

Annex 7 to Interim Report

Market review of scheme and processing fees

Econometric analysis

May 2024

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Note: The places in this document where confidential material has been redacted are marked with a [REDACTED]

Annex 7

Econometric analysis

Introduction

- 7.1** Our descriptive data analysis, presented in Annex 6, on the evolution of scheme and processing fees suggests that the average acquirer gross fee revenues (expressed as a share of transaction value) increased for both Mastercard (1%) and Visa (1%) between 2017 to 2021 and the financial years 2018 to 2022 respectively.
- 7.2** The average acquirer gross fee revenue (expressed as a share of transaction value) is a derived metric calculated for each acquirer by dividing its annual gross scheme and processing fees paid by the annual total card transaction value acquired.
- 7.3** We examine whether there has been an increase in average acquirer gross fee revenues after controlling for transaction mix for the population of all acquirers. This is important because, for example, an observed increase in average acquirer gross fee revenues in our descriptive data analysis may be mainly driven by changes in transaction mix over the same period as the increase. In this annex, we explain how we use econometric techniques to control for the main transaction characteristics such as observed transaction volume, value and mix, to isolate any change in acquirer fee revenues that may represent a price change, except for the level of optional services take up. Because not controlling for optional services take up may potentially distort our isolation of acquirer fee revenue changes, as certain acquirers may pay higher average fee revenues to opt in for optional services, we have also looked at whether acquirer gross fee revenues have increased for mandatory (ie. non-optional) services only in our sensitivities. We have not undertaken further disaggregated analysis as the focus of this annex is to examine cumulative changes in average acquirer fees *for all acquirers* as opposed to changes in individual service prices. The amount of optional fees an acquirer pays may increase or decrease as the acquirer opts in or out of optional services and including them in the analysis would distort the assessment of whether changes in fees were driven by changes in fee levels
- 7.4** Our analysis builds upon the evidence base set out in the Card Acquiring Market Review final report (CAMR), Annex 4 (published [here](#) on 3 November 2021). In that analysis, we undertook a similar econometric analysis where we modelled the increase in average acquirer fee revenues on an absolute basis only including explanatory variables that were individually significant, for scheme and processing fees separately and combined. We found evidence of an increase in the average scheme and processing fee after controlling for changes in transaction mix, between 2014-2018, for Mastercard and Visa. Mastercard's advisers suggested further analysis that we could have done on the CAMR data, we have addressed relevant points raised within the relevant sections of this annex.¹

1 Visa made no technical comments on our results.

7.5 Due to a lack of available data, in this current analysis, we estimate the increase in average acquirer gross fee revenues over the most recently available four to five-year periods for which we could obtain data from Mastercard and Visa. We find:

- a. Average acquirer gross fee revenues (expressed as a share of transaction value) increased by around [X%] for Mastercard between 2017 and 2021. However, given that services described by Mastercard as optional account for [X%] to [X%] of Mastercard's total annual acquirer gross fee revenues and [X], we note that some of the increase in Mastercard acquirer gross fee revenues (as a share of transaction value) found in this analysis may in part be due to the increase in the take-up and use of optional services purchased by acquirers.
- b. Our analysis suggests that average acquirer gross fee revenues (as a share of transaction value) increased by around [X%] for Visa between 2019 and 2022 (with no significant change between 2018 and 2019). When estimating the regression analysis on mandatory acquirer gross fee revenues only, we estimate a [X] increase in acquirer gross fee revenues (expressed as a share of transaction value), of just over [X%] between 2019 and 2022. Finally, we also find an increase in acquirer fee revenues of around [X%] for Visa between 2018 and 2022, when 2018 is used as the base year in our models. However, given the levels of statistical significance that we find in some of these models, our preferred model uses 2019 as the baseline year.

7.6 In preparing this annex, we have shared confidential working papers setting out our econometric analysis with Mastercard and Visa. We have addressed relevant points raised in each party's submissions on our analysis within the relevant section of this annex.

7.7 The rest of the annex is structured as follows:

- We set out our data and methodology (paragraphs 7.8 to 7.40).
- We present the results (paragraphs 7.41 to 7.76).
- We summarise our results (paragraphs 7.77 to 7.78).

Data and methodology

The data

7.8 Our analysis focuses on the two largest card payment systems in the UK, Mastercard and Visa.

7.9 We collected data from Mastercard on the annual total scheme and processing fees paid to Mastercard by acquirers (including both optional and mandatory fees), covering all fees associated with core scheme, core processing and optional services.² The data collected from Mastercard covered 2017–2021 (calendar years corresponding to Mastercard's financial years).

2 Mastercard response to PSR questions dated 21 November 2022. [X]

- 7.10** We collected data from Visa on the annual total scheme and processing fees paid to Visa by acquirers (including fees for both optional and mandatory services), covering all fees associated with core scheme, core processing and optional services.³ The data collected from Visa covered 1 October 2017 to 30 September 2022 (corresponding to Visa’s 2018-2022 financial years).
- 7.11** We also collected data from both schemes to control for observed transaction value, volume and mix. This covered the monthly volume and value of UK card transactions (where the cardholder or the merchant is UK based) by acquirer for the corresponding time periods, by transaction characteristic:
- Transactions where the card was present versus card-not-present (we refer to the former as **CP transactions** and the latter as **CNP transactions**);
 - Domestic transactions versus cross-border transactions, where cross-border transactions were further disaggregated by EEA and rest of the world (ROW);
 - Transactions disaggregated by the card-type used, including whether the transaction was made using a consumer or commercial card and a credit or debit card.
- 7.12** To identify individual acquirers within each card payment system’s data, we grouped acquirer entities with a common owner, that also paid acquirer fees, treating each group as a single acquirer to best reflect the commercial relationship between the two schemes and their clients.⁴ We identified over 125 acquirers ([redacted] for Mastercard; [redacted] for Visa) for each of the two schemes on this basis. Each of these acquirers is recorded as processing at least one transaction greater than £1 in a year over the period considered.⁵ But we note that some acquirers in the data we received had processed transactions (greater than £1 in annual transaction value) for only some of the years considered, so we have limited information to control for the transaction characteristics of these acquirers. We have therefore excluded any acquirers that acquired transactions (greater than £1 in annual transaction value) in fewer than four out of the five years for which we received data from Mastercard and Visa. We also excluded from our analysis acquirer fees that could not be attributed to a specific acquirer.⁶
- 7.13** Table 1 below sets out the acquirer count by year in the dataset we have prepared for the purposes of our analysis using data provided by Mastercard and by Visa.⁷ The [redacted] acquirers included in our Mastercard estimation sample together accounted for over 95% ([redacted]%) of Mastercard’s total UK transaction value and over 95% ([redacted]%) of Mastercard’s total UK acquirer gross fees revenue in 2021. The [redacted] acquirers included in our Visa estimation sample together accounted for over 95% ([redacted]%) of Visa’s total UK transaction value and over 95% ([redacted]%) of Visa’s total UK acquirer gross fee revenues in 2022. Only [redacted] of the [redacted] acquirers included in our Visa sample are recorded as having processed transactions in 2018. [redacted]. For this reason, it was not possible for Visa to prepare wholly consistent datasets covering the earlier years.

3 Visa response to PSR questions dated 23 November 2022. [redacted]

4 We note that we observe similar results for our main models when they are estimated using ‘ungrouped’ acquirer entities from the raw data submitted by the card schemes.

5 We excluded acquirers with less than £1 because these acquirers would have a negative [redacted]

6 We also limited the share of transactions for any explanatory variables based on share of transactions to between 0 and 1 (in cases where a negative adjustment was present in the data).

7 We have prepared Visa’s data for the purpose of our analysis using internal financial data provided by Visa.

Table 1: Acquirers count by year in estimation sample for Mastercard and Visa

Dimension	2017	2018	2019	2020	2021	2022
Mastercard	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Visa	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

7.14 We checked the impact of excluding the acquirers noted above on the average acquirer fee revenues that were included in our modelling and found the exclusions had a small impact on weighted average acquirer gross fee revenues for each scheme. Figure 1 and Figure 2 below show, for Mastercard and Visa respectively, the average acquirer gross fee revenues calculated before and after removing acquirers from our sample. The grey line shows the average fees derived from revenues from all acquirers recorded in the data; and the blue line shows the average acquirer gross fee revenues derived for the acquirers we have used in our econometric modelling.

Figure 1: [REDACTED]

[REDACTED]

Source: PSR calculations of data submitted by Mastercard for the 2017-2021 financial years in response to PSR questions dated 21 November 2022. [REDACTED]

Figure 2: [REDACTED]

[REDACTED]

Source: PSR calculations of data submitted by Visa for the 2018-2022 financial years in response to PSR questions dated 23 November 2022. [REDACTED]

7.15 We have not made material changes to our analysis to address the following points raised by Mastercard related to the selection of our data sample:

- a. "The PSR have aggregated acquirers based on string searches of the name and using those aggregated names as the unit of observation for analysis without consideration for the underlying billing process. Mastercard's billing is generally aligned to the Interbank Card Association (ICA) number, which in turn is linked to the entity names added to the PSR data. Acquirers may set up different entities for a variety of reasons, e.g. to serve different types of merchants. Mastercard may calculate some [REDACTED]. When aggregating the data the PSR thus may conflate the effects of changes to fees with the acquirer's choice of business structure. On the other hand, some [REDACTED]. As a result, modelling at the [REDACTED] level is also not reflective of the underlying billing process. Modelling at the [REDACTED] level would introduce additional challenges due to the nature of different data sources, therefore we consider the PSR's current approach the most viable one, but Mastercard wanted to highlight its limitations.⁸"

PSR response: Since Mastercard have been unable to propose an alternative viable approach to the one used in our sample, we have not made further adjustments to account for Mastercard's point about its billing process.⁹

8 Mastercard's response to PSR questions dated 19 February 2024 [REDACTED]

9 But we note that we observe similar results for our main models when they are estimated on Mastercard's [REDACTED] level sample.

- b. “[...] of the [X] acquirers in the PSR sample, [X] account for [X]% of transacted volumes in each year. Due to the PSR’s use of weighting, [X] datapoints thus drive the direction of results. [...] there are several factors that affect unit revenues and must, therefore, be controlled for in order to isolate any potential price effects. In addition to controlling for these factors, the PSR’s new model requires four dummies[...], and a dummy for each acquirer. These bring up the total number of variables to control for to a minimum of 82. Given the relatively small size of the PSR’s data sample and the large number of (potential) explanatory variables included in Mastercard’s model estimates, it is unlikely that many variables will be statistically significant. As the degrees of freedom are limited, this implies that statistical inference in comprehensive specifications (ie. Those including a complete set of explanatory variables) is fragile because, with fewer degrees of freedom, estimates are less precise and hence less likely to appear statistically significant, either individually or jointly.¹⁰”

PSR response: While we acknowledge that our sample is relatively small, we consider that it is large enough to accurately estimate the statistical significance of cumulative increases in fees over the periods considered. We note that we have responded to similar comments that Mastercard raised in response to our analysis in CAMR by increasing the sample size from [X] to [X] observations ([X]).¹¹ We also note that even though model estimates which include a large number of explanatory variables due to the use of acquirer fixed effects have lower degrees of freedom, we consider less data is required in our model estimates after controlling for acquirer fixed effects.¹²

- c. “In the PSR’s analysis of Mastercard’s acquirer fee revenues, the coefficient of interest, the 2021 dummy variable, captures the change in average fees relative to 2017. As such, for [X] acquirers that have missing data for 2017 the coefficient captures a change relative to a different year”.¹³

PSR response: We consider that the coefficient of interest in our estimate does capture the average change in acquirer fees relative to 2017 for a given acquirer’s characteristics as we control for an acquirer’s characteristics with the use of acquirer fixed effects. On that basis, we also consider that the inclusion of acquirers with missing 2017 data does not bias our results. Where possible, our estimates should capture the average change in acquirer fees for the *full population of all acquirers*, where, for example, certain acquirers in the population may have data missing in 2017 because they entered the UK market in 2018 so they should be included in our data sample. Further, unlike acquirers which we have already excluded for having missing data for more than one year (because for them there is limited data to control for their transaction characteristics), we do not believe acquirers with data missing in 2017 only risk having a different relationship between explanatory variables and average fees. Nevertheless, for one of our robustness checks, we have excluded acquirers which acquired no transactions in 2017. We found that it only had a minimal impact on the results (see Table 12).

10 Mastercard response to PSR working paper dated 13 December 2023. [X]

11 Mastercard mention the issue of small sample size in Mastercard’s submission dated 23 November 2020 [X]

12 As mentioned in Jeffrey M Wooldridge, *Econometric Analysis of Cross Section and Panel Data*, 2001, p272, the degrees of freedom for our fixed effect regressions can be obtained by $(N(T-1)-K)$. This formula multiplies the number of acquirers by the number of years we received data from acquirers less one minus the number of explanatory variables included in our models (including the constant).

13 Mastercard response to PSR working paper dated 13 December 2023. [X]

- d. “The PSR does not account for outliers in its analysis, either through appropriate filtering or its control variables.” Mastercard stated that “[a]s the PSR has included [⌘] fees in its analysis, acquirers with small transaction volumes are recorded as observations with extremely high unit revenues.¹⁴”

PSR response: We consider it is unclear that an acquirer’s low volume or value of transactions or its high proportion of total fees attributed to non-transaction fees is sufficient grounds to regard it as an outlier. Our analysis is meant to examine whether there has been an increase in average fees after controlling for transaction mix for the population of *all* acquirers. Acquirers with low transaction volume or value, or acquirers being paid a high proportion of non-transaction fees may be an important feature of the overall acquirer population, even though together their total contribution to overall weighted average fees is small. If these ‘outlier’ acquirers were excluded from our sample, we risk estimating our models over a sample that is unrepresentative of the acquirer population. Nevertheless, we have included additional model estimates in our robustness checks where our sample is adjusted in accordance with Mastercard’s proposals and note excluding ‘outliers’ only has a minimal impact on results (see Table 12).

Our model

- 7.16** Mathematically, our econometric model can be written as:

$$f_{it} = \hat{\alpha}_i + \hat{\mu}_t + \sum_{k=1}^K \hat{\beta}_k x_{kit} + \hat{\epsilon}_{it}$$

f_{it} is the dependent variable: average fee rate for scheme or processing services as a percentage of GBP transacted by acquirer i in year t

$\hat{\alpha}_i$ captures acquirer-specific time-invariant characteristics

$\hat{\mu}_t$ is a vector of four-year dummies capturing year-specific effects (that is, the cumulative amount the average fee revenues have changed since the base year) holding all other variables constant, which gives us the increase in fees paid that can be attributed to increases in fee levels

x_{kit} are the values of the k explanatory variables for each acquirer in each year that could include transaction volume, value and mix and the β_k are their coefficients

$\hat{\epsilon}_{it}$ is a random error term

- 7.17** We estimate our model using weighted least squares (WLS) with time- and acquirer-specific fixed effects. Acquirer-specific fixed effects ($\hat{\alpha}_i$) capture acquirer-specific time-invariant characteristics; and the year effects ($\hat{\mu}_t$) capture time-specific acquirer-invariant differences.

14 Mastercard response to PSR working paper dated 13 December 2023. [⌘]

7.18 We weight data points with the transaction value. Giving more weight to the observations that account for a larger share of transaction value gives a more accurate representation of how fees have changed on average for each scheme as we expect an acquirer's relationship between transaction characteristics and fees is likely to depend on the size of the acquirer.

7.19 We estimate robust standard errors clustered at the acquirer level to allow for correlation over time.

The dependent variable – the log of acquirer average fees

7.20 The dependent variable in our model, that is the variable our model is predicting, is the log of average gross fee revenues (expressed as a percentage of the GBP value of card transactions) for an acquirer in a given year. In calculating the average gross fee revenues we have included:

- a. All scheme and processing fee income regardless of whether the fee is levied on the basis of a transaction activity or if it is fixed.
- b. Fees that the schemes have claimed are optional.¹⁵ We have also estimated a model where such fees are excluded, but, as discussed in paragraph 7.56, the sample size for our Mastercard estimates are too small to inform our findings. As stated in paragraph 4.181 of Chapter 4, we also note in relation to optional services on the acquiring side Mastercard has various degrees of market power across their optional services, with strong indications that lack of effective alternatives may result in Mastercard facing effective competitive constraints in the supply of some of these services.
- c. All fees associated with UK transactions. In providing this information, the schemes have had to make some assumptions to identify relevant revenue (see Annex 6).

7.21 We note that our modelling is based on the gross fee revenues paid by acquirers before any incentives or rebates from Mastercard or Visa. [REDACTED]. As set out in Annex 6, we found that total incentive and rebate payments allocated to acquirers amounted to [REDACTED]% of gross acquirer fee revenues for Mastercard in 2021 and [REDACTED]% of gross acquirer fee revenues for Visa in 2022. For this reason, we consider that excluding incentives and rebates from our analysis should not affect our assessment of acquirer fee revenues in a material way.

7.22 We have chosen to use log-transformed average fees because there are likely to be [REDACTED] between explanatory variables and the dependent variable. As suggested by Mastercard's response to our CAMR analysis, when the dependent variable is modelled [REDACTED] the [REDACTED] between the dependent variable and explanatory variable may not hold, due to [REDACTED].¹⁶ We also consider log-transformed average fees models seem to represent a 'better fit' for both Mastercard's and Visa's data over average fees modelled on an absolute-level basis. This is

15 By submitting to us optional fees in accordance with the definition we provided in our November s81 information notices.

16 Mastercard submission dated 23 November 2020. [REDACTED]

based on the results of our Box-Cox transformation tests¹⁷ and other informal observations of the differences between our log-transformed and absolute-level model estimates.¹⁸

7.23 For Mastercard, as discussed in paragraph 7.30a and 7.30b, there are likely to be [redacted] relationships between certain explanatory variables, such as the [redacted], and the dependent variable. When we estimate by Maximum Likelihood a Box-Cox transformation three of the four models used in our main results (M4-M6) all null hypotheses for different functional forms (linear, log, multiplicative inverse) are rejected in formal tests.¹⁹ Nevertheless, we note that the parameters estimated under our formal tests (the restricted log likelihood and theta estimate) produce parameter estimates that are closer to log transformation as the most appropriate functional form for the dependent variable.²⁰ Informally, we also note the adjusted R-squared for the log-transformed version of average acquirer gross fee revenues (see Table 4) is substantially greater than for equivalent models estimated on absolute-level bases (see Table 11).²¹

7.24 For Visa, we consider that there are likely to be [redacted] relationships between explanatory variables and the dependent variable, as discussed in paragraph d.34a and d.34b. We also estimate by Maximum Likelihood a Box-Cox transformation of our dependent variable for the four models used in our main results (V3-V6). In three out of the four models, the log-likelihood statistics suggests a better fit for a log specification when compared to a linear specification.²² Informally, we also note the adjusted R-squared for the log-transformed version of average fees (see Table 13) is greater than the adjusted R-squared of the equivalent absolute-level estimated models (see Table 19).²³

7.25 Mastercard argued that “Contrary to the PSR’s assertion that the choice of a log-linear model is supported by the Box-Cox test, the results of this test on the PSR specification clearly reject the null hypothesis that the log-transformation is appropriate.” Mastercard also told us that the PSR could also explore the use of a Fractional Outcome model or a quantile regression approach.

PSR response: As stated in paragraph 7.23 above, while we note that for three out of the four models used in our main results (M4-M6) all functional forms are rejected when estimated by the Box-Cox transformation, we also note that the parameters estimates under our formal tests produce parameter estimates that are closer to log transformation as the most appropriate functional form for the dependent variable. We also consider that Fractional Outcome models are those suited for modelling bounded variables which

17 As mentioned in Davidson, R., and J. G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. New York: Oxford University Press p502, there are numerous ways to test the specification of linear and loglinear models but the most commonly used tests are based on the fact that these are both special cases of the conventional Box-Cox model.

18 The Box-Cox transformation is a statistical tool designed to transform non-normally distributed data into a form that better resembles a normal distribution. By estimating the Box-Cox transformation by Maximum Likelihood we also estimate the parameter Theta, which can be used to test the appropriate functional form of the dependent variable in our model estimates. An estimate of: Theta equals one suggests a linear model; Theta equals zero suggests a log model; and Theta equals minus one suggest a multiplicative inverse model.

19 Within the estimation sample we also excluded any years when acquirers had a negative or zero total annual value of transactions, total annual volume of transactions or negative average acquirer fees as the Box-Cox transformation is designed only for positive values.

20 We estimate a Box-Cox transformation Theta parameters of [redacted].

21 The adjusted R-squared for the log-transformed M4 and M5 is between [redacted] whereas the R-squared for M22 and M23 which are estimated on absolute bases is [redacted].

22 The formal tests for V3, V5 and V6 reject a linear specification but not a log specification (at the 1% level).

23 The adjusted R-squared for the [redacted] whereas the R-squared for V26 and V27 which are estimated on [redacted].

typically represent the fraction of another variable. The bounded nature of such variables and the possibility of observing values at the boundaries raise issues about the appropriate functional forms and inferences that can be drawn. Even though the fee levels for many acquirers when measured as a percentage of transaction value are relatively small, it is not strictly a bounded variable, so it is unclear that Fractional Outcome models are necessarily appropriate for our modelling.²⁴ We have not included further analysis of quantile regressions because, as noted in Mastercard's own submission, that approach requires larger sample sizes for meaningful results.²⁵

Rationale for the explanatory variables

- 7.26** Scheme and processing fees are complex, accumulated through many billing events that are triggered by different transaction and acquirer or merchant characteristics. Some fees are also stepped or tiered (ie. the same fee is charged at different rates depending on a transaction characteristic metric), such that the relationship between the driver of the fee and the amount ultimately charged is not always linear. Fee structure is also not constant over time.
- 7.27** Our choice of explanatory variables for the model was informed by our review of the information provided by schemes on the structure and characteristics of their fees. Our primary goal is to include explanatory variables capturing the main drivers of fees. It is particularly important to include in our model fee drivers that are linked to transaction characteristics that may have changed over time.
- 7.28** Below we provide an overview of the main fee drivers for Mastercard and Visa based on their submissions.²⁶

Main fee drivers for Mastercard

- 7.29** To identify features relevant to our modelling, we reviewed Mastercard's description of its fee structure, and the composition of acquirer fee revenues by fee driver (as set out in our descriptive analysis of fees in Annex 6).
- 7.30** We consider the following fee drivers, which together were drivers for [X]% of total acquirer gross fee revenue in any given year between 2017 and 2021, to be the main transaction characteristics included as explanatory variables in our modelling:
- The **logged [X]**. Our dependent variable is the log of acquirer average fees expressed as a percentage of the value of transactions. Therefore, we consider that adding the log of [X] in the model as an explanatory variable is relevant if we expect that the relationship between total value of transactions and total gross fees billed may be [X]. This would be the case if, for example, some fees are [X] in such a way that the percentage fee [X]. Based on information provided by Mastercard, we understand that Mastercard [X]. Overall, [X] suggests that the logged [X] may be a relevant explanatory variable.
 - The **logged [X]**. Similar to [X], including this variable in the model allows for the [X] relationship between [X].

24 Nevertheless, we observe similar results when we estimate Fractional Outcome model estimates using Beta estimates for both Mastercard and Visa.

25 Mastercard response to PSR working paper dated 13 December 2023. [X]

26 Responses to our Section 81 information notices dated November 23 requesting [X].

- c. The **share of transactions that are CNP**. Calculated as the proportion of an acquirer’s transaction value that is attributable to CNP transactions, the variable models the difference between the average fee paid for CP transactions and CNP transactions. We expect this explanatory variable to be relevant to our model because Mastercard has a Card Not Present category of fees applied to CNP transactions on top of other fees.
- d. The **share of transactions that are cross-border**. Similar to CNP transactions, we consider that the share of cross-border EEA and the share of ROW transactions are relevant because Mastercard has multiple categories of fees specific to cross-border transactions.

7.31 We do not consider that the share of credit card and the share of commercial card transactions are relevant for modelling Mastercard’s acquirer fee revenues. These variables would be relevant if fees were differentiated by card type, or if there were fees that were applied to credit cards specifically. Mastercard told us that it did not differentiate its scheme and processing fees by [REDACTED].²⁷ If this is correct, [REDACTED].

7.32 We did not request acquirer-level data for the remaining drivers of Mastercard’s acquirer gross fee revenues (set out in Table 2) because we considered that they each only accounted for a small proportion of acquirer gross fee revenues or were highly correlated with the drivers listed above, so we have not included them as explanatory variables in our analysis.

Table 2: Remaining drivers of Mastercard acquirer fee revenues between 2017 and 2021

Fee driver	Annual % of total acquirer fee revenues
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

Source: PSR calculations of data submitted by Mastercard in response to PSR questions dated 21 November 2022 [REDACTED]

7.33 We note that amongst the fee drivers we omitted as explanatory variables from the models:

- a. [REDACTED] is likely to be highly correlated with an acquirer’s volume of transactions. There was a high degree of correlation between the annual total level of the driver and annual total transaction volume, across all acquirers that paid fees driven by each driver.²⁸

27 Mastercard response to PSR questions dated 25 July 2022 [REDACTED]

28 For [REDACTED], we estimated a Pearson correlation coefficient of [REDACTED] between total annual [REDACTED] and total transaction volume amongst customers that paid fees driven by [REDACTED] over the period.

- b. Five of the remaining fee drivers ([REDACTED]) each accounted for no more than [REDACTED]% of total fees in a given year.
- c. As noted in paragraphs 7.37 to 7.39, we use acquirer fixed effects to control for determinants of fees which are correlated with acquirer-specific characteristics where we cannot otherwise control for those determinants explicitly using other explanatory variables.

Main fee drivers for Visa

7.34 We found that [REDACTED]% of acquirer gross revenues had the following ‘activity drivers’: ‘transaction value’ and ‘volume of transactions cleared/settled’. We include the following transaction characteristics as explanatory variables in our modelling:

- a. The **logged [REDACTED]**. Our dependent variable is the log of acquirer average fees expressed as a percentage of the value of transactions. Therefore, we consider that including the [REDACTED] to the Visa model as an explanatory variable is relevant if we expect that the relationship between total value of transactions and total gross fees billed is [REDACTED], for example, in the event of [REDACTED]. Visa removed most of its [REDACTED],²⁹ therefore we do not expect this variable to be significant. However, we have tested this empirically by including it in our models.
- b. The **logged [REDACTED]**. Including this variable allows for the [REDACTED] between the volume transacted and acquirer fee revenues. [REDACTED]. We have tested the significance of this variable empirically by including it in our models.
- c. The **share of transactions that are CNP**. We expect the proportion of an acquirer’s transaction value that is attributable to CNP transactions to be relevant to our model because there are specific rates that apply to CNP transactions (that is some fee categories have rates that vary by transaction environment).³⁰
- d. The **share of transactions that are cross-border**. We consider that the share of cross-border EEA and the share of ROW transactions are relevant variables because Visa has multiple categories of fees specific to cross-border transactions, International CNP and International Acquiring fees.³¹
- e. The **share of credit card** transactions. We consider that this variable would be relevant if fees varied by card type or were applied to credit cards specifically. [REDACTED].³²
- f. The **share of commercial card** transactions. We consider that this variable would be relevant if fees varied by card type or were applied to commercial cards specifically. [REDACTED].³³

7.35 We have excluded certain explanatory variables from our analysis (as set out in Table 3), including those that are not associated with the following ‘activity drivers’: ‘transaction value’ or ‘transaction volume cleared/settled’. We considered that many of these excluded variables fee drivers likely explained few fee changes that were not already explained by

29 As set out in Table 6 of the PSR’s June 2023 Working Paper on scheme and processing fees (MR22/1.6), as part of the changes to core processing and scheme fees for acquirers, Visa replaced a tiered fee on clearing and settlement and a tiered structure for acquirer scheme fees with flat fees.

30 [REDACTED] in Visa response to PSR questions dated 21 November 2022. [REDACTED]

31 Visa response to PSR questions dated 21 November 2022. [REDACTED]

32 Visa response to PSR questions dated 22 August 2023. [REDACTED].

33 Visa response to PSR questions dated 22 August 2023. [REDACTED].

the variables listed above, as many of them were either highly correlated with the variables listed above or only accounted for a small proportion of fee revenues.

Table 3: Remaining drivers of Visa’s acquirer fee revenues between 2018 and 2022

Fee driver	Annual % of total acquirer fee gross revenues
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

Source: PSR calculations of data submitted in Visa response to PSR questions dated 23 November 2022 [REDACTED]

7.36 We note that amongst the fee drivers we omitted as explanatory variables from the models:

- a. We find that four of the remaining fee drivers (number of clients, number of disputes, number of authorisations, number of chargebacks) each accounted for no more than [REDACTED]% of total fees in a single year.
- b. Visa have indicated that there are [REDACTED].³⁴ But as these dimensions of fee differentiation refer to characteristics that are relatively uncommon (i.e. comprise a small proportion of acquirers’ transaction portfolios) within “Other fees not allocated” we have not included them in our modelling.
- c. As noted in paragraph 7.37 to 7.39, we use acquirer fixed effects to control for determinants of fees which are correlated with acquirer-specific characteristics where we cannot otherwise control for those determinants explicitly using other explanatory variables.

Acquirer fixed effects

7.37 We also looked at including acquirer fixed effects dummy variables for both Mastercard and Visa as they allow us to control for acquirer-specific differences in fees, which could be due to the profile of the acquirer in terms of their merchant base, or the type and amount of optional services they purchase. The acquirer-specific dummy variables capture these factors to the extent that they are constant over time. This includes controlling for determinants of fees which are correlated with acquirer-specific characteristics but where we cannot otherwise control for those determinants explicitly using other explanatory variables. We have included acquirer fixed effect dummy variables in all our main results and robustness checks.

7.38 We note that our approach is consistent with Mastercard’s comments on our CAMR analysis which suggest acquirer fixed effects should be included ‘[REDACTED] that needs to be captured with acquirer-specific fixed effects, in the form of acquirer dummy variables.’³⁵

34 Visa response to PSR questions dated 22 August 2023. [REDACTED].

35 Mastercard submission dated 23 November 2020. [REDACTED]

7.39 In response to our confidential working paper, Mastercard submitted to us that it would expect any differences in the transaction characteristics between acquirers and their merchants to be captured by explicit fee drivers included as explanatory variables. We regard it as impracticable to consider all fee drivers explicitly in our analysis since some fee drivers only account for a small proportion of fees and, as noted within Mastercard's own submission, estimates with relatively small sample size and a large number of explanatory variables are less precise due to limited degrees of freedom.³⁶ Mastercard has also submitted that since (partly due to the small sample size) it is not possible to account for all drivers in the regression analysis, the econometric model is an imperfect approximation of MC's fee structure. 'To accurately estimate the change in unit revenues due to changes in fee levels, it is important that the regression model controls for all relevant factors. Failing to do so would result in a mis-specified model, and the resulting estimates would be biased and inconsistent.³⁷ In this context, we consider the inclusion of acquirer effects is an effective approach to control for acquirer-specific characteristics where we cannot otherwise control for those determinants explicitly.³⁸

Year dummies

- 7.40** We included year dummy variables for each year in the five-year period of our analysis to estimate the change in average fees relative to a base year in all our models:
- a. For Mastercard, we included dummy variables for 2018, 2019, 2020 and 2021 to estimate the change in average fee relative to 2017 (the base year). The main parameter of interest in all Mastercard models is the coefficient estimate for the 2021-year dummy, which measures the change in average fees relative to 2017.³⁹ The year dummy estimates for the annual changes in average fees since 2017 can be converted to estimate the % change in fees over the period (by taking the exponential and subtracting one).
 - b. For Visa, we included dummy variables for 2018, 2020, 2021 and 2022 to estimate the change in average fee relative to 2019 (the base year). We have chosen 2019 rather than 2018, the first year in the five-year period for Visa, as we consider this is a more appropriate way to interpret results for Visa because it is likely to be more challenging to robustly estimate a statistically significant change from 2018, due to the more limited acquirer data available in that year.^{40, 41} The main parameter of interest in all Visa models is the coefficient estimate for the 2022-year dummy, which measures the change in average fees relative to 2019.⁴² The year dummy estimates for the annual changes in average fees since 2019 can be converted to estimate the % change in fees over the period (by taking the exponential and subtracting one).

36 Mastercard response to PSR working paper dated 13 December 2023. [REDACTED]

37 Mastercard submission dated 23 November 2020. [REDACTED]

38 Nevertheless, we note that when acquirer fixed effects are excluded, we estimate similar results for our main models.

39 This row is shown in bold in all tables below.

40 Although we note we also find a statistically significant increase in fees when 2018 is used as the base year (as shown in Table 20).

41 But we note the size of the estimated increase over the whole period considered is unchanged regardless of the base year chosen.

42 This row is shown in bold in all tables below.

Results

7.41 We set out below the results of our modelling and sensitivities.

Mastercard

7.42 Table 4 below shows the results for our model for Mastercard. We present six versions of the model M1-M6.

7.43 M1 shows the estimated trend in fees without controlling for transaction mix or acquirer-specific differences. M2 shows the estimated trend in fees before controlling for transaction mix but after controlling for acquirer-specific differences.

7.44 Models M3, M4, M5 and M6 comprise estimates of our main results under two approaches:

- a. M3-M5 include explanatory variables for all fee drivers we consider relevant to our modelling, with different combinations of '[X]' and '[Y]' explanatory variables amongst the three models.
- b. M6 adopts a variation of a general-to-specific approach,⁴³ removing explanatory variables from model M3 that were both not individually statistically significant and not pairwise jointly significant with another explanatory variable which was individually significant. Across M3-M5 only the share of ROW transactions, [X] (only in M4) and [Y] (only in M5) are individually significant, and none of the other explanatory variables are pairwise jointly significant with each other at the 5% level.

7.45 We have considered M6 alongside M3-M5 following the further submissions of Mastercard in paragraph 7.49a regarding our selection of explanatory variables in our main results.

7.46 For models M3-M5, although we recognise that both '[X]' and '[Y]' variables may each individually be relevant in explaining the trend in fees, we note the high correlation between the two variables (we estimate a Pearson correlation coefficient of [X] between [Y]). As a result, we consider that our models which include just one of '[X]' or '[Y]' (M4 and M5) are our baseline models; in any case these give similar results.

7.47 As set out in paragraph 7.40a, we can derive an estimate for the percentage change in fees between 2017 and 2021 from the coefficient estimate for the 2021-year dummy in each Mastercard Model,⁴⁴ by taking the exponential and subtracting one. The relevant coefficient estimates are highlighted in bold within our main results and robustness checks.

7.48 We observe from Table 4 that between 2017 and 2021:

- We find a statistically significant increase in acquirer fees of [X]% in M1 before controlling for both transaction mix and acquirer characteristics.
- We find a statistically significant increase in acquirer fees of [X]% in M2 before controlling for transaction mix but not controlling for acquirer characteristics.

43 D.F. Hendry and J-F. Richard. *On the formulation of empirical models in dynamic econometrics*. Journal of Econometrics, 20:3–33, 1982.

44 The number reported against 2021 for each model reported in Tables 4-10 and 12.

- Across models M3, M4, M5 and M6 presented, we find a [REDACTED] in acquirer fees between [REDACTED].

Table 4: Results of regression analysis for Mastercard

Variable	M1	M2	M3	M4	M5	M6
2018	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2019	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2020	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2021	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Share of CNP	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Share of EEA cross-border	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Share of ROW cross-border	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Acquirer fixed effects	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
N	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Adjusted R-squared	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

7.49 In response to the analysis set out in our confidential working papers, which excluded M6 from our main results, Mastercard submitted to us that:

- “The PSR does not appear to have run a coherent process for selecting control variables and as a result omits several relevant control variables.⁴⁵”:
 - As regards selecting control/explanatory variables, Mastercard further argued that “the PSR does not elaborate on how it arrived at its final specification in the disclosure paper”,⁴⁶ and “[t]he PSR makes reference to the share of variation explained by its model. The PSR then does not mention that a substantial proportion of the explanatory power is however attributable to acquirer fixed effects.⁴⁷”

45 Mastercard response to PSR working paper dated 13 December 2023. [REDACTED]

46 Mastercard response to PSR working paper dated 13 December 2023. [REDACTED]

47 Mastercard response to PSR working paper dated 13 December 2023. [REDACTED]

PSR response: We included models which exclude relevant explanatory variables following a general-to-specific approach using joint and individual statistical significance (resulting in M6) in addition to our approach which includes all explanatory variables we consider relevant (M3-M5). We consider this is a coherent process which appropriately balances statistical inference with limitations in degrees of freedom due to relatively small sample size. We also note the approach addresses Mastercard's comments raised in response to our CAMR analysis, that we should account for joint and individual significance in our models.⁴⁸

- o As regards generally omitting relevant control explanatory variables, Mastercard told us in response to our information requests that "for this review, Mastercard submitted information on the transaction specific drivers of all transaction-related fee categories. The information submitted covered [redacted] distinct drivers. In addition, [redacted] fees have additional bespoke drivers (eg. [redacted]). Of these several dozen drivers only four were considered by the PSR in the analysis."⁴⁹

PSR response: As stated in paragraph 7.32 above, we did not request acquirer-level data for other drivers noted by Mastercard. Fee drivers we considered relevant accounted for [redacted]% of total fees between 2017 and 2021, and other fee drivers likely explain few fee level changes not explained by the drivers we have included. There is also a risk that, if we were to include too many additional drivers as explanatory variables, degrees of freedom would fall below the level required for reliably accurate model estimation.

- b. Mastercard identified specific refinements to our models and estimated "fee increases seven percentage points lower than the lower bound estimated by the PSR."⁵⁰ The specific refinements that Mastercard detailed were:

- o "The PSR acknowledges that both '[redacted]' and '[redacted]' variables may each individually be relevant in explaining the trend in fees', but only includes them individually in its preferred models due to concerns about multicollinearity."⁵¹ Mastercard agreed that "both [redacted] may explain the level of unit revenues. To account for the correlation between these control variables, we suggest using the ratio of [redacted] as a control variable in place of using both [redacted]."⁵²

PSR response: We have added estimates that include the [redacted] in our robustness checks, but observe that its inclusion only has a very small impact for our base models; we estimate an average fee increase [redacted] when we include the variable in our base models.

48 Mastercard response to PSR working paper dated 13 December 2023. [redacted]

49 Mastercard response to PSR working paper dated 13 December 2023. [redacted]

50 Mastercard response to PSR working paper dated 13 December 2023. [redacted]

51 Mastercard response PSR working paper dated 13 December 2023. [redacted]

52 Mastercard response PSR working paper dated 13 December 2023. [redacted]

- o Mastercard argued that since the PSR includes [redacted] fees in its analysis, “the current model is not suited to explaining these fees. To account for this, we include the squared logged [redacted] in the regression.” Mastercard further explained that “[redacted]”. Thus they constitute a disproportionate amount of the fees for small acquirers (for instance, an acquirer with a [redacted] would incur [redacted], but [redacted] of [redacted]). The log-log relationship estimated by the PSR is not flexible enough to account for this non-linearity. Adding a squared term allows the model to account for both the significant [redacted] for acquirers at low transaction volumes and the additional [redacted]. This can be further illustrated by modifying the figure below (see Figure 3) to include the fitted value of a model with a squared term. As can be seen below, the fitted values of the models are comparable for most years. However, for the low-volume years ([redacted]) the prediction error of the PSR’s model is much reduced by the inclusion of the squared term.”⁵³

Figure 3: [redacted] Observed log unit revenue evolution and fitted values

[redacted]

Source: [redacted] analysis of Mastercard data submitted to the PSR.

PSR response: We believe it is unclear based on Mastercard’s submission how [redacted] explains fee rises due to non-transactional fees. Nevertheless, when [redacted] is included within our base models, we observe it only slightly changes our estimate of fee increases between 2017 and 2021 to [redacted]%.⁵⁴

- c. “The PSR reports an increase of ‘[redacted]’ in unit revenues based on the new model” but that “there is *no* evidence of a statistically significant increase in mandatory fees”.⁵⁵ Mastercard told us that “In this review, Mastercard did submit the data for the largest acquirers, collectively accounting for 95% of UK transactions by volume in 2021, disaggregated by fee category (‘the large acquirers’). In written submissions, Mastercard also specified whether these fee categories were mandatory or optional.⁵⁶” Mastercard argued that “it is possible, therefore, to re-estimate the PSR’s preferred models on mandatory unit revenues only. While this necessarily limits the sample to the large acquirers, the weighting of data points applied by the PSR limits the impact of a reduced sample. This approach is also consistent with CAMR, where only the 17 largest acquirers were included in the sample.”⁵⁷

53 Mastercard’s response to PSR questions dated 19 February 2024 [redacted]

54 This is true regardless of whether the ratio of transaction value to volume is also included.

55 Mastercard response PSR working paper dated 13 December 2023. [redacted]

56 Mastercard response PSR working paper dated 13 December 2023. [redacted]

57 Mastercard response PSR working paper dated 13 December 2023. [redacted]

Table 5 below sets out the results of Mastercard’s analysis.

Table 5: [REDACTED]PSR model results for Mandatory fees⁵⁸

Variable	M4 Mandatory Fees	M4 Large acquirers (all fees)	M5 Mandatory Fees	M5 Large acquirers (all fees)
2018	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2019	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2020	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2021	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
-[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Share of CNP	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Share of EEA cross-border	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Share of ROW cross-border	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Acquirer fixed effects	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
N	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Adjusted R-squared	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Source: [REDACTED] based on Mastercard data. P-values in parentheses: *p<0.1; **p<0.05, ***p<0.01.

- d. Alongside the table, Mastercard stated that “for comparison purposes they have also re-estimated the PSR’s preferred model on the same sample”,⁵⁹ and observed that:
- “The PSR’s preferred model does not support a hypothesis that mandatory fees increased over time as the estimate is not statistically significantly different from zero. The point estimate of the model in fact suggest that unit revenues [REDACTED] by [REDACTED]%;
 - This result does not appear to be driven by the sample. Estimating the PSR models on the smaller sample with mandatory and optional unit revenues as the dependent variable yields results that are broadly consistent with the results estimated on the full sample.⁶⁰”

58 Mastercard response PSR working paper dated 13 December 2023. [REDACTED]

59 Mastercard response PSR working paper dated 13 December 2023. [REDACTED]

60 Mastercard response PSR working paper dated 13 December 2023. [REDACTED]

PSR response: We disagree with Mastercard's comments which suggest accurate estimates can be reliably obtained using a much smaller sample of only the 17 largest acquirer [redacted]. In our view, reducing the sample size to cover just the largest acquirers reduces the degrees of freedom below the threshold to obtain accurate estimates reliably, and we take the same position on our robustness checks estimated on an equivalent basis. By contrast, the weighting of data points does not impact the degrees of freedom for our model estimates.⁶¹ We are also not considering results estimated over mandatory and non-mandatory fees separately because as stated in paragraph 4.181 of Chapter 4, in relation to optional services on the acquiring side Mastercard has various degrees of market power across their optional services, with strong indications that lack of effective alternatives may result in Mastercard facing effective competitive constraints in the supply of some of these services.

Sensitivities

7.50 We have tested further modifications to our models above. In particular:

- a. We looked at models M7-M9 including squared [redacted] and the [redacted] as proposed by Mastercard (see paragraph 7.49b) in Table 6.
- b. We looked at including different combinations of card-type explanatory variables in models M10-M15 in Table 7. This involved including variables for the share of credit and the share of commercial transactions.
- c. We added variables measuring the share of an acquirer's transaction value attributable to CNP transactions that are also cross-border in models M16-M17 in **Table 8** shows models including separate variables for domestic CNP, EEA CNP and ROW CNP transactions. These changes to the models result in a slightly greater estimate between [redacted]% and [redacted]% for the difference in the 2021 and 2017 fee levels.
- d. Table 8. This would allow for the possibility that there is an additional premium to be paid on CNP cross-border transactions relative to CNP domestic transactions.
- e. We estimated our models M18-M19 without weighting data points by transaction value in Table 9.
- f. We estimated our models using a dependent variable measured on an absolute level basis (ie not log-transformed). We estimated our models M20m-M21m on mandatory fees only in Table 10.
- g. We estimated our models M22-M23 using a dependent variable measured on an absolute level basis (ie not log-transformed) in Table 11.
- h. We estimated our models M24-M29 excluding acquirers with data missing in 2017 and two acquirers ([redacted]) in Table 12. [redacted] were brought up by Mastercard as an example, where the nonlinear relationship could be accounted for in the analysis by, for instance, introducing a square term of transaction value as an explanatory variable.

61 As noted in Jeffrey M Wooldridge, *Introductory Econometrics: A Modern Approach*, 5th Ed., 2012, p283, the estimates and standard errors for WLS are different from OLS, but the way we interpret those estimates, standard errors, and test statistics is the same.

7.51 The following tables present the results of these modifications on our baseline models M4 and M5.

7.52 Table 6 shows that when we only include the [X], we estimate a statistically significant increase of [X]%. We estimate a statistically significant increase of [X]% when [X] is included, regardless of whether the [X] is also included.

Table 6: Additional models for Mastercard: Additional explanatory variables

Variable	M7	M8	M9
2018	[X]	[X]	[X]
	[X]	[X]	[X]
2019	[X]	[X]	[X]
	[X]	[X]	[X]
2020	[X]	[X]	[X]
	[X]	[X]	[X]
2021	[X]	[X]	[X]
	[X]	[X]	[X]
[X]	[X]	[X]	[X]
	[X]	[X]	[X]
[X]	[X]	[X]	[X]
	[X]	[X]	[X]
[X]	[X]	[X]	[X]
	[X]	[X]	[X]
Share of CNP	[X]	[X]	[X]
	[X]	[X]	[X]
Share of EEA cross-border	[X]	[X]	[X]
	[X]	[X]	[X]
Share of ROW cross-border	[X]	[X]	[X]
	[X]	[X]	[X]
Acquirer fixed effects	[X]	[X]	[X]
N	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

7.53 Table 7 shows models including different combinations of card type explanatory variables (the share of commercial and the share of credit transactions). These changes to the model result in a slightly higher estimate between [X] and [X] for the difference in the 2021 and 2017 fee levels (ie, the estimated coefficient for 2021 converted to a percentage increase).

Table 7: Additional models for Mastercard: Card type

Variable	M10	M11	M12	M13	M14	M15
2018	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2019	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2020	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2021	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Credit	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border – EEA	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border RoW	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Commercial	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Acquirer fixed effects	[X]	[X]	[X]	[X]	[X]	[X]
N	[X]	[X]	[X]	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]	[X]	[X]	[X]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.54 Table 8 shows models including separate variables for domestic CNP, EEA CNP and ROW CNP transactions. These changes to the models result in a slightly greater estimate between [X]% and [X]% for the difference in the 2021 and 2017 fee levels.

Table 8: Additional models for Mastercard: CNP transactions

Variable	M16	M17
2018	[X]	[X]
	[X]	[X]
2019	[X]	[X]
	[X]	[X]
2020	[X]	[X]
	[X]	[X]
2021	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
Share of CNP – domestic	[X]	[X]
	[X]	[X]
Share of CNP – EEA cross-border	[X]	[X]
	[X]	[X]
Share of CNP – ROW cross-border	[X]	[X]
	[X]	[X]
Share of EEA Cross-border	[X]	[X]
	[X]	[X]
Share of ROW Cross-border	[X]	[X]
	[X]	[X]
Acquirer fixed effects	[X]	[X]
N	[X]	[X]
Adjusted R-squared	[X]	[X]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

7.55 Table 9 below shows models estimated without weighting data points by transaction value, ie without giving greater weight to larger acquirers in our dataset. We estimate a statistically significant increase between [redacted]% and [redacted]% on an unweighted basis.

Table 9: Additional models for Mastercard: Unweighted data

Variable	M18	M19
2018	[redacted]	[redacted]
	[redacted]	[redacted]
2019	[redacted]	[redacted]
	[redacted]	[redacted]
2020	[redacted]	[redacted]
	[redacted]	[redacted]
2021	[redacted]	[redacted]
	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]
Share of Credit	[redacted]	[redacted]
	[redacted]	[redacted]
Share of CNP	[redacted]	[redacted]
	[redacted]	[redacted]
Share of Cross-border – EEA	[redacted]	[redacted]
	[redacted]	[redacted]
Share of Cross-border – RoW	[redacted]	[redacted]
	[redacted]	[redacted]
Acquirer fixed effects	[redacted]	[redacted]
N	[redacted]	[redacted]
Adjusted R-squared	[redacted]	[redacted]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.56 Table 10, below, shows models estimated for mandatory fees only on the largest acquirers. We estimate an increase between 2017 and 2021 that is not statistically significant, when only Mastercard’s mandatory fees are considered. We only received mandatory fees data on the 17 largest acquirer entities ([X]) from Mastercard and could only estimate models over this sample. As such, we do not consider that these results are reliably accurate to inform our findings. As stated in paragraph 4.181 of Chapter 4, we also note in relation to optional services on the acquiring side Mastercard has various degrees of market power across their optional services, with strong indications that lack of effective alternatives may result in Mastercard facing effective competitive constraints in the supply of some of these services. So we are only considering results estimated over mandatory and non-mandatory fees combined.

Table 10: Additional models for Mastercard: Mandatory fees only

Variable	M20m	M21m
2018	[X]	[X]
	[X]	[X]
2019	[X]	[X]
	[X]	[X]
2020	[X]	[X]
	[X]	[X]
2021	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
Share of Credit	[X]	[X]
	[X]	[X]
Share of CNP	[X]	[X]
	[X]	[X]
Share of Cross-border – EEA	[X]	[X]
	[X]	[X]
Share of Cross-border – RoW	[X]	[X]
	[X]	[X]
Share of Commercial	[X]	[X]
	[X]	[X]
Acquirer fixed effects	[X]	[X]
N	[X]	[X]
Adjusted R-squared	[X]	[X]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

7.57 Table 11 shows the equivalent models using a dependent variable measured on an absolute-level basis (i.e. acquirer fees as a percentage of transaction value). We estimate a statistically significant increase in fees for 2021 relative to 2017 on this basis. We are not considering results estimated on an absolute level-basis for Mastercard for the reasons set out in paragraphs 7.22 and 7.23.

Table 11: Additional models for Mastercard: Absolute-level dependent variable

Variable	M22	M23
2018	[⊗]	[⊗]
	[⊗]	[⊗]
2019	[⊗]	[⊗]
	[⊗]	[⊗]
2020	[⊗]	[⊗]
	[⊗]	[⊗]
2021	[⊗]	[⊗]
	[⊗]	[⊗]
[⊗]	[⊗]	[⊗]
	[⊗]	[⊗]
[⊗]	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Credit	[⊗]	[⊗]
	[⊗]	[⊗]
Share of CNP	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Cross-border – EEA	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Cross-border – RoW	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Commercial	[⊗]	[⊗]
	[⊗]	[⊗]
Acquirer fixed effects	[⊗]	[⊗]
N	[⊗]	[⊗]
Adjusted R-squared	[⊗]	[⊗]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.58 Table 12 shows base model estimates which exclude certain acquirers from our main data sample. Of the six model estimates:

- a. M24 and M25 exclude selected outlier acquirers referenced by Mastercard (as mentioned in paragraph 7.49b).
- b. M26 and M27 exclude acquirers with data missing in 2017.
- c. M28 and M29 exclude both outlier acquirers and acquirers with data missing in 2017.

7.59 We estimate statistically significant increases between [X] % and [X] % across all six model estimates.

Table 12: Additional models for Mastercard: Alternative data samples proposed by Mastercard

Variable	M24	M25	M26	M27	M28	M29
2018	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2019	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2020	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2021	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of EEA cross-border	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of ROW cross-border	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Acquirer fixed effects	[X]	[X]	[X]	[X]	[X]	[X]
N	[X]	[X]	[X]	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]	[X]	[X]	[X]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

Visa

- 7.60** In this section we set out the results for our modelling for Visa. Just as for Mastercard, we present six versions of the models V1-V6 with models V3, V4, V5 and V6 comprising our main results.
- 7.61** V1 shows the estimated trend in fees without controlling for transaction mix or acquirer-specific differences.
- 7.62** V2 shows the estimated trend in fees before controlling for transaction mix but controlling for acquirer-specific differences.
- 7.63** V3-V5 and V6 comprise our main models under the same two approaches we used for Mastercard:
- V3, V4 and V5, are the Visa equivalents to Mastercard's M3, M4 and M5.
 - V6 is the Visa equivalent to Mastercard's model M6 which adopts a variation of a general-to-specific approach. Across V3-V5 only the share of CNP transactions is individually significant and, of the remaining explanatory variables, only the share of credit transactions and the share of commercial transactions are pairwise jointly significant with each other at the 5% level. So, alongside acquirer effects, only the share of CNP transactions, the share of credit transactions and the share of commercial transactions are included as explanatory variables in V6.
- 7.64** Just as for Mastercard, we have considered V6 alongside V3, V4 and V5 following Visa's submissions on the selection of explanatory variables as set out in paragraph 7.67a. We also exclude V3 from our baseline models on the basis that the '[X]' and '[Y]' for Visa are highly correlated.⁶² So V4 and V5 are our base models; the Visa equivalents for Mastercard's M4 and M5.
- 7.65** As set out in paragraph 7.40b, we can derive an estimate of the % change in fees between 2019 and 2022 from the coefficient estimate for the 2022-year dummy in each Visa model,⁶³ by taking the exponential and subtracting one.
- 7.66** We observe from Table 13 that between 2019 and 2022:
- We find a statistically significant increase in acquirer fees of [X]% in V1 before controlling for transaction mix and acquirer characteristics.
 - We find a statistically significant increase in acquirer fees of [Y]% in V2 before controlling for transaction mix but not controlling for acquirer characteristics.
 - Across V3,V4, V5 and V6, the coefficient estimates for the 2022 year dummy (as well as some of the earlier year dummies) are positive and statistically significant. We find that Visa's average fee to acquirers has increased between [X]% and [Y]% between 2019 and 2022, and between 2018 and 2019 no statistically significant change was estimated.

62 We observe a Pearson Correlation Coefficient of [X] between [Y].

63 The number reported against 2022 for each model reported in Tables 13-18 and 20.

Table 13: Results of regression analysis for Visa

Variable	V1	V2	V3	V4	V5	V6
2018	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2020	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2021	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2022	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Credit	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border – EEA	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border – ROW	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Commercial	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Acquirer Fixed Effects	[X]	[X]	[X]	[X]	[X]	[X]
N	[X]	[X]	[X]	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]	[X]	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.67 In response to the analysis set out in our confidential working papers, which excluded V6 in our main results, Visa submitted to us that:

- a. “None of the explanatory variables included in V3-V5 are individually significant [X], and most of these variables are not jointly significant in any of V3-V5 based on our review of the PSR’s code.” Moreover, “[T]here is only a modest increase in adjusted R-squared observed for V3-V5 versus V2. Given the already high level of adjusted R-square in V2, the further increase to V3-V5 may be consistent with overfitting in these specifications.”⁶⁴

64 Visa response to PSR working paper dated 13 December 2023 [X]

PSR response: We have now added model V6 to our main results. The model comprises all explanatory variables included in V3 but removes variables following a general-to-specific approach using joint and individual statistical significance. We consider our approach which considers a range of estimates for model V3-V6 appropriately balances statistical inference with limitations in degrees of freedom due to relatively small sample size.

- b. “The PSR’s results cannot be reconciled with actual changes in Visa’ fees, indicating there are significant flaws in the PSR’s underlying assumptions.⁶⁵” Visa explained that “[redacted].⁶⁶” Visa also highlighted “[redacted].⁶⁷”

PSR response: We consider that our model estimates are sufficiently robust to estimate cumulative fee increases over a multi-year period for the following reasons. We consider it is entirely consistent that our models identify larger cumulative increases in fees, between 2019 and 2022, but not smaller cumulative increases in fees over shorter periods as statistically significant; the scale of a cumulative increase is a key determinant of its statistical significance.

- c. “The PSR’s modelling approach is not consistent with the commercial reality of Visa’s pricing and revenue generation. Visa note that the PSR uses the average fee rate for scheme or processing services as a percentage of GBP transacted by acquirers as its dependent variable, which combines all mandatory and non-mandatory fees without any adjustments and does not account for difference between net and gross fees. This dependent variable does not reflect the complexity of the underlying fees, their different drivers, development of services and introduction of fees over time, or the optionality and avoidability of non-mandatory fees.⁶⁸”

PSR response: We do not consider further disaggregated analysis is required because we have already undertaken robustness checks separating out mandatory fees from optional fees for the following reasons. First, as shown in Table 18, we estimate a [redacted]% increase in mandatory fees between 2019-2022 that is only slightly different from our main results. Second, as stated in paragraph 7.21, we have only applied our econometric analysis to gross fees because it was not possible to capture client incentive data [redacted]. We consider this will not affect our analysis in a material way as we found that [redacted]. Finally, as mentioned in paragraph 7.3, our aim is to identify cumulative changes in average acquirer fees across all acquirers and not changes in individual service prices. We do not consider this aim is served by a more disaggregated analysis.

65 Visa response to PSR working paper dated 13 December 2023 [redacted]

66 Ibid.

67 Ibid.

68 Visa response to PSR working paper dated 13 December 2023 [redacted]

Sensitivities

7.68 We have tested further modifications to our baseline models V4 and V5 above. In particular:

- a. We looked at models V7-V9 including squared logged [\ln^2] and [\ln] (as proposed by Mastercard in paragraph 7.49b) in Table 14.
- b. We have looked at excluding card type transaction characteristic variables, including both the 'Share of Commercial' and the 'Share of Credit' variables in models V10-V15 in Table 15.
- c. We added variables measuring the share of an acquirer's transaction value attributable to CNP transactions that are also cross-border or that are also under a specific card type, models V16-V21 in Table 16. This would allow for the possibility that there is:
 - o An additional premium to be paid on CNP cross-border transactions relative to CNP domestic transactions. As Visa has a fee category relating to International CNP, we expect this variable to be relevant to our model.
 - o An additional premium to be paid on CNP credit transactions relative to CNP debit transactions.
 - o An additional premium to be paid on CNP commercial transaction relative to CNP consumer transactions
- d. We estimated our models V22-V23 on an unweighted basis in Table 17.
- e. We estimated our models V24m-V25m on mandatory fees only in Table 18.
- f. We estimated our models V26-V27 using a dependent variable measured on an absolute level basis (ie not log-transformed) in Table 19.
- g. We estimated our models V28-V29 using 2018 as the base year instead of 2019 in Table 20.

7.69 The following tables present the results of these modifications on our baseline models.

7.70 Table 14 shows models including separate variables for the ratio of transaction value to transaction volume and squared logged transaction value. These changes to the model result in a similar but slightly higher estimate between [X] % and [X] % for the difference in the 2022 and 2019 fee levels (ie the estimated model parameter for 2022).

Table 14: Additional models for Visa: Additional explanatory variables

Variable	V7	V8	V9
2018	[X]	[X]	[X]
	[X]	[X]	[X]
2020	[X]	[X]	[X]
	[X]	[X]	[X]
2021	[X]	[X]	[X]
	[X]	[X]	[X]
2022	[X]	[X]	[X]
	[X]	[X]	[X]
[X]	[X]	[X]	[X]
	[X]	[X]	[X]
[X]	[X]	[X]	[X]
	[X]	[X]	[X]
[X]	[X]	[X]	[X]
	[X]	[X]	[X]
Share of Credit	[X]	[X]	[X]
	[X]	[X]	[X]
Share of CNP	[X]	[X]	[X]
	[X]	[X]	[X]
Share of Cross-border – EEA	[X]	[X]	[X]
	[X]	[X]	[X]
Share of Cross-border – ROW	[X]	[X]	[X]
	[X]	[X]	[X]
Share of Commercial	[X]	[X]	[X]
	[X]	[X]	[X]
Acquirer Fixed Effects	[X]	[X]	[X]
N	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.71 Table 15 shows the baseline models excluding different combinations of card type explanatory variables (the share of commercial and the share of credit transactions). These changes to the model result in a similar but slightly lower estimate between [X]% and [X]% for the difference in the 2022 and 2019 fee levels (ie the estimated model parameter for 2022).

Table 15: Additional models for Visa: Card Type

Variable	V10	V11	V12	V13	V14	V15
2018	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2020	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2021	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2022	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Credit	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border – EEA	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border RoW	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Commercial	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Acquirer fixed effects	[X]	[X]	[X]	[X]	[X]	[X]
N	[X]	[X]	[X]	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]	[X]	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.72 Table 16 shows models including the value of CNP transactions as multiple separate variables. This includes separate variables disaggregating CNP transactions by card type as Visa has indicated that its fees vary by card type. We estimate a slightly higher increase in average fee to acquirers ranging from [X] % to [X] % between 2019 and 2022 on this basis (fees did not increase or decrease between 2018 and 2019).

Table 16: Additional models for Visa: CNP Transactions

Variable	V16	V17	V18	V19	V20	V21
2018	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2020	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2021	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
2022	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
[X]	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Credit	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – domestic	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – EEA cross-border	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – ROW cross-border	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – Credit	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – Debit	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – Commercial	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of CNP – Consumer	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border – EEA	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Cross-border – ROW	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]
Share of Commercial	[X]	[X]	[X]	[X]	[X]	[X]
	[X]	[X]	[X]	[X]	[X]	[X]

Variable	V16	V17	V18	V19	V20	V21
	[X]	[X]	[X]	[X]	[X]	[X]
Acquirer fixed effects	[X]	[X]	[X]	[X]	[X]	[X]
N	[X]	[X]	[X]	[X]	[X]	[X]
Adjusted R-squared	[X]	[X]	[X]	[X]	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.73 Table 17 below shows models estimated without weighting data points by transaction value, i.e. without giving greater weight to larger acquirers in our dataset. We estimate a statistically significant increase of [X]% for both models between 2019 and 2022 (fees did not increase or decrease between 2018 and 2019).

Table 17: Additional models for Visa: Unweighted data

Variable	V22	V23
2018	[X]	[X]
	[X]	[X]
2020	[X]	[X]
	[X]	[X]
2021	[X]	[X]
	[X]	[X]
2022	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
Share of Credit	[X]	[X]
	[X]	[X]
Share of CNP	[X]	[X]
	[X]	[X]
Share of Cross-border – EEA	[X]	[X]
	[X]	[X]
Share of Cross-border – RoW	[X]	[X]
	[X]	[X]
Share of Commercial	[X]	[X]
	[X]	[X]
Acquirer fixed effects	[X]	[X]
N	[X]	[X]
Adjusted R-squared	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05

7.74 Table 18 below shows models estimated for mandatory fees only. We estimate a statistically significant increase of between [X]% and [X]% between 2019 and 2022 when only Visa’s mandatory fees are considered (fees did not increase or decrease between 2018 and 2019). As stated in paragraph 4.181 of Chapter 4, we also note in relation to optional services on the acquiring side Visa has various degrees of market power across their optional services, with strong indications that lack of effective alternatives may result in Visa facing effective competitive constraints in the supply of some of these services. So, we are only considering results estimated over mandatory and non-mandatory fees combined.

Table 18: Additional models for Visa: Mandatory fees only

Variable	V24m	V25m
2018	[X]	[X]
	[X]	[X]
2020	[X]	[X]
	[X]	[X]
2021	[X]	[X]
	[X]	[X]
2022	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
Share of Credit	[X]	[X]
	[X]	[X]
Share of CNP	[X]	[X]
	[X]	[X]
Share of Cross-border – EEA	[X]	[X]
	[X]	[X]
Share of Cross-border – RoW	[X]	[X]
	[X]	[X]
Share of Commercial	[X]	[X]
	[X]	[X]
Acquirer fixed effects	[X]	[X]
N	[X]	[X]
Adjusted R-squared	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

7.75 Table 19 shows the models estimated using the dependent variable measured on an absolute-level basis (ie acquirer fees as a percentage of transaction value). We are not considering results on an absolute-level basis for the reasons set out in paragraph 7.24. Even so, we do estimate a statistically significant increase in 2022 relative to 2019 on an absolute-level basis for Visa (fees did not increase or decrease between 2018 and 2019).

Table 19: Additional models for Visa: Absolute-level dependent variable

Variable	V26	V27
2018	[⊗]	[⊗]
	[⊗]	[⊗]
2020	[⊗]	[⊗]
	[⊗]	[⊗]
2021	[⊗]	[⊗]
	[⊗]	[⊗]
2022	[⊗]	[⊗]
	[⊗]	[⊗]
[⊗]	[⊗]	[⊗]
	[⊗]	[⊗]
[⊗]	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Credit	[⊗]	[⊗]
	[⊗]	[⊗]
Share of CNP	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Cross-border – EEA	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Cross-border – RoW	[⊗]	[⊗]
	[⊗]	[⊗]
Share of Commercial	[⊗]	[⊗]
	[⊗]	[⊗]
Acquirer fixed effects	[⊗]	[⊗]
N	[⊗]	[⊗]
Adjusted R-squared	[⊗]	[⊗]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

7.76 Table 20 shows the models estimated using 2018 as a base year to estimate the fee increase over the period from 2018 to 2022. As discussed in paragraph 7.40b, we chose to use 2019 as a base year as we considered this provided a more robust estimate. Nevertheless, we note that we still estimate a statistically significant increase of between [X]% and [X]% between 2018 to 2022 when 2018 is used as the base year.

Table 20: Additional models for Visa: Models calculated using the 2018 base year

Variable	V28	V29
2019	[X]	[X]
	[X]	[X]
2020	[X]	[X]
	[X]	[X]
2021	[X]	[X]
	[X]	[X]
2022	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
[X]	[X]	[X]
	[X]	[X]
Share of Credit	[X]	[X]
	[X]	[X]
Share of CNP	[X]	[X]
	[X]	[X]
Share of Cross-border – EEA	[X]	[X]
	[X]	[X]
Share of Cross-border – RoW	[X]	[X]
	[X]	[X]
Share of Commercial	[X]	[X]
	[X]	[X]
Acquirer fixed effects	[X]	[X]
N	[X]	[X]
Adjusted R-squared	[X]	[X]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.001, ** p<0.01, *p<0.05.

Summary of results

- 7.77** Our descriptive data analysis on the evolution of scheme and processing fees presented in Annex 6, showed that average acquirer gross fee revenues (expressed as a share of transaction value) for Mastercard and Visa increased between 2017-2021 and 2018-2022 respectively.
- 7.78** By using regression analysis to control for the main transaction characteristics affecting Mastercard's and Visa's acquirer fee revenues, we find that:
- a. Average acquirer gross fee revenues (as a share of transaction value) increased by around [X]% for Mastercard between 2017 and 2021. However, given that services described by Mastercard as optional account for [X]% to [X]% of Mastercard's total annual acquirer revenues and [X], we note that some of the increase in Mastercard acquirer gross fee revenues (as a share of transaction value) found in this analysis may in part be due to the increase in optional services purchased by acquirers. We do not consider that our results estimated on mandatory fees only over the largest acquirers are sufficiently reliably accurate to inform our findings due to small sample size.
 - b. Our analysis suggests that average acquirer gross fee revenues (as a share of transaction value) increased by around [X]%-[X]% for Visa between 2019 and 2022 (with no significant change between 2018 and 2019). When estimating the regression analysis on mandatory acquirer fee revenues only, we estimate a [X] increase in gross fee revenues (expressed as a share of transaction value), of just over [X]% between 2019 and 2022; accordingly, we consider that the increase in Visa acquirer fee revenues fees is unlikely to be explained by changes in optional services purchased by acquirers. Finally, we also find an increase in acquirer fee revenues of around [X]% for Visa between 2018 and 2022, when 2018 is used as the base year in our models. However, given the levels of statistical significance that we find in some of these models, our preferred model uses 2019 as the baseline year.

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