each firm requires z_f amount of capital, where $z_f > 1$. The gross return to this capital is defined as R_i, which is determined by the marginal product of capital. The economies also have depositors who own capital and for the purpose of this

outline, we assume that each depositor owns one unit of capital. The depositors invest their capital in banks, for gross interest R_i^D.

Lastly, the economies have banks, that provide loans to firms and take deposits from depositors, both domestically and cross-border. We focus on UK-resident banks, given the context we are studying. Banks are endowed with some capital, and for the purpose of this outline, we assume that each bank can use one unit of its own capital endowment for the loan it extends to a firm (this element will be clarified with market clearing). UK-resident banks are part of a larger company group, with nationality n, which could be any of the three countries. Each bank has an efficiency in monitoring the loans, denoted by a_b. This efficiency is drawn from a distribution, and the parameters of the distribution vary with nationality of the bank and its incorporation status in the UK. The monitoring cost for a bank b extending a loan of amount z_f is:

$$c(a_b) = \frac{h(z_f)}{a_b} \tag{6.1}$$

where h is an increasing and convex function. The monitorig cost depends on the country of the firm as well. If a bank takes deposits from a UK resident to provide loans to a UK firm, then its profit is:

$$\pi_{bBB} = R_B z_f - \frac{h(z_f)}{a_b} - R_B^D(z_f - 1) \tag{6.2}$$

where the first subscript of π denotes bank b, the second denotes country of residence of depositor and the third denotes country of residence of the firm.

UK-resident banks can also provide their services cross-border. If a UK bank lends to a firm in country j, then it incurs a fixed cost of χ_{Bj}^L. There is an additional variable cost, which is "iceberg" in nature. The firm pays a gross interest of R_j but the bank receives $\tau_{ij}R_j$, where $\tau_{ij} < 1$. If a UK bank raises deposits from country j then it incurs a fixed cost of χ_{Bj}^D. The iceberg variable cost implies that to pay R_j^D to the depositor, the bank incurs a variable cost of $t_{ij}R_j$, where $t_{ij} > 1$. Alternatively, the bank can set-up a subsidiary to eliminate the variable cost, by incurring a fixed cost of χ_{Bj}^S. The fixed costs are such that $\chi_{ij}^L < \chi_{ij}^B < \chi_{ij}^S$, where the first inequality represents more regulations that banks are subject to when taking deposits and the second inequality represents higher cost of setting up new operations.

With these additional possibilities of providing services cross-border or through subsidiaries, banks can borrow from, lend to and establish subsidiaries in any of the three countries, and the profit from a lending activity depends on these locational choices. For eg., if a UK-resident bank borrows from the a depositor in the UK and lends to a firm in EEA, its profit is $\pi_{bBE} = \tau_{BE}R_E - h(z_f)/a_b - R_B^D(z_f - 1) - \chi_{BE}^L$. Instead if it provided intermediation service in the EEA through a subsidiary, its profit is $\pi_{bEE} = R_E - h(z_f)/a_b - R_E^D - \chi_{BE}^S$. In equilibrium (which includes market clearing conditions), we obtain cutoffs for bank efficiencies for the different types of activities.

UK's withdrawal from the EEA and the subsequent trade barriers change the fixed and variable cost of providing services to the EEA. We begin with the initial assumption that the costs incurred by UK-resident banks are such that the fixed and variable costs for providing services cross-border to or establishing a subsidiary in EEA is lower than the corresponding costs for non-EEA. Additionally, the profit from taking deposit and providing loan to a

country cross-border is greater than the profit from establishing a subsidiary in the country. However, the trade barriers increase the cost for EEA such that cost of cross-border activity and establishing subsidiary increases, while costs for non-EEA remain unchanged. Moreover, the increase in cost of providing services to EEA cross-border, is so much larger that establishing a subsidiary may become a viable option for some banks. This captures the loss of passporting and increased regulatory and licensing requirements.

The model is calibrated and estimated for the two sets of cost-structures to determine how the increased trade barriers change efficiency thresholds for the different activities and thereby change how banks with different characteristics (captured by efficiency) conduct their foreign activity. The changes in cut-offs lead to changes in composition of the UK banking sector, in terms of their characteristics. We estimate the effect of the change in composition on the efficiency of the banking sector as a whole. The quantification of the impact on the sector is important as banking is a significant part of the UK economy. More broadly, the banking sector in an economy plays a crucial role in providing capital to firms and mobilising capital from savers. The performance of the sector has wider role in the economy, making it imperative to study the impact on it of any changes in policy.

7 Summary and Next Steps

To summarise, we document the following about the impact of changes in UK-EU trade relations on cross-border banking services:

1. Exports of deposit-taking and lending services by UK-resident banks, as proxied by FISIM and fees and commissions, have not been significantly affected by the referendum or the new trade arrangement between the UK and the EU, but this could largely reflect measurement and data limitations
2. Aggregate stocks corresponding to the exports (i.e. stocks of deposits taken and loans provided) by UK-resident banks to non-banks in an EEA country declines significantly relative to a non-EEA country, especially after the new trade arrangement came into effect in 2021.
3. Focusing on the non-financial sector, stocks of deposits from EEA fall and non-EEA rise a few periods before 2021 while stocks of loans to EEA fall and non-EEA rise after the referendum.
4. Banks that have more of their stocks of deposits from the EEA before the referendum see a fall in stock of deposits from EEA and a rise from non-EEA after the referendum. A higher share of EEA in stock of loans in the pre-referendum period is associated with a fall in stock of loans to EEA after the referendum and a further fall after 2021, but no effect on stocks of loans to non-EEA. This reflects importance of pre-referendum exports with EEA in impact and a shift in some cross-border activities towards non-EEA.
5. Trade of UK-resident banks with EEA-based intragroup entities relative to non-EEA based intragroup entities increases significantly

This suggests a significant change in the way banks provide cross-border services with the EEA, with a potential move away from the EEA market.

In work in progress, we continue our investigation of the impact and the mechanisms by which banks respond to the changes in trade barriers. Our results suggest that UK banks reduced

their stocks of deposits from and loans to EEA countries and the fall was driven by banks that had a higher share of EEA in stocks in the period before the referendum. We expand on this by looking at shares of EEA in total deposit-taking and lending activity (i.e. domestic and cross-border) to understand the target market of the banks. We explore the role of the nationality of the ultimate owner of the bank in the impact. This analysis would also provide insights on the structure of cross-border trade and presence of branches or subsidiaries used by different company-groups to access different markets, and thereby, the adjustments made by company-groups to changes in trade barriers. We expand our analysis on trade with intragroup entities by studying how stocks of deposits from and loans to intragroup entities change with changes in trade arrangements. Evidences from these analyses allows us to obtain insights on the operation of banks as multinational organisations and their response to changes in trade barriers through changes in structure and intragroup activities. We build a theoretical framework that embeds this multinational structure in a model of cross-border banking, to rationalise the evidence and allow for a counterfactual analysis to quantify the impact of trade barriers on the UK banking sector.

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A Appendix

A.1 Coverage of BoE bank-level data

We compare the values of stocks in the BoE data, aggregated to the level of partner country and quarter, with equivalently aggregated data of the BIS-LBS for the UK, to learn about the coverage of the BoE data. The BoE data is reported in pounds, irrespective of the currency in which the transaction had taken place[35], while BIS-LBS is reported in dollars. While we convert the BoE data to dollars, the stocks in the datasets may differ due to the difference in exchange rate being used. For loans 82% of the observations across the two datasets differ by atmost ± 5%, and about 90% of the observations differ by atmost ± 10%. The match is better for deposits. Figure 11 shows the frequency of difference in stocks, compared across the two datasets, by observation (i.e. at partner country and quarter level) for the UK i.e.

$$Percentage\ difference\ in\ stock\ = \frac{BoE_stock - BISLBS_stock}{BoE_stock} \times 100$$

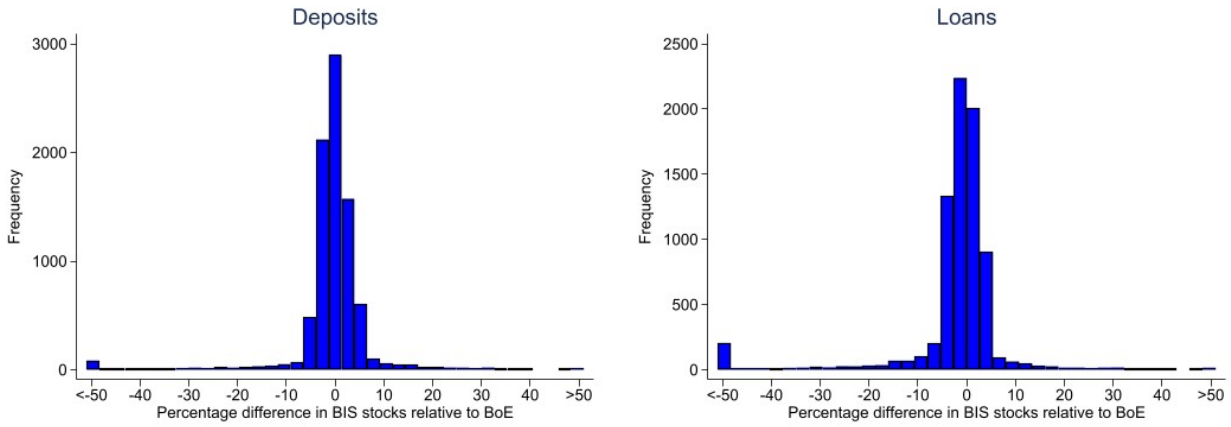


Figure 11: Comparing BoE and BIS-LBS stocks for UK

Note that most components of stocks are common between the BoE and the BIS-LBS data (loans and advances, finance leases, repurchase agreements etc.), there are some (like bills) that are not common. However, this does not lead to substantial over- or under-reporting of stocks in one dataset relative to the other.

BIS-LBS also contains information for non-bank counterparty sector. Since FISIM, which is the main component of export value of these services, does not include deposits from and loans to financial intermediaries including banks, we conduct our analysis for non-banks as well.[36] We compare the BIS-LBS data, aggregated to the level of partner country and quarter, with stocks constructed for Non-banks in the BoE data (where non-banks include households, non-financial corporations, general government and other financial corporations).

For loans, 70% of the observations across the two datasets differ by atmost ± 5%, and about 75% of the observations differ by atmost ± 10%. The match is better for deposits. Figure 12

[35]Outstanding liabilities and assets in currencies other than sterling should be converted into sterling at the middle market spot rate pertaining in the London market at 4pm London time on the last working day of the London market in the period covered by the report, as stated in the General Notes and Definitions for reporting.

[36]Breakdown of stocks by partner country is not available in BIS-LBS for other counterparty sectors when UK is the reporting country, so this is the closest we can get to our analysis of the non-financial sector.

shows the frequency of difference in stocks, compared across the two datasets, by observation (i.e. at partner country and quarter level) for the UK (measure same as above).

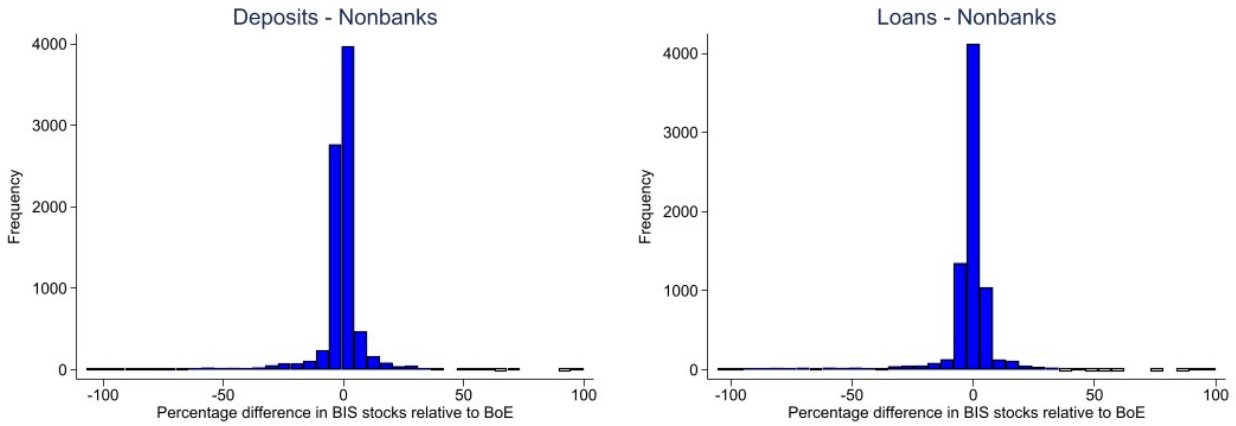


Figure 12: Comparing BoE and BIS-LBS stocks corresponding to Non-banks for UK

We note that the stocks of loans and deposits obtained from BIS-LBS and the BoE data includes repurchase agreements, but the stocks used by the ONS to calculate FISIM does not. We include repurchase agreements in the stocks for our analysis for three reasons. First, repurchase agreements may have a FISIM components and the reason for ONS to remove it is to maintain consistency is FISIM calculation over time. Stocks by counterparty entity was not available previously, and since repurchase agreements are largely used for transaction between financial intermediaries, removing repurchase agreements from the stocks was a way to remove stocks corresponding to the financial intermediaries. With more granular data available by counterparty entity now, elimination of repurchase agreement for this purpose is not needed. Second, stocks for repurchase agreements are not reported separately for each partner country. To remove them for our analysis, we will have to assume a distribution of repurchase agreements across countries, and this imputation may compromise the data. Third, our aim is not to reconstruct FISIM but to understand how service provision changed with trade barriers.

Additionally, the stocks of loans from the BoE data that we use includes bills, which does not generate FISIM. We are unable to remove bills from the stocks because these are not reported separately by the banks for each partner country and sector. However, bills would only constitute a small component of of the stocks for the non-financial sector.

A.2 Explicit charges for deposit-taking and lending services to non-residents

A.2.1 Fees and Commission

Fees and commissions constitute a substantial share of the total value of exports of UK's banking sector. This includes income from arrangement of loans and advances, current account services, management of portfolio of securities and other financial and non-financial services. Although banks report fees and commission for partner country, they do not report what part of this income is received for each of the different services provided, for partner country. However, the banks separately report fees and commissions received from non-resident entities, by service provided:

1. Investment management and securities
2. Loans, advances, commitment and utilisation services - This includes reservation fees, early redemption fees, switching fees or any ongoing servicing fees, as well as participation or front-end fees and underwriting, commitment, facility and utilisation fees for euronote facilities[37]
3. Derivatives instruments provided to non-residents
4. Current account services
5. Other financial services - For e.g. fees receivable for guarantees payable under break clauses, fees for administering loans on behalf of other lenders
6. Non-financial services - For e.g. e.g. executor and trustee services, computer bureau services

Figure 13 shows the number of firms by share of fees and commissions from providing deposit-taking and lending services (2+4 above) in total fees and commissions received from non-resident entities. The figure shows three periods - before the referendum (2014q3), after the referendum but before UK's exit from the EU (2018q3) and after the new trade arrangement between UK and EU comes into effect (2023q3). There are a total of 365, 367 and 334 banks in the three periods, respectively, in our dataset. For all three periods, for most UK banks, fees and commissions explicitly charged for deposit-taking and lending services account for either none or all of the fees and commissions. There is no substantial difference in the distribution of firms across the shares over time, after taking into account changes in number of banks. Therefore, are results are not driven by a few banks exporting service.

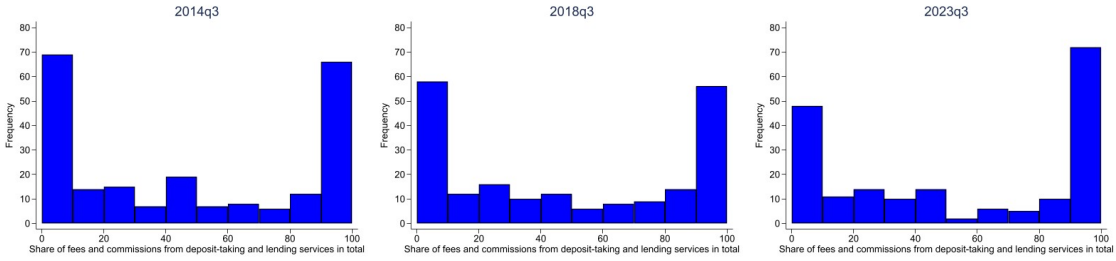


Figure 13: Number of banks by share of fees and commissions from deposit-taking and lending exports

Figure 14 shows the share of the different components of fees and commissions, aggregated across UK-banks, over time. Here, other financial services includes 1,3 and 5 above. The shares of the different services exported by UK-resident banks in total export value remains constant over time. Share of fees and commissions from exporting deposit-taking and lending services is 27% on average over the period of analysis. Nearly all of the fees and commissions from intermediation services is from lending services. A caveat here is that fees and commission from deposit-taking and lending services can be charged to other banks and financial intermediaries, and even to intragroup banks (when they can separate these charges from other charges). However, our measure of export should ideally exclude charges from deposit-taking and lending to these entities as they may not have a service component. Due

[37]These are facilities were a syndicate of banks underwrites the issuance of a short-term negotiable notes, providing them with access to funds

to data limitations, we are unable to separate fees and commissions by sector. Additionally, an argument can be made that since deposit-taking and lending to banks and financial intermediaries does not have a service component, explicit charges on them would be small.

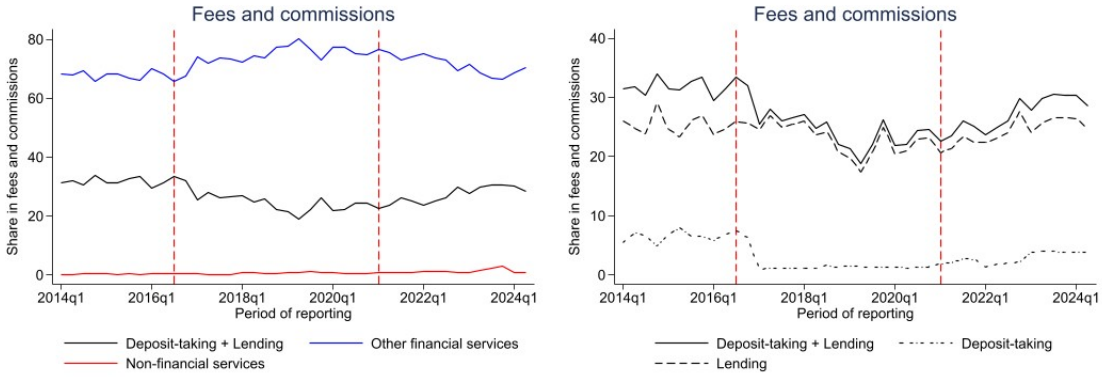


Figure 14: Share of components of fees and commissions

A.2.2 Reporting of explicit charges

We note that not all UK-resident banks report these explicit charges for each partner country. Moreover, some banks report this information quarterly, while other report annually. To measure export of all UK-resident banks by partner country, data for non-reporters are imputed, and this may be used in the aggregate data of UK exports. Our analysis uses only reported values. To measure export quarterly, we allocate annually reported values to each quarter equally. We do not include any imputed values in our analysis, but are results hold when we include them.

A.3 Export by UK-resident banks

Figure 15 shows the total export of UK resident banks measured as the sum of fees and commissions, intragroup fees and cost recharges, net spread earnings (NSE) and FISIM (on loans and deposits), to EEA and non-EEA, relative to the corresponding value in 2016q1. Exports to non-EEA is twice that of exports to EEA. There is no substantial difference in the change in export to EEA and to non-EEA, over the period of analysis, again, suggesting that the uncertainty after the referendum or the new trade relationship with the EEA, which has more trade barriers, has had no effect of exports by banks. However, as mentioned in Section 3, (i) NSE and FISIM (which constitute 60% of total trade) are apportioned for partner country using distribution of other variables associated with export, and are not informative of changes across countries or country groups over time, (ii) NSE does not capture intermediation services, (iii) intragroup fees and cost recharges is categorised as other business services in Balance of Payments and (iv) fees and commissions includes income from services other than intermediation service that banks may offer.

Following the discussion on Figure 1, we split our proxy of export of banking services into Fees and Commission and FISIM in Figure 16. While initially export, as measured by fees and commission, for the EEA and non-EEA follow the same trend, they diverge in the period between the referendum (2016Q3) and the new trade relation between the UK and EU (2021Q1). Exports to non-resident non-intragroup entities, are falling for both EEA and non-EEA but the fall is larger for EEA. On the other hand, export measured by FISIM, are nearly equal for EEA and non-EEA in our reference period of 2016Q1 and the changes

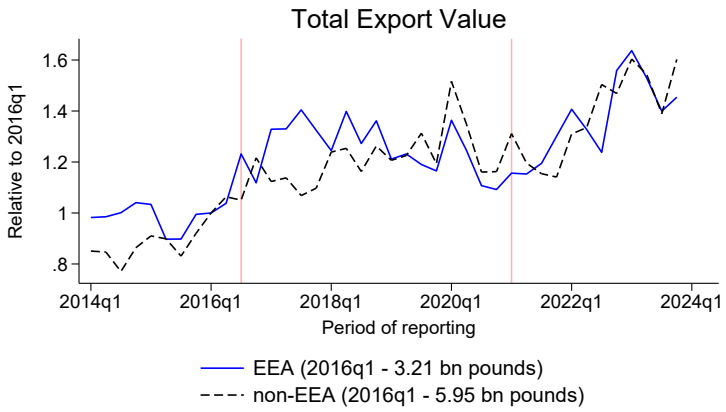


Figure 15: Total exports by UK resident banks

over time for these two country groups are nearly equal. This is largely driven by the mathematical formula for calculating FISIM (which multiplies difference between interest payable/receivable and the reference rate with total stocks) and the apportioning (which uses country-level stocks).[38]

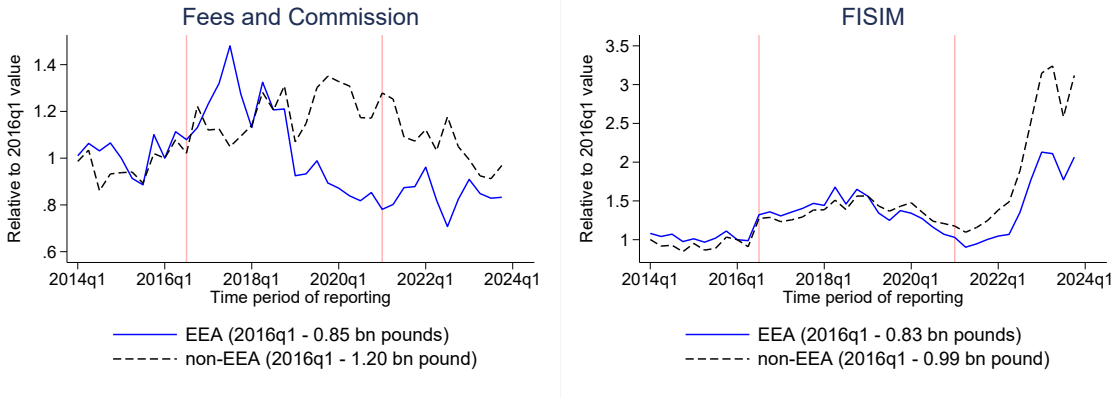


Figure 16: Exports by UK-resident banks - Fees and Commission, FISIM

A.4 Stocks exported by UK banks

Figure 17 shows the stocks of deposits from and loans to non-residents by UK banks, aggregated from bank-level BoE data. Banks report these values in pounds and we convert them to dollars, to compare with BIS-LBS and to take changes in exchange rate into account. The trends in this figure is similar to the trends in Figure 2, which also speaks to the coverage of the BoE data.

[38] Note that the FISIM calculation here excludes repo in loans and deposits to be consistent with aggregate trade statistics of the UK.

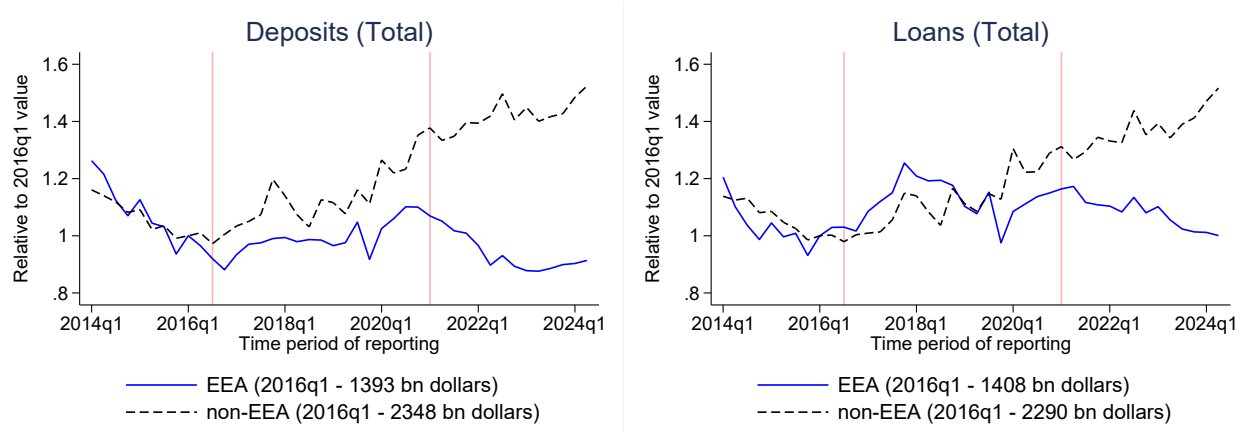


Figure 17: Stocks of Deposits from and Loans to non-residents (BoE)

A.5 Analysis with bank-level data

To determine whether banks with higher quantities of exports to EEA were more affected by the uncertainties in the future of trade and the higher trade barriers, we measure this initial share of EEA in stocks of deposits from and loans to non-residents. Table 6 provides the summary statistics for these measures. The average bank has about 40-45% of its stocks of deposits and loans from cross-border activity corresponding to the EEA. Banks vary more in the share of EEA in deposit stocks than in loan stocks, although for both deposits and loans, there are some banks that have all their stocks from exporting services to EEA and some have none of their stocks from exporting services to EEA.

	Mean	S.D.	10th Pctl	25th PCtl	Median	75th Pctl	90th Pctl	Min	Max
PreEEAExpDep	45.00	35.86	0.19	9.41	41.99	81.17	97.64	0.00	100.00
PreEEAExpLoan	42.97	30.37	3.75	15.63	41.39	67.66	86.58	0.00	100.00

Table 6: Summary statistics for Measure of Share of EEA in Stocks before Referendum

We use the median values to categorise banks as having a high or low share of EEA in their stocks of deposits and loans. $HighPreEEAExp = \mathbb{1}\{PreEEAExp \geqslant median(PreEEAExp)\}$. We run the following regression:

$$\ln(stock_{bt}) = \alpha + \beta_1 Dum_PostRefer_t \times HighPreEEAExp_b + \beta_2 Dum_Post21_t \times HighPreEEAExp_b + \alpha_b + \alpha_t + \varepsilon_{bt} \quad \text{(A.1)}$$

We run this regression for stocks of deposits and loans separately, and on stocks corresponding to EEA only, non-EEA only and total stocks from/to non-residents.

Table 7 shows the output for the regression on deposits. Column 1 shows that banks with above median share of EEA in stocks do not have more or less change in stocks after the referendum or after the trade barriers come into effect compared to banks with below median share of EEA in stocks. However, banks with high share of deposits from EEA before the referendum have a lower stock of deposits from the EEA after the referendum relative to banks with lower share of EEA in stocks and this effect is statistically significant (Column

2). There is no additional effect after 2021. Banks with above median share of EEA in stocks increase deposits taken from non-EEA after the referendum, the same period when they reduce their stocks for EEA (Column 3), as well as after the new trade arrangement.

	(1) Aggregate	(2) EEA	(3) non-EEA
Dum_PostReferxHighPreEEAExpDep	-0.008	-0.582***	0.438***
	(0.141)	(0.204)	(0.152)
Dum_Post21xHighPreEEAExpDep	0.184	0.055	0.463*
	(0.224)	(0.298)	(0.253)
Constant	12.553***	11.272***	11.667***
	(0.060)	(0.088)	(0.060)
Observations	5832	5377	5620
Adjusted R^2	0.807	0.808	0.810

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Banks' Deposits from EEA and non-EEA - share of EEA in stocks

For lending services (as shown in Table 8), banks with above median share of EEA in loan stocks before the referendum have a fall in total stocks of loans to non-residents after the referendum. These banks reduce their lending to the EEA after the referendum, and reduce it even further after the new trade barriers come into effect (Column 2). We do not observe an export substitution for loans when banks have above median share of EEA in stock of lending, as the coefficients in Column 3 are insignificant.

	(1) Aggregate	(2) EEA	(3) non-EEA
Dum_PostReferxHighPreEEAExpLoan	-0.285*	-0.534***	-0.065
	(0.154)	(0.167)	(0.174)
Dum_Post21xHighPreEEAExpLoan	-0.162	-0.367*	-0.073
	(0.206)	(0.211)	(0.193)
Constant	13.373***	12.397***	12.729***
	(0.062)	(0.070)	(0.062)
Observations	6170	5813	5931
Adjusted R^2	0.767	0.776	0.791

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Banks' Loans to EEA and non-EEA - share of EEA in stocks