PSR Payment Systems Regulator

Annex 7 to final report

Market review of card scheme and processing fees

Econometric analysis

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MR22/1.10 Annex 7

Contents

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

Annex 7
Econometric analysis

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 ([✂]%) and Visa ([✂]%) between 2017 to 2023 and the financial years 2018 to 2023 respectively. However, we consider that these increases are likely to be impacted by changes in transaction mix, particularly given the growth in Mastercard's debit card business can be attributed to some large issuers switching to Mastercard from Visa.

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 driven by a greater value or volume of transactions 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 (that is, non-optional) services only. 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 and we have addressed relevant points raised within the relevant sections of this annex.[1]

1 In the CAMR we stated, at paragraph 5.67, that 'Visa Europe did not comment in detail on our analysis of how scheme fees have changed or the conclusions drawn'.

7.5 We estimate the increase in average acquirer gross fee revenues over the most recently available time periods for which we could obtain data from Mastercard (seven years) and Visa (six years). For each scheme, we estimate fee increases across different models to obtain ranges (our main results) for the increase in average acquirer gross fee revenues for overall fees and mandatory fees only. Together we consider these ranges appropriately balance:

- controlling for all relevant drivers of acquirer fees
- the consideration of reduced models to address potential statistical inference concerns when all relevant drivers are included
- for Mastercard only – the impact of potential outliers

7.6 Since our interim report publication, we have extended our analysis so that it covers the most recently available periods for which we could obtain data (up to 2023), and also looks at the increase in Mastercard's acquirer fees separately for mandatory fees only. We have also updated our choice of main models in response to submissions from:

- Mastercard, to address refinements they have proposed (as set out in paragraph 7.70 to 7.72)
- Visa, to exclude variables which are not relevant to our modelling (as set out in paragraphs 7.108 to 7.111)

7.7 We find:

a. Across our main results for overall fees,[2] Mastercard's average acquirer gross fee revenues (expressed as a share of transaction value) increased by around ([✂]% to [✂]%) between 2017 and 2023. However, given that services described by Mastercard as optional account for [✂]% to [✂]% of Mastercard's total annual acquirer gross fee revenues and this share has been rising over time, 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, so we have also looked at the increase in mandatory fees only. When estimating the main results of our regression analysis on mandatory acquirer gross fee revenues only,[3] we estimate a slightly lower increase in mandatory acquirer gross fee revenues (expressed as a share of transaction value) of [✂]% to [✂]% between 2017 and 2021,[4] and find no evidence that fees have fallen between 2021 and 2023.

b. Across our main results for overall fees,[5] Visa's average acquirer gross fee revenues (as a share of transaction value) increased by around [✂]% to [✂]% between 2019 and 2023 (with no significant change between 2018 and 2019). When estimating the main results of our regression analysis on mandatory acquirer gross fee revenues only,[6] we estimate a similar increase in acquirer gross fee revenues (expressed as a share of transaction value), of [✂]% to [✂]% between 2019 and 2023.

2 Models M3 to M8 in Table 4.
3 Models M3m to M8m in Table 9.
4 That is [✂] than the [✂] estimated for the sum of mandatory and optional fees.
5 Models V3 and V4 in Table 14.
6 Models V2m and V3m in Table 23.

7.8 In preparing this annex, we have taken account of feedback provided by Mastercard and Visa in response to the econometric analysis set out in Annex 7 of our interim report and earlier (separate) confidential working papers setting out our econometric analysis to Mastercard and Visa.[7]

7.9 The rest of the annex is structured as follows:

- We describe the data we have used (paragraphs 7.10 to 7.32).
- We set out our methodology (paragraphs 7.33 to 7.59).
- We present the results for Mastercard's overall fees (paragraphs 7.60 to 7.83).
- We present the results for Mastercard's mandatory fees only (paragraphs 7.84 to 7.96).
- We present the results for Visa's overall fees (paragraphs 7.97 to 7.126).
- We present the results for Visa's mandatory fees only (paragraphs 7.127 to 7.141).
- We summarise our results (paragraphs 7.142 to 7.143).

Data

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

7.11 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.[8] The data collected from Mastercard covered the seven-year period 2017-2023 (calendar years corresponding to Mastercard's financial years).

7.12 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.[9] The data collected from Visa covered the six-year period 1 October 2017 to 30 September 2023 (corresponding to Visa's 2018-2023 financial years).

7.13 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:

- Card-present (CP) transactions versus card-not-present (CNP) transactions.
- Domestic transactions versus cross-border transactions, where cross-border transactions were further disaggregated by the European Economic Area (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 In this annex, we refer to the Econometrics confidential working paper as the Econometrics CWP. Please note that other annexes (for example, Annexes 1, 9 and 10) use CWP to refer to the respective confidential working paper for that annex.

8 Mastercard response to PSR questions dated 21 November 2022 [✂].

9 Visa response to PSR questions dated 23 November 2022 [✂].

7.14 To identify individual acquirers within each card payment system's data, we grouped acquirer entities with a common owner, before 2017 and 2018 for Mastercard and Visa respectively, 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.[10] We identified at least [✂] acquirers ([✂] for Mastercard; [✂] 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.[11] 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 six or seven 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.[12]

7.15 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.[13] The [✂] acquirers included in our Mastercard estimation sample together accounted for [✂] ([✂]%) of Mastercard's total UK transaction value and [✂] ([✂]%) of Mastercard's total UK acquirer gross fees revenue in 2023. The [✂] acquirers included in our Visa estimation sample together accounted for [✂] ([✂]%) of Visa's total UK transaction value and [✂] ([✂]%) of Visa's total UK acquirer gross fee revenues in 2023. Only [✂] of the [✂] acquirers included in our Visa sample are recorded as having processed transactions in 2018. [✂]. For this reason, it was not possible for Visa to prepare wholly consistent datasets covering earlier years.

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

Dimension	2017	2018	2019	2020	2021	2022	2023
Mastercard	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Visa	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]

10 We note that we observe similar results for our main models of overall fees when they are estimated using 'ungrouped' acquirer entities from the raw data submitted by the card schemes.

11 We excluded acquirers with less than £1 because these acquirers would have a negative [✂].

12 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).

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

7.16 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: Mastercard's weighted average acquirer fee revenues as a % of GBP card transaction value, in the raw data versus the estimation sample

[✂]

Source: PSR calculations of data submitted by Mastercard for the 2017-2023 financial years [✂].

Figure 2: Visa's weighted average acquirer fees revenues as a % of GBP card transaction value, in the raw data versus the estimation sample

[✂]

Source: PSR calculations of data submitted by Visa for the 2018-2023 financial years [✂].

Mastercard's comments on our sample selection

7.17 Mastercard raised points related to the selection of our sample: the treatment of outliers, our basis for including or excluding acquirers with missing data, sample size, and our use of aggregated acquirer data. We set out their points and our responses below.

Treatment of outliers

7.18 Mastercard commented that we had not accounted for outliers, such as acquirers with [✂] or acquirers with a [✂] in our analysis. Mastercard told us that '…[t]o minimise the adverse impact of extreme observations… on the PSR's baseline model, such observations should either be removed from the estimation sample or a relevant control variable should be introduced'.[14] Mastercard stated that '[✂] are charged irrespective of [✂]. As a result, acquirers with [✂] show up with [✂], since these are defined as the ratio of total value of fees paid to total value of acquired transactions multiplied by a 100. This issue is especially severe when an acquirer's [✂], because it creates the illusion that unit revenues (the working definition for prices in the Interim Report) have drastically changed. Given the specification of the PSR's baseline model, this variation would be incorrectly attributed to price changes even if there was no underlying price change.'[15]

7.19 Mastercard also submitted Figure 3, which they advised '…shows the distribution of unit revenues in the estimation sample by year'.[16] They also noted that '[t]here are [✂], since their unit revenues are very different from other acquirers in the sample. We note that for some acquirers, [✂] (unit revenues can be interpreted as the value of fees, expressed in

14 Mastercard response to MR22/1.9 (21 May 2024) Annex 1, pages 5 and 6, paragraphs 2.6 to 2.9.
15 Mastercard response to MR22/1.9 (21 May 2024) Annex 1, page 5, paragraph 2.7.
16 Mastercard response to MR22/1.9 (21 May 2024) Annex 1, page 5, paragraph 2.8.

pence, per £1 transacted or the value of fees as a percentage of total transaction value). This means that [✂] in that year. We note that there are [✂] such extreme observations – [✂].'[17]

Figure 3: Mastercard analysis of the distribution of acquirer unit (ie average) revenues in the estimation sample by year.

[✂]

Note: Please note that the X-axis is not linear to accommodate extreme values of unit revenues. Vertical lines indicate weighted average unit revenue.

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

7.20 We consider, on the evidence before us, that there are insufficient grounds for acquirers with low transaction volumes or value of transactions, or a high proportion of total fees attributed to non-transactional fees, to be regarded as outliers. 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 acquirers are treated as 'outliers' and 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 to exclude acquirers which Mastercard has previously suggested to us may be potential outliers and note that excluding 'outliers' has a minimal impact on results (as set out in paragraphs 7.25 to 7.28).

7.21 We have also looked at additional models of overall fees and mandatory fees which limit the impact of potential outliers, including some of Mastercard's modelling refinements.

7.22 For overall fees, we have now included Mastercard's preferred specifications, model M7, and an additional model which adds further [✂] variables attributable to specific types of transaction characteristics (whether a transaction is CNP, EEA or ROW), M8, within our main results in Table 4. When estimating the increase in overall fees across these models, our main results are unchanged by the presence or absence of M7 and M8.

7.23 For mandatory fees only, we have now included additional models which are the mandatory fees equivalent models to M7 and M8 (M7m-M8m in Table 9). When estimating the increase in mandatory fees only across these models, we obtain mixed results for the increase in fees between 2017 and 2023. We observe no statistically significant increase in fees in M7m but find a statistically significant increase in fees for M8m ([✂]%). The size of increase estimated in M8m is above the range estimated in our main results for mandatory fees only after excluding M7m and M8m ([✂]% to [✂]%).

7.24 We therefore consider that better accounting for potential outliers by including additional [✂] variables in our models of overall fees would not materially change the fee increase estimated in our modelling, but it is unclear whether including the same variables in our modelling of mandatory fees only would change the fee increase estimated.

17 Mastercard response to MR22/1.9 (21 May 2024) Annex 1, page 5, paragraph 2.8.

Acquirers with missing data

7.25 Mastercard's view was that acquirers which had missing data in the base year (2017) would capture a change relative to a different year (that is, not 2017).[18]

7.26 Mastercard also commented that one specific acquirer, [✂], as it had positive revenues in only [✂] years, should be excluded. Mastercard stated that 'The Interim Report states that it "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". In the estimation sample used in the Interim Report, [✂] unit revenues are [✂]. As a result of log transformation these two years of data are discarded by the statistical software and the econometric model is estimated on just three [✂] observations. [✂] should thus be completely removed from the estimation sample to be consistent with its stated approach of excluding acquirers with less than four years of data.'[19]

7.27 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. 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, we have looked at excluding acquirers which acquired no transactions in 2017 and found that it only had a minimal impact on the results.[20]

7.28 We have retained [✂] in our analysis because we have now received additional years of data for that acquirer with positive revenue and, even after discarding years with negative revenue, now have four or more years data for the acquirer. Nevertheless, we have taken further steps to only include acquirers with four or more years data after accounting for data discarded by our main models in our latest estimation sample. We have also undertaken further sensitivity analysis to look at the impact of only including acquirers that do not have any missing data or outliers and note we note this results in minimal differences to our main models.[21]

18 Mastercard stated that 'the PSR's variable of interest in this analysis is the dummy variable for the year 2021. The PSR states that this coefficient captures "the change in average fees relative to 2017"—for the PSR's interpretation of the coefficient to hold, the base case of 2017 has to be present in the data. For [✂] acquirers included in the PSR sample, this is not the case. Thus, for these acquirers the coefficient instead captures the change relative to a different year." Mastercard response to PSR working paper dated 13 December 2023. [✂]

19 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 7, paragraph 2.13.

20 We estimate an increase in overall fees of [✂]% to [✂]% between 2017 and 2023 for our baseline models M3, M4 and M7, and an increase in mandatory fees only of [✂]% to [✂]% between 2017 and 2021 for our baseline models M3m, M4m and M7m, when acquirers with no transactions in 2017 are excluded.

21 We estimate an increase in overall fees of [✂]% to [✂]% between 2017 and 2023 for our baseline models M3, M4 and M7, and an increase in mandatory fees only of [✂]% to [✂]% between 2017 and 2021 for our baseline models M3m, M4m and M7m, when potential outliers and acquirers with missing are excluded.

Sample size

7.29 Mastercard commented on the size of our sample and the associated limited degrees of freedom used in our analysis.[22]

7.30 We note that we have now increased our sample size to [✂] observations for Mastercard (seven annual observations for [✂] acquirers in the Mastercard sample). 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,[23] we consider less data is required in our model estimates after controlling for acquirer fixed effects. While we acknowledge that our sample is relatively small, we consider that it is now large enough to accurately estimate the statistical significance of cumulative increases in fees over the periods considered.

Data aggregation

7.31 Mastercard highlighted the limitations that our aggregated acquirer data, which groups acquirer entities, [✂].[24]

7.32 We have not made further adjustments to our sample to account for Mastercard's [✂] because we consider our approach of grouping acquiring entities is the most appropriate one. Mastercard have also confirmed that despite there being limitations in our approach it is [✂].[25]

22 Mastercard stated that '... of the [✂] acquirers included in the PSR sample, [✂] account for [✂]% to [✂]% of transacted volumes in each year. Due to the PSR's use of weighting, [✂] 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 and the large number of (potential) control variables, 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 control 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.' Mastercard response to PSR working paper dated 13 December 2023. [✂].

23 As mentioned in Jeffrey M Wooldridge, *Econometric Analysis of Cross Section and Panel Data*, 2001, p.272, 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).

24 Mastercard told us '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 [✂]. Mastercard's billing is generally [✂]. Acquirers may set up different entities for a variety of reasons, e.g. to serve different types of merchants. Mastercard may calculate some [✂]. When aggregating the data the PSR thus may conflate the effects of changes to fees with the acquirer's choice of business structure.' [✂].

25 Mastercard also told us 'On the other hand, [✂]. As a result, modelling at the [✂] level is also [✂]. Modelling at the [✂] level would introduce additional challenges due to the [✂], therefore we consider the PSR's current approach [✂], but Mastercard wanted to highlight its limitations.' [✂].

Methodology

Our model

7.33 Mathematically, our econometric model can be written as:

$$\boldsymbol{f}_{it} = \widehat{\boldsymbol{\alpha}}_i + \hat{\mu}_t + \sum_{k=1}^{K} \widehat{\boldsymbol{\beta}}_k \boldsymbol{x}_{kit} + \hat{\boldsymbol{\varepsilon}}_{it}$$

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

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

7.34 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.

7.35 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.

7.36 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

7.37 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 said are optional.[26] We have also estimated models on a 'mandatory fees only' basis, where such optional fees are excluded for both schemes.

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).

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

7.38 We note that our modelling is based on the gross fee revenues paid by acquirers before any incentives or rebates from Mastercard or Visa. [✂]. We found that total incentive and rebate payments allocated to acquirers and merchants amounted to [✂]% of gross acquirer fee revenues for Mastercard in 2023. We found that total incentive and rebate payments allocated to acquirers amounted to [✂]% of gross acquirer fee revenues for Visa in 2023.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.

7.39 We have chosen to use log-transformed average fees because there are likely to be [✂] between explanatory variables and the dependent variable. As suggested by [✂], when the dependent variable is modelled on an absolute basis the assumption of a [✂] between the dependent variable and explanatory variable may not hold, due to the skewed variation in the dependent variable, and a log transformation of the dependent variable would stabilise the variance.[27] We also note, as discussed in paragraphs 7.48a to 7.48b for Mastercard, that there are likely to be [✂] between certain explanatory variables, such as the [✂], and the dependent variable. We therefore consider log-transformed average fees models are likely to represent a 'better fit' for both Mastercard's and Visa's data over average fees modelled on an absolute-level basis. This is also supported by the results of our Box-Cox transformations and other informal observations, such as the greater adjusted R-squared levels we observe in our log-transformed model estimates compared to our absolute-level model estimates.[28,29,30,31,32] Nevertheless, with the only exception of M20, we do estimate a statistically significant fee increase between 2017 and 2023 at a similar or higher level on an absolute-level basis as well.[33]

27 Mastercard submission dated 23 November 2020 **[✂].**

28 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 suggests a multiplicative inverse model.

29 We estimated our main models of Mastercard's overall fees (M3 to M8) using a Box-Cox transformation by Maximum Likelihood once the dependent variable has been rescaled by its mean. In five out of the six models used in our main results (M3 and M5 to M8), all null hypotheses for different functional forms (linear, log, multiplicative inverse) are rejected in formal tests. 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 a multiplicative inverse or log transformation as the most appropriate functional form for the dependent variable. Informally, we also note the adjusted R-squared for the log-transformed version of average acquirer gross overall and mandatory fee revenues (see Table 4) are substantially greater than for equivalent models estimated on absolute-level bases (see Table 8).

30 We estimated our main models of Mastercard's mandatory fees (M3m to M8m) using a Box-Cox transformation by Maximum Likelihood. All null hypotheses are rejected in formal tests. But the log-likelihood statistics of the transformation suggest a better fit for a log specification when compared to a linear specification. Informally, we also note, just as for the equivalent models of Mastercard's overall fees, the adjusted R-squared for the log-transformed version of our models (see Table 9) are substantially greater than for equivalent models estimated on absolute-level bases (see Table 13).

31 We estimated our main models of Visa's overall fees (V3 and V4) using a Box-Cox transformation by Maximum Likelihood. All null hypotheses are rejected in formal tests at the 5% level. But in all models the log-likelihood statistics suggests a better fit for a log specification when compared to a linear specification. Informally, we also note the adjusted R-squared for the log-transformed version of average fees (see Table 14) is greater than the adjusted R-squared of the equivalent absolute-level estimated models (see Table 19).

32 We estimated our main model of Visa's mandatory fees (V3m) using a Box-Cox transformation by Maximum Likelihood. All null hypotheses are rejected in formal tests at the 5% level. The log-likelihood statistic estimated for V3m suggests a better fit for a log specification when compared to a linear specification. Informally, we also note the adjusted R-squared for the log-transformed version of average mandatory fees (see Table 21) is greater than the adjusted R-squared of the equivalent absolute-level estimated models (see Table 26).

33 We estimate a statistically significant increase between 2017-2022 of more than [✂]% and [✂] between 2022 and 2023 for M20.

Mastercard's comments on our dependent variable

Our Box-Cox results

7.40 Mastercard argued that '[c]ontrary 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'.[34]

7.41 While we note that for all six models used in our main results for overall fees (M3-M8) all functional forms are rejected when estimated by the Box-Cox transformation, we also note that the formal tests produce parameter estimates that are closer to log transformation or multiplicative inverse as the most appropriate functional form for the dependent variable. Similarly, while our main models of mandatory fees only (M3m to M8m) are rejected under formal tests under the Box-Cox transformation, the tests produce estimates that are closer to log transformation as the most appropriate functional form for the dependent variable.

Alternative approaches

7.42 Mastercard also told us that the PSR could also explore the use of a Fractional Outcome model or a quantile regression approach.[35]

7.43 We consider that Fractional Outcome models are those suited for modelling bounded variables which 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.[36] 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.[37]

Rationale for the explanatory variables

7.44 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 (i.e. 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.

7.45 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.

34 Mastercard response to PSR working paper dated 13 December 2023. [✂]
35 Mastercard response to PSR working paper dated 13 December 2023. [✂]
36 Nevertheless, for both Mastercard and Visa, we observe similar results for mandatory fees and overall fees when we estimate Fractional Outcome model estimates using Beta estimates.
37 Mastercard response to PSR working paper dated 13 December 2023. [✂]

7.46 Below we provide an overview of the main fee drivers for Mastercard and Visa based on their submissions.[38]

Main fee drivers for Mastercard

7.47 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).

7.48 We consider the following fee drivers, which together were drivers for [✂]%-[✂]% 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:

a. The [✂]. 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 [✂] 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 [✂]. This would be the case if, for example, some fees are [✂] in such a way that the percentage fee [✂]. Based on information provided by Mastercard, we understand that Mastercard [✂]. Overall, [✂] suggests that the [✂] may be a relevant explanatory variable.

b. The [✂]. Similar to [✂], including this variable in the model allows for the [✂] relationship between [✂].

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.

7.49 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 [✂].[39] If this is correct, [✂].

7.50 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.

38 Responses to our Section 81 information notices dated November 23 requesting [✂].

39 [✂]

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

Fee driver	Annual % of total acquirer fee revenues
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
Total remaining fee drivers	[✂]%-[✂]%

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

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

a. [✂] 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.[40]

b. Five of the remaining fee drivers ([✂]) each accounted for no more than [✂]% of total fees in a given year.

c. As noted in paragraphs 7.56 to 7.58, 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

7.52 We found that [✂]% to [✂]% 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 **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).[41]

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

41 [✂] in Visa response to PSR questions dated 21 November 2022. [✂]

b. 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.[42]

c. 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. [✂].[43]

7.53 We have updated our position on the relevance of certain transaction characteristics as explanatory variables following Visa's response to our interim report (as explained in more detail in paragraphs 7.108 to 7.111). We no longer consider that the [✂], [✂] and the [✂] are relevant for modelling Visa's acquirer fee revenues (this an update to the position in our interim report as explained). These variables would be relevant if acquirer fees were differentiated between [✂], or if there were fees that were [✂]. Visa has told us that it does not differentiate acquirer fees depending on whether fees are attributable to [✂].[44,45]

7.54 We have also continued to exclude 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 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
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
[✂]	[✂]%-[✂]%
Total remaining fee drivers	**[✂]%-[✂]%**

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

42 Visa response to PSR questions dated 21 November 2022. [✂]

43 Visa response to PSR questions dated 22 August 2023. [✂]

44 Visa stated that '[✂]…'. Visa's response to MR22/1.9 (21 May 2024), page 20, paragraph 2.16, footnote 85.

45 Visa stated it had [✂]. Visa's response to MR22/1.9 (21 May 2024), page 20, paragraph 2.16, footnote 86.

7.55 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 [✂]% of total fees in a single year.

b. Visa have indicated that there are [✂].[46] But as these dimensions of fee differentiation refer to characteristics that are relatively uncommon (that is, 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 paragraphs 7.56 to 7.58, 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

7.56 We also included 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.

7.57 We note that our approach is consistent with Mastercard's comments on our CAMR analysis which suggest acquirer fixed effects should be included '[✂] that needs to be captured with acquirer-specific fixed effects, in the form of acquirer dummy variables'.[47]

7.58 In response to [✂], Mastercard also submitted to us 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. Mastercard subsequently clarified, in response to our interim report, that we should include fixed effects to avoid omitted variable bias and, instead, only control for relevant fee drivers which appropriately capture changes over time.[48]

46 Visa response to PSR questions dated 22 August 2023 [✂].

47 Mastercard submission dated 23 November 2020 [✂].

48 Mastercard response to MR22/1.9 (21 May 2024), Annex 1 page 14 paragraph 4.5.

Year dummies

7.59 We included year dummy variables for each year in the six- and seven-year periods of our analysis to estimate the change in average fees relative to a base year (the main parameter of interest) in all our models:

a. For Mastercard, we included dummy variables for 2018, 2019, 2020, 2021, 2022 and 2023 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 2023-year dummy, which measures the change in average fees relative to 2017.[49] 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, 2022 and 2023 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.[50,51] The main parameter of interest in all Visa models is the coefficient estimate for the 2023-year dummy, which measures the change in average fees relative to 2019.[52] 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).

Mastercard results: overall fees

7.60 Table 4 below shows the results for our modelling of overall fees for Mastercard. We present eight versions of the model – M1-M8.

7.61 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.

7.62 Models M3, M4, M5, M6, M7 and M8 comprise estimates of our main results under three approaches (M3, M4 and M7 are our baseline models):

a. M3 and M4 include explanatory variables for all fee drivers we consider relevant to our modelling, with different combinations of [✂] and [✂] explanatory variables amongst the two models.

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

50 Although we note we also find a statistically significant increase in fees when 2018 is used as the base year (as shown in Tables 20 and 27).

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

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

b. M5 and M6 adopt a variation of a general-to-specific approach,[53] removing explanatory variables from models M3 and M4 that were not individually statistically significant at the 5% level. Across M3 and M4 only the share of ROW transactions, the [✂] and the [✂] explanatory were statistically significant at the 5% level.

c. M7 and M8 include the addition of two explanatory variables ([✂] and the [✂]). Mastercard has proposed to improve our modelling to limit the impact of potential outliers and address our concerns when including [✂] and [✂] due to multicollinearity.

7.63 For models M3 and M4, although we recognise that both [✂] and [✂] variables may each individually be relevant in explaining the trend in fees, we note the high correlation between the two variables.[54] As a result, we consider that our models should include just one of [✂] or [✂] in M3 and M4 respectively but not both variables; in any case these give similar results.

7.64 We have considered M5-M8 following the further submissions of Mastercard in paragraph 7.75, regarding our selection of explanatory variables in our main results (for M5 and M6), and in paragraphs 7.70 to 7.72, regarding Mastercard's suggested refinements to our models (for M7 and M8).

7.65 As set out in paragraph 7.59a, we can derive an estimate for the percentage change in fees between 2017 and 2023 from the coefficient estimate for the 2023-year dummy in each Mastercard model.[55] The relevant coefficient estimates are highlighted in bold within our main results and robustness checks.

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

54 We estimate a Pearson correlation coefficient of **[✂]** between **[✂]**.

55 The number reported against 2023 for each model reported in Tables 4 to 7 can be converted to a percentage increase by taking the exponential and subtracting one. For example, we would estimate a 10% increase for a coefficient of 0.09531 as 10% = $100(e^{(0.09531)} - 1)$ in accordance with paragraph 7.59a.

Table 4: Results of regression analysis of overall fees for Mastercard

Variable	M1	M2	M3	M4	M5	M6	M7	M8
2018	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Share of EEA cross-border	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Share of ROW cross-border	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.5, *p<0.1.

7.66 We observe from Table 4 above that between 2017 and 2023:

- We find a statistically significant increase in acquirer fees of [✂]% (at the 10% level) in M1 (the first column) before controlling for both transaction mix and acquirer characteristics.[56]

56 This is based on our fee increase calculation of [✂]% = [✂] for model M1 in accordance with paragraph 7.59a.

- We find no statistically significant increase in acquirer fees in M2 (the second column) before controlling for transaction mix but after controlling for acquirer characteristics.
- Across models M3, M4, M5, M6, M7 and M8 (columns 3 to 8), we find a [✂] in acquirer fees between [✂]% and [✂]% once transaction mix and acquirer characteristics have been accounted for.[57]

Mastercard's comments on PSR analysis of overall fees

7.67 In response to our previous analyses (the interim report and [✂]), Mastercard submitted to us that our models had not accounted for the take-up of optional services, did not include specific refinements it had previously suggested, may omit relevant control/explanatory variables, and that we had not fully explained our model selection criteria. We deal with these points in the following paragraphs.

Optional services

7.68 Mastercard argued that '…[g]iven that none of the PSR's models control for the take-up of optional services, the estimated unit revenue increase is likely biased upwards.'[58,59]

7.69 As stated in paragraph 7.3, not controlling for optional services take-up may potentially distort our estimates of acquirer fee revenue changes. As a result, we have also separately looked at the fee increase for mandatory fees only in paragraphs 7.84 to 7.96. When estimating our regression analysis on mandatory fees only, we estimate a slightly lower increase in fees of [✂]% to [✂]% between 2017 and 2021 (based on models M3m-M8m in Table 9) and find no evidence that fees have fallen between 2021 and 2023.

Model refinements

7.70 Mastercard identified refinements to our models to:

a. include the [✂] as a control variable in place of using both [✂] to account for their concerns of including both variables due to multicollinearity[60]
b. include [✂] to limit the impact of potential outliers, such as [✂] or a high proportion of total fees attributed to [✂] fees[61]

7.71 We have added estimates that include the [✂] in our main results but observe that its inclusion [✂] for our base models. We also estimate an average fee increase of [✂]%

57 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂], [✂]% = [✂], [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M3, M4, M5, M6, M7 and M8 respectively in accordance with paragraph 7.59a.

58 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 10, paragraph 3.1.

59 Mastercard also stated that 'there are also significant changes over time in the [✂] for many acquirers'. Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 13, paragraph 4.3.

60 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 4, paragraph 2.4.

61 Mastercard submitted to us that 'To minimise the adverse impact of extreme observations ([✂]) on the PSR's baseline model, such observations should either be removed from the estimation sample or a relevant control variable should be introduced. The Interim report states that it was reluctant to remove these extreme observations from the estimation sample, as it believed it would "risk estimating our models over a sample that is unrepresentative of the acquirer population". [✂] did not suggest removing observations, but instead suggested controlling for their unusual nature by using a "[✂]". It is common practice in econometric modelling to introduce a square term to account for [✂], making the functional form more flexible and less sensitive to extreme observations.' Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 6, paragraphs 2.9 to 2.11.

when we only include the [✂] variable in our base models M3 and M4 for overall fees, which is within the range of our main results ([✂]% to [✂]%).

7.72 As set out in paragraph 7.22, we have also looked at the impact of including [✂] and other [✂] variables in addition to the [✂] in our main results and sensitivities for overall fees and found that [✂]. As also stated in paragraph 7.23, we obtained mixed results for the increase between 2017 and 2023 when we also looked at the impact of including the same variables in our models of mandatory fees. As such, we consider that better accounting for potential outliers by including additional [✂] variables in our models of overall fees would not change the fee increase estimated in our modelling, and that it is unclear whether including the same variables in our modelling of mandatory fees only would lower the fee increase estimated. Nevertheless, Mastercard's preferred model specification (M7 and M7m) and our model which adds further [✂] variables (M8 and M8m) have been added to our main results for both mandatory fees and overall fees.

Omitted variables

7.73 Mastercard submitted that our analysis only considered a limited number of fee drivers and may omit relevant controls or explanatory variables because '[i]t is… unlikely that acquirers have seen no changes to their merchant base in the period of 2017–2021, especially since this period includes the COVID-19 pandemic which resulted in major changes in spending patterns'.[62] Mastercard stated '[t]he Interim Report thus contradicts the available evidence by assuming that these factors are constant over time' and '[t]his leads to the acquirer fixed effects not capturing the effects that the Interim Report speculates they do'.[63] In addition, '[f]or this review, Mastercard submitted information on the [✂]. The information submitted covered [✂] distinct drivers. In addition, non-transaction related fees have additional bespoke drivers (e.g. [✂]). Of these [✂] possible drivers only four were considered by the PSR in the analysis.'[64] Finally, Mastercard noted that '[i]f such omitted drivers are not constant across time, their intertemporal evolution would be captured by the time fixed effects (the variable of interest). This means that the analysis contained in the Interim Report cannot determine whether the apparent increase in unit revenues is due to changes in the behaviour of acquirers (eg. purchasing decisions for optional services, changes in merchant base, avoidance of behavioural fees) and transaction characteristics within a given fee structure or due to intertemporal changes in the fee structure.'[65]

7.74 As stated in paragraph 7.50 above, we did not request acquirer-level data for other drivers noted by Mastercard and we note Mastercard has not provided further data on additional drivers in response to our interim report. However, fee drivers we considered relevant accounted for [✂]% to [✂]% of total fees between 2017 and 2021 (as set out in Table 2), and other fee drivers likely explain few fee-level changes not explained by the drivers we have included. We have also looked at fee increases for mandatory services only, which are less impacted by acquirer behaviour. We therefore consider that, even though our analysis does not control for all possible fee drivers, it is sufficiently robust to account for the main transaction characteristics and behaviour of acquirers. 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. Finally,

62 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 13, paragraph 4.3.
63 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 13, paragraph 4.3.
64 Mastercard response to PSR working paper dated 13 December 2023 **[✂].**
65 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 13, paragraph 4.4.

in relation to controlling for changes in the behaviour of acquirer purchasing decisions for optional services, we note that we have also looked at fee increases in mandatory fees only in paragraphs 7.84 to 7.96.

Model selection criteria

7.75 Mastercard submitted to us that the PSR had '…not elaborate[d] on how it arrived at its final specification…' when selecting controls and explanatory variables.[66]

7.76 We have now included additional models M7 and M8 in our main results. These additional models limit the impact of potential outliers and better address concerns of including both variables (the log of transaction value and transaction volume) due to multicollinearity. Our main models (M3-M8) now appropriately balance the requirement to:

- control for all relevant drivers of acquirer fees (M3 and M4)
- also consider reduced models (M5 and M6) given potential statistical inference concerns when all relevant drivers are included (partly related to limited sample size)
- consider the impact of potential outliers (M7 and M8)

Sensitivities: Overall fees

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

a. We looked at including card-type explanatory variables in models M9-M11 in Table 5. This involved including variables for the share of credit and the share of commercial card transactions.

b. We added variables measuring the share of an acquirer's transaction value attributable to CNP transactions that are also cross-border in models M12-M14 in Table 6. 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.

c. We estimated our models M15-M17 without weighting data points by transaction value in Table 7.

d. We estimated our models M18-M20 using a dependent variable measured on an absolute level basis (that is, not log-transformed) in Table 8.

7.78 The following tables present the results of these modifications on our baseline models M3, M4 and M7.

7.79 Table 5 shows models including card type explanatory variables (the share of commercial and the share of credit transactions). M9, M10 and M11 are our baseline models M3, M4 and M7 with both the share of commercial transaction and the share of credit transactions included. These changes to the model result in slightly higher estimates, between [✂]% and [✂]%, for the difference in the 2023 and 2017 fee levels for models M9-M11.[67]

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

67 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M9, M10 and M11 respectively in accordance with paragraph 7.59a.

Table 5: Additional models for Mastercard overall fees: Card type

Variable	M9	M10	M11
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	**[✂]**	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
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<0.01, ** p<0.05, *p<0.1.

7.80 Table 6 shows models including separate variables for domestic CNP, EEA CNP and ROW CNP transactions. M12, M13 and M14 are our baseline models M3, M4 and M7 with the domestic CNP, EEA CNP and ROW CNP transactions variables included. These changes to the models result in a slightly higher estimate, between [✂]% and [✂]%, for the change in fee levels between 2017 and 2023.[68]

Table 6: Additional models for Mastercard overall fees: CNP transactions

Variable	M12	M13	M14
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	**[✂]**	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Share of CNP – domestic	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of CNP – EEA cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of CNP – ROW cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of EEA Cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of ROW Cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	**[✂]**	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
[✂]	**[✂]**	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

68 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M12, M13 and M14 respectively in accordance with paragraph 7.59a.

7.81 Table 7 below shows models estimated without weighting data points by transaction value – that is, without giving greater weight to larger acquirers in our dataset. M15, M16 and M17 are our baseline models M3, M4 and M7 without weighting datapoints by transaction value. We estimate a statistically significant increase between [✂]% and [✂]% on an unweighted basis.[69]

Table 7: Additional models for Mastercard overall fees: Unweighted data

Variable	M15	M16	M17
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Share of CNP	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

7.82 Table 8 shows the equivalent models using a dependent variable measured on an absolute-level basis (that is, acquirer fees as a percentage of transaction value). M18, M19 and M20 are our baseline models M3, M4 and M7 using absolute level dependent variables. We estimate a statistically significant increase in fees for 2023 relative to 2017 on this basis in models M18

69 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M15, M16 and M17 respectively in accordance with paragraph 7.59a.

and M19 but not in M20.[70] We are not considering results from our models estimated on an absolute level-basis in our main results for Mastercard for the reasons set out in paragraphs 7.37 to 7.41. We also note that if we were to include variables for [✂], [✂] and [✂] (as we have done so for M8) to our model M20 or alternatively estimate M18 and M19 with outliers excluded, we estimate a statistically significant increase in fees for 2023 relative to 2017.[71]

Table 8: Additional models for Mastercard overall fees: Absolute-level dependent variable

Variable	M18	M19	M20
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Share of CNP	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

70 If we were to assume that fee levels were [✂] for overall fees in 2017, our estimates for models M18 and M19 would suggest an increase of [✂]. This is based on calculated fee increases of [✂] and [✂] for M18 and M19 respectively.

71 If we were to assume that fee levels were [✂] for overall fees in 2017, our estimates for models of M20 with additional variables included or M18 and M19 with outliers and missing data excluded would suggest an increase of [✂]. This is based on calculated fee increases of [✂], [✂] and [✂] for M20 (with additional variables), M19 (without outliers and missing data) and M18 (without outliers and missing data) respectively.

7.83 Across all our model sensitivities for Mastercard's overall fees, we find statistically significant estimated overall fee increases between 2017 and 2023 at the 10% level except for model M20, which we do not consider appropriate to take account of for the reasons set out in paragraphs 7.37 to 7.41.

Mastercard results: mandatory fees only

7.84 Table 9 below shows the results for our modelling of changes in mandatory fees only. We present eight models (M1m-M8m) which are equivalents to models M1-M8 for overall fees. M1m shows the estimated trend in mandatory fees only without controlling for transaction mix or acquirer-specific differences. M2m shows the estimated trend in mandatory fees only before controlling for transaction mix but controlling for acquirer-specific differences. M3m-M8m are our main models for mandatory fees under the same three approaches we have used to model overall fees (that is, controlling for all relevant drivers of acquirer fees, considering reduced models on the basis of statistical significance and accounting for potential outliers), and M3m, M4m and M7m are the baseline models for our sensitivities.

7.85 Just as for overall fees, as set out in paragraph 7.59a, we can derive an estimate for the percentage change in mandatory fees only between 2017 and 2023 from the coefficient estimate for the 2023-year dummy in each Mastercard model.[72] The relevant coefficient estimates are highlighted in bold within our main results and robustness checks.

72 The number reported against 2023 for each model reported in Tables 9-12 can be converted to a percentage increase by taking the exponential and subtracting one. For example, we would estimate a 10% increase for a coefficient of 0.09531 as $10\% = 100(e^{(0.09531)} - 1)$.

Table 9: Results of regression analysis of mandatory fees only for Mastercard

Variable	M1m	M2m	M3m	M4m	M5m	M6m	M7m	M8m
2018	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Share of EEA cross-border	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Share of ROW cross-border	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

7.86 We observe from Table 9 that between 2017 and 2023:

a. We find no statistically significant increase in mandatory acquirer fees in M1m (the first column) before controlling for both transaction mix and acquirer characteristics.

b. We find no statistically significant increase in mandatory acquirer fees in M2m (the second column) before controlling for transaction mix but after controlling for acquirer characteristics.

c. Across models M3m, M4m, M5m, M6m, M7m and M8m (columns 3 to 8), we find a statistically significant increase in mandatory acquirer fees between [✂]% and [✂]% once transaction mix and acquirer characteristics have been accounted for between 2017 and 2021.[73] We also consider it is likely that mandatory fees have not fallen between 2021 and 2023 as we find a statistically significant increase in mandatory fees for all our models except for M7m between 2017 and 2023, and for M7m it appears the lack of statistical significance is likely to be more driven by the imprecision of the estimate rather than the size of the fee increase estimated (as shown in Figure 4 below).

Mastercard's analysis of mandatory fees only

7.87 Mastercard submitted, in its response to our interim report, that it had '…submitted results of its analysis based on the sample of mandatory fees only for the [✂] largest acquirers' and '…found that when estimating the PSR's baseline models on mandatory fees only, the unit revenues [✂]' for the period 2017-2021.[74] Mastercard also responded that the PSR '…dismisses estimating its models on mandatory fees only on the basis of small sample size. While the interpretation of regression results in small samples is a valid concern, we note that during the CAMR, the PSR drew conclusions from models with 70 observations compared with 73 observations in the mandatory-fees-only model. To account for the different number of control variables in each model, we can look at the degrees of freedom. The PSR's model at the CAMR has 49 degrees of freedom, whereas the mandatory-fees-only model has 47 degrees of freedom.'[75,76]

7.88 We still consider that the result of Mastercard's mandatory fees only analysis, based on a limited sample of [✂] largest acquirers (and 47 degrees of freedom), is not reliably accurate, as it is based only on a small sample of acquirers.

7.89 We have now estimated results over a much larger sample of more than [✂] acquirers over a longer period between 2017 and 2023. We have found a consistent statistically significant increase between 2017 and 2021 across all our main models. While we do not observe a statistically significant increase in mandatory fees between 2017 and 2023 in one of our main models (M7m), we also consider it is likely that fees have not fallen between 2021 and 2023 because:

a. As stated in paragraph 7.86c, we find a statistically significant increase in mandatory fees between 2017 and 2023 in all our other main models. We note that in M8m, when additional [✂] explanatory variables are included, in addition to [✂] in M7m to limit the impact of potential outliers, we observe a statistically significant increase in mandatory fees of [✂] between 2017 and 2023.

73 This is based on our fee increase calculations of [✂]% = [✂] ,[✂]% = [✂], [✂]% = [✂], [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M3m, M4m, M5m, M6m, M7m and M8m respectively in accordance with paragraph 7.59(a).

74 Mastercard response to MR22/1.9 (21 May 2024), Annex 1 page 10 paragraph 3.2.

75 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 10, paragraph 3.3.

76 Mastercard response to MR22/1.9 (21 May 2024), Annex 1, page 6, paragraphs 2.9 to 2.11.

b. We find a statistically significant increase in mandatory fees at the 10% level between 2017 and 2023, greater than the increase between 2017 and 2021, in many of the sensitivities we have applied to M7m as a base model.[77]

c. We observe that, even for M7m, as noted in paragraph 7.86c, the lack of statistical significance for cumulative fee changes between 2017 and 2023 appears to be driven more by the imprecision of the estimate than by the size of the mandatory fee increase estimated by the model. As shown in Figure 4 below, the size of the mandatory fee increase estimated by M7m is in fact greater in the years 2022 and 2023 than in 2021, and it is the wider confidence intervals around the estimated cumulative mandatory fee increases (as the bottom of the interval is below 0% in both years) which is driving the fee increases' lack of statistical significance.

Figure 4: 95% confidence intervals for estimated cumulative mandatory fee increases in each year in model M7m (2017-2023)

[✂]

Source: PSR analysis of data provided by Mastercard.

Sensitivities: Mastercard mandatory fees only

7.90 We have tested further modifications to our models of Mastercard's mandatory fees above, with the same sensitivities we have used for overall fees:

a. We looked at including card-type explanatory variables in models M9m-M11m in Table 10. This involved including variables for the share of credit and the share of commercial card transactions.

b. We added variables measuring the share of an acquirer's transaction value attributable to CNP transactions that are also cross-border in models M12m-M14m in Table 11. 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.

c. We estimated our models M15m-M17m without weighting data points by transaction value in Table 12.

d. We estimated our models M18m-M20m using a dependent variable measured on an absolute level basis (that is, not log-transformed) in Table 13.

7.91 The following tables present the results of these modifications on our baseline models M3m, M4m and M7m.

7.92 Table 10 shows our baseline models for mandatory fees only including card type explanatory variables (both the share of commercial and the share of credit transactions). M9m, M10m and M11m are our baseline models M3m, M4m and M7m with both the share of commercial transactions and the share of credit transactions included. We find no statistically significant increase in mandatory fees in any of our models in which card-type variables have been included. However, we do not consider these models are relevant to our overall findings for the reasons set out in paragraph 7.49.

77 These include: M14m, which includes the share of an acquirer's transaction value attributable to CNP transactions that are also cross-border; M17m, which is estimated on unweighted data; and M20m, which is estimated on absolute fee levels (that is, not log-transformed).

Table 10: Additional models for Mastercard mandatory fees only: Card type

Variable	M9m	M10m	M11m
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	**[✂]**	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
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<0.01, ** p<0.05, *p<0.1.

7.93 Table 11 shows our models including separate variables for domestic CNP, EEA CNP and ROW CNP transactions. M12m, M13m and M14m are our baseline models M3m, M4m and M7m with domestic CNP, EEA CNP and ROW CNP transactions variables included. These changes to the models result in a slightly higher estimate, between [✂]% and [✂]%, for the change in mandatory fee levels between 2017 and 2023.[78]

Table 11: Additional models for Mastercard mandatory fees only: CNP transactions

Variable	M12m	M13m	M14m
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	**[✂]**	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Share of CNP – domestic	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of CNP – EEA cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of CNP – ROW cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of EEA Cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of ROW Cross-border	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

78 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M12m, M13m and M14m respectively in accordance with paragraph 7.59a.

7.94 Table 12 below shows models estimated without weighting data points by transaction value – that is, without giving greater weight to larger acquirers in our dataset. M15m, M16m and M17m are our baseline models M3m, M4m and M7m without weighting datapoints by transaction value. We estimate a statistically significant increase in mandatory fees between [✂]% and [✂]% on an unweighted basis.[79]

Table 12: Additional models for Mastercard mandatory fees only: Unweighted data

Variable	M15m	M16m	M17m
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

79 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models M15m, M16m and M17m respectively in accordance with paragraph 7.59a.

7.95 Table 13 shows the models estimated using the dependent variable measured on an absolute-level basis (that is, acquirer fees as a percentage of transaction value). M18m, M19m and M20m are our baseline models M3m, M4m and M7m using absolute level dependent variables.[80] We are not considering results on an absolute-level basis in our main results for the reasons set out in paragraphs 7.37 to 7.41. Even so, we find a statistically significant increase for mandatory fees only between 2018 and 2023 on an absolute-level basis.

Table 13: Additional models for Mastercard mandatory fees only: Absolute-level dependent variable

Variable	M18m	M19m	M20m
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2019	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	**[✂]**
	[✂]	[✂]	**[✂]**
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Share of CNP	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
[✂]	[✂]	**[✂]**	[✂]
	[✂]	**[✂]**	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Mastercard. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

80 If we were to assume that mandatory fee levels were **[✂]** for overall fees in 2017, our estimates for models M18m, M19m, M20m would suggest an increase of [✂]. This is based on calculated fee increases of [✂], [✂] and [✂] for M18m, M19m and M20m respectively.

7.96 Across all our model sensitivities for Mastercard's mandatory fees, we find statistically significant estimated mandatory fee increases for 2021 and 2023 at the 10% level across all models used in our sensitivities except for those which include card type explanatory variables. We do not consider models which include card type explanatory variables are relevant to our findings for the reasons set out in paragraph 7.49.

Visa results: overall fees

7.97 In this section we set out the results for our modelling of overall fees for Visa. We present four versions of the models, V1-V4, with models V3 and V4 comprising our main results.

7.98 V1 shows the estimated trend in fees without controlling for transaction mix or acquirer-specific differences.

7.99 V2 shows the estimated trend in fees before controlling for transaction mix but controlling for acquirer-specific differences.

7.100 V3 and V4 comprise our main models:

a. V3 is the Visa equivalent to Mastercard's model M3.

b. V4 is the Visa equivalent to Mastercard's model M6 which applies a variation of a general-to-specific approach to V3. Only the share of credit transactions is individually significant at the 5% level. So, alongside acquirer effects, only the share of credit transactions is included as an explanatory variable in V4.

7.101 V3 and V4 follow two of the three approaches we have used for Mastercard: V3 controls for all relevant drivers of fees and V4 is a reduced version of V3 after explanatory variables have been removed on the basis of lack of statistical significance. We have considered V4 following Visa's submissions on our selection of explanatory variables as set out in paragraphs 7.108 to 7.111. V3 is our only baseline model but for each of our sensitivities we have also looked at additional models (V6, V8, V10, V12, V14, V16, V18 and V20). The additional sensitivity models exclude explanatory variables from the base model V3 that are not significant at the 5% level.

7.102 As set out in paragraph 7.59(b), we can derive an estimate of the % change in fees between 2019 and 2023 from the coefficient estimate for the 2023-year dummy in each Visa model.[81] The relevant coefficient estimates are highlighted in bold within our main results and robustness checks.

81 The number reported against 2023 for each model reported in Tables 14 and 17-20 can be converted to a percentage increase by taking the exponential and subtracting one. For example, we would estimate a 10% increase for a coefficient of 0.09531 as 10% = $100(e^{(0.09531)} - 1)$.

Table 14: Results of regression analysis of overall fees for Visa

Variable	V1	V2	V3	V4
2018	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – ROW	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Acquirer Fixed Effects	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

7.103 We observe from Table 14 above that between 2019 and 2023:

- We find a statistically significant increase in acquirer fees of [✂]% in V1 (the first column) before controlling for transaction mix and acquirer characteristics.[82]
- We find a statistically significant increase in acquirer fees of [✂]% in V2 (the second column) before controlling for transaction mix but after controlling for acquirer characteristics.[83]
- Across V3 and V4 (columns 3 and 4) the coefficient estimates for the 2023-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 [✂]% and [✂]% between 2019 and 2023.[84]

7.104 None of our main models estimate a statistically significant increase between 2018 and 2019.

82 This is based on our fee increase calculation of [✂]% = [✂] for model V1 in accordance with paragraph 7.59b.

83 This is based on our fee increase calculation of [✂]% = [✂] for model V2 in accordance with paragraph 7.59b.

84 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V3 and V4 respectively in accordance with paragraph 7.59(b).

Visa's comments on PSR analysis of overall fees

7.105 In response to our previous analyses (the interim report and Econometrics CWP), Visa submitted that our models do not control for the take-up of optional services, may 'overfit' the data as they include irrelevant or only marginally relevant variables, did not account for changes in service quality, and that our results were not reconciled or consistent with commercial reality.[85] We deal with these points in the following paragraphs.

Optional services

7.106 Visa stated that '[t]he inclusion of optional fees is not appropriate as they are charged by Visa for new and innovative services, many of which were introduced part-way through the period under review. Because the [interim report]'s regressions do not control for the value of these new, optional services, this creates an upwards bias in the [interim report's] estimates of Visa fee changes.'[86]

7.107 As stated in paragraph 7.3, we acknowledge that our analysis does not account for changes in the take-up of optional services. However, we have also looked at the increase in mandatory fees only in paragraphs 7.127 to 7.141 and estimated fee increases of [✂]%-[✂]% between 2019 and 2023 in our main results (as set out in Table 23).

Overfitting

7.108 Visa responded that the main models used in our interim report, V3i-V6i[87], suffer from misspecification issues as they '…do… not properly reflect the factors driving the dependent variable of interest'[88] because '[f]or example, inclusion of irrelevant (or marginally relevant) explanatory variables can lead to the problem of overfitting'.[89] Visa also commented on these and other models we presented in the interim report (as set out in Table 15 below). Visa noted '[t]here is no structural rationale for the inclusion of certain additional control variables in [V3i-V6i] namely the share of [✂],[90] [✂]. Visa's acquirer fees have [✂]. As such, the [✂] of an acquirer's transactions in a year are not structural drivers of gross fees paid as a proportion of transaction value.[91] All of the remaining additional control variables have little – if any – explanatory power, and could confound the results of the analysis.[92] As such, there are good reasons to doubt whether these additional controls included in [V3i-V6i] are appropriate for the IR's modelling. Overall, this indicates that the IR should, at a minimum, place more weight than it does on specification [V2i].'[93]

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85 Visa response to MR22/1.9 (21 May 2024), Technical Annex 2.

86 Visa response to MR22/1.9 (21 May 2024), page 20, paragraph 2.17.

87 Note: Visa refers to these models as 'V3-V6'.

88 Visa response to MR22/1.9 (21 May 2024), page 19, paragraph 2.15.

89 Visa response to MR22/1.9 (21 May 2024), page 19, paragraph 2.15.

90 Visa also stated that '[t]he share of [✂] is only a driver of scheme and processing fees for issuers, not acquirers'. Visa response to MR22/1.9 (21 May 2024), [✂].

91 Visa also stated it had [✂]. Visa response to MR22/1.9 (21 May 2024), page 20, paragraph 2.16, footnote 86.

92 Visa stated '[s]ome of these controls show very limited within-acquirer variation between 2019 and 2022 and therefore provide little (if any) further explanatory power above and beyond the acquirer dummy variables. This is especially the case where large acquirers (e.g. [✂]) show little variation as the IR's main models are weighted by acquirer transaction value. Similarly, the [✂] is highly correlated with the share of [✂] transactions when weighted by transaction value (correlation coefficient of [✂]).' Visa also told us that '[n]one of these controls were individually statistically significant' in the models V3[i]-V6[i] [of our interim report] 'except for the share of credit transactions in V6[i] which is only significant at the [✂]% level'. Visa response to MR22/1.9 (21 May 2024), page 20, paragraph 2.16, footnote 87.

93 Visa response to MR22/1.9 (21 May 2024), page 20, paragraph 2.16.

Table 15: PSR results of regression analysis of overall fees for Visa (as presented in the interim report)

Variable	V1i	V2i	V3i	V4i	V5i	V6i
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.

7.109 Visa also noted estimating the equivalent model to V2i on mandatory fees only '…leads to significantly lower estimates of increases in Visa acquirer fees. [Table 16] below shows the [interim report]'s V2, which regresses the log of gross fees paid by acquirers as a proportion of transaction value on dummy variables for each financial year and controls for acquirer-specific differences. The [interim report]'s V2 specification – which excludes potentially problematic control variables – indicates that Visa's acquirer fees have increased by [✂]% between 2019 and 2022 and estimates an even lower increase of [✂]% when focusing on mandatory fees. These findings are significantly lower than the [✂]%-[✂]% increase relied on by the [interim report] based on the [V3i-V6i] "main models".'[94]

94 Visa response to MR22/1.9 (21 May 2024), page 20, paragraph 2.18.

Table 16: Regression results submitted by Visa 'adjusting for selected errors' in the PSR's interim report analysis

Variable	Excluding potentially problematic control variables*	Excluding potentially problematic control variables and analysing mandatory fees only
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
Acquirer Fixed Effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: Visa analysis of Visa data submitted to the PSR.
Note: Results are per the 'V2' specification present in MR22/1.9 (21 May 2024), Annex 7 Table 13.

7.110 We have now removed the share of commercial card transactions, [✂] and [✂] from all models used in our main results and added V4. V4 comprises all explanatory variables included in V3 but removes variables following a general-to-specific approach using individual statistical significance at the 5% level. We consider our approach, which accounts for a range of estimates for models V3 and V4, appropriately balances controlling for all relevant drivers of acquirer fees and considering reduced models given potential statistical inference concerns when all relevant drivers are included (partly due to sample size). Nevertheless, we also note that the estimated fee increase in V2 ([✂]%) in Table 14, the equivalent model to V2i in our interim report, is within the range of our main results ([✂]% to [✂]%).

7.111 We have also now estimated the fee increase in V2 for overall fees in Table 14 (above) and in V2m in Table 23 (below) for mandatory fees only over the period from 2019 and 2023. In each case we estimate statistically significant fee increases ([✂]% and [✂]%) within the ranges of our main results for overall fees (i.e. V3 and V4) and mandatory fees only (that is, V3m) respectively.

Service quality

7.112 Visa submitted that the PSR's results '…present an incomplete picture and overstate the extent of fee increases as they do not account for increase in service quality over time… Visa invests significant amounts to continuously improve existing services and innovates to develop new services and functionalities, for the benefit of all end users including UK merchants.'[95]

95 Visa response to MR22/1.9 (21 May 2024), page 21, paragraph 2.19.

7.113 We do not consider it appropriate to include service quality in our econometric analysis as we have not specifically requested data from Visa that reports service quality improvement for each acquirer to use in our econometric analysis. But we note that Visa did not include such data within their response to our Interim Report. As such, we judge it is more appropriate to consider service quality improvements separately as we have done in paragraphs 6.138 to 6.190 of Chapter 6.

Reconciliation and consistency with commercial reality

7.114 Visa submitted to us '[t]he PSR's results cannot be reconciled with actual changes in Visa fees, indicating there are significant flaws in the PSR's underlying assumptions.'[96] Visa explained that [✂].[97] Visa also highlighted [✂].[98]

7.115 Visa also responded that '…[t]he PSR's modelling approach is not consistent with the commercial reality of Visa's pricing and revenue generation …as its 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'.[99]

7.116 We consider that our model estimates are sufficiently robust to estimate cumulative fee increases over a multi-year period for the following reasons: 1) we now estimate consistent statistically significant cumulative increases in overall fees in [✂] for V3 and [✂] for V4 at the 1% level; 2) it is entirely consistent that our models identify larger cumulative increases in fees, between 2019 and 2023, but not smaller cumulative increases in fees over shorter periods as statistically significant, as the scale of a cumulative increase is a key determinant of its statistical significance.

7.117 We do not consider further disaggregated analysis is required for the following reasons. First, as shown in Table 22, we estimate a [✂]% to [✂]% increase in mandatory fees between 2019 and 2023, which is only slightly different from our main results for overall fees. Second, as stated in paragraph 7.38, we have only applied our econometric analysis to gross fees because it was not possible to capture client incentive data [✂].[100] We consider this will not affect our analysis in a material way as we found that [✂]. 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.

96 Visa response to PSR working paper dated 13 December 2023 [✂].
97 Ibid.
98 Ibid.
99 Visa response to PSR working paper dated 13 December 2023 [✂].
100 This was [✂].

Sensitivities: Visa overall fees

7.118 We have tested further modifications to our baseline models V3 and V4 above. In particular:

a. We have looked at models which include only one of the [✂] or [✂] variables in V5-V8 in Table 17.

b. We looked at including card-type explanatory variables in models V9-V10 in Table 18. This involved including a variable for the share of commercial card transactions.

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 in models V11-V14 in Table 19. This would allow for the possibility that there is:

- An additional premium 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.
- An additional premium paid on CNP credit transactions relative to CNP debit transactions.

d. We estimated our models V15 and V16 on an unweighted basis in Table 20.

e. We estimated our models V17 and V18 using a dependent variable measured on an absolute level basis (that is, not log-transformed) in Table 21.

f. We estimated our models V19 and V20 using 2018 as the base year instead of 2019 in Table 22.

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

7.120 Table 17 shows the baseline models including one of either the [✂] or [✂] explanatory variable: V5 is our baseline model V3 with [✂] included and V7 is our baseline model V3 with [✂]. V6 and V8 exclude explanatory variables from V5 and V7 that are not significant at the 5% level respectively. These changes to our models result in slightly higher estimates, between [✂]% and [✂]%, for the difference in the 2023 and 2019 fee levels (that is, the estimated model parameter for 2023).[101] (Our results did not find a statistically significant change in overall fees between 2018 and 2019.)

Table 17: Additional models for Visa: [✂]

Variable	V5	V6	V7	V8
2018	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – ROW	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Acquired fixed effects	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

101 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models V5, V6, V7 and V8 respectively in accordance with paragraph 7.59b.

7.121 Table 18 shows models including the 'share of commercial' explanatory variable. V9 is our baseline model V3 with the 'share of commercial' variable included. V10 excludes explanatory variables from V9 that are not significant at the 5% level. These changes to the model result in a slightly higher estimate, between [✂]% and [✂]%, for the increase in fee levels between 2019 and 2023.[102] (Our results did not find a statistically significant change in overall fees between 2018 and 2019.)

Table 18: Additional models for Visa: Card Type

Variable	V9	V10
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
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<0.01, ** p<0.05, *p<0.1

102 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V9 and V10 respectively in accordance with paragraph 7.59b.

7.122 Table 19 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. V11 is our baseline model V3 with credit or debit CNP transactions included. V13 is our baseline model V3 with domestic or cross-border CNP transaction variables included. V12 and V14 excludes explanatory variables from V11 and V13 that are not significant at the 5% level respectively. We estimate a similar level of increases in average fees to acquirers, ranging from [✂]% to [✂]%, between 2019 and 2023 on this basis.[103] (Our results did not find a statistically significant change in overall fees between 2018 and 2019.)

Table 19: Additional models for Visa: CNP Transactions

Variable	V11	V12	V13	V14
2018	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – domestic	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – EEA cross-border	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – ROW cross-border	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – Debit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – ROW	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

103 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models V11, V12, V13 and V14 respectively in accordance with paragraph 7.59b.

7.123 Table 20 below shows models estimated without weighting data points by transaction value – that is, without giving greater weight to larger acquirers in our dataset. V15 is our baseline model V3 estimated on an unweighted basis. V16 excludes explanatory variables from V15 that are not significant at the 5% level. We estimate a slightly higher statistically significant increase in fees for 2023 relative to 2019 of between [✂]% and [✂]% in models V15 and V16 on this basis.[104] (Our results did not find a statistically significant change in overall fees between 2018 and 2019.)

Table 20: Additional models for Visa: Unweighted data

Variable	V15	V16
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
Share of Credit	[✂]	[✂]
	[✂]	[✂]
Share of CNP	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]
	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

104 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V15 and V16 respectively in accordance with paragraph 7.59b.

7.124 Table 21 shows the models estimated using the dependent variable measured on an absolute-level basis (i.e., acquirer fees as a percentage of transaction value). V17 is our baseline model V3 estimated on an absolute-level basis. V18 excludes explanatory variables from V17 that are not significant at the 5% level.[105] We are not considering results on an absolute-level basis in our main results for the reasons set out in paragraphs 7.37 to 7.41. Even so, we do estimate a statistically significant increase in 2023 relative to 2019 on an absolute-level basis. (Our results did not find a statistically significant change in overall fees between 2018 and 2019.)

Table 21: Additional models for Visa: Absolute-level dependent variable

Variable	V17	V18
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
Share of Credit	[✂]	[✂]
	[✂]	[✂]
Share of CNP	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]
	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

105 If we were to assume that fee levels were [✂] for overall fees in 2019, our estimates for models V17 and V18 would suggest an increase of [✂]. This is based on calculated fee increases of [✂] and [✂] for V17 and V18 respectively.

7.125 Table 22 shows the models estimated using 2018 as the base year to estimate the fee increase over the period from 2018 to 2023. V19 is our baseline model V3 estimated using 2018 as the base year. V20 excludes explanatory variables from V19 that are not significant at the 5% level. As discussed in paragraph 7.59(b), 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 [✂]% and [✂]% between 2018 to 2023 when 2018 is used as the base year.[106]

Table 22: Additional models for Visa: Models calculated using the 2018 base year

Variable	V19	V20
2019	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
Share of Credit	[✂]	[✂]
	[✂]	[✂]
Share of CNP	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]
	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

7.126 Across all our model sensitivities for Visa's overall fees, we find statistically significant estimated overall fee increases, either between 2019 and 2023, or between 2018 and 2023 for models V19 and V20 in Table 22, at the 10% level.

Visa Results: mandatory fees only

7.127 Table 23 below shows the results for our modelling of mandatory fees only for Visa. We present three models (V1m to V3m) which are equivalents to models V1 to V3 for overall fees. V1m shows the estimated trend in mandatory fees only, without controlling for transaction mix or acquirer-specific differences. V2m shows the estimated trend in mandatory fees only, before controlling for transaction mix but controlling for acquirer-

106 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V19 and V20 respectively in accordance with paragraph 7.59b.

specific differences. V3m, which controls for all relevant drivers of acquirer fees, and V2m are the models used in our main results for mandatory fees under the same two approaches we have used to model overall fees (as set out in paragraph 7.101).

7.128 We have not included a fourth model in our main results for mandatory fees only and instead include model V2m because it represents an equivalent model to V4: we would obtain the same model as V2m if we were to exclude explanatory variables from model V3m based on statistical significance. As such, V3m is our only baseline model.

7.129 As set out in paragraph 7.59(b), just as for overall fees, we can derive an estimate for the percentage change in mandatory fees only between 2019 and 2023 from the coefficient estimate for the 2023-year dummy in each Visa model.[107] The relevant coefficient estimates are highlighted in bold within our main results and robustness checks.

Table 23: Results of regression analysis of mandatory fees only for Visa

Variable	V1m	V2m	V3m
2018	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Share of Cross-border – ROW	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
Acquirer Fixed Effects	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

107 The number reported against 2023 for each model reported in Tables 23-27 can be converted to a percentage increase by taking the exponential and subtracting one. For example, we would estimate a 10% increase for a coefficient of 0.09531 as 10% = $100(e^{(0.09531)} - 1)$.

7.130 We observe from Table 23 that between 2019 and 2023:

- we find a statistically significant increase in acquirer fees of [✂]% in V1m (the first column) before controlling for transaction mix and acquirer characteristics[108]
- we find a statistically significant increase in acquirer fees of [✂]% in V2m (the second column) before controlling for transaction mix but after controlling for acquirer characteristics[109]
- we find a statistically significant increase in acquirer fees of [✂]% in V3m (the third column) between 2019 and 2023, and the coefficient estimate for the 2022-year dummy is also positive and statistically significant[110]

7.131 None of our main models estimate a statistically significant increase between 2018 and 2019.

7.132 Visa has not made any submissions specifically on our analysis of mandatory fees only.

Sensitivities: Visa Mandatory fees only

7.133 We have tested further modifications to our baseline models (V3m and the V3m base model sensitivity with explanatory variables that are not significant at the 5% level excluded). In particular:

a. We have looked at models which include only one of the [✂] or [✂] variables in V4m to V7m in Table 24.

b. We looked at including card-type explanatory variables in models V8m and V9m in Table 25. This involved including a variable for the share of commercial card transactions.

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 in models V10m-V13m, in Table 26. This would allow for the possibility that there is:

- An additional premium 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.
- An additional premium paid on CNP credit transactions relative to CNP debit transactions.

d. We estimated our models V14m and V15m on an unweighted basis in Table 27.

e. We estimated our models V16m and V17m using a dependent variable measured on an absolute level basis (that is, not log-transformed) in Table 28.

f. We estimated our models V18m and V19m using 2018 as the base year instead of 2019 in Table 29.

7.134 V3m is our only baseline model, but for each of our sensitivities we have also looked at additional models which exclude explanatory variables based on statistical significance (that is, in our sensitivity analysis we exclude explanatory variables from the V3m base model that are not significant at the 5% level).

108 This is based on our fee increase calculation of [✂]% = [✂] for model V1m in accordance with paragraph 7.59b.
109 This is based on our fee increase calculation of [✂]% = [✂] for model V2m in accordance with paragraph 7.59b.
110 This is based on our fee increase calculation of [✂]% = [✂] for model V3m in accordance with paragraph 7.59b.

7.135 Table 24 shows our baseline sensitivities for mandatory fees only, including one of either the [✂] or [✂] explanatory variable. V4m is our baseline model V3m with [✂] included and V6m is our baseline model V3m with [✂]. V5m and V7m exclude explanatory variables from V4m and V6m that are not significant at the 5% level respectively. These changes to our models result in slightly higher estimates, between [✂]% and [✂]%, for the difference in the 2023 and 2019 fee levels (that is, the estimated model parameter for 2023).[111] Our results did not find a statistically significant change in mandatory fees between 2018 and 2019.

Table 24: Additional models for Visa: [✂]

Variable	V4m	V5m	V6m	V7m
2018	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
[✂]	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

111 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models V4m, V5m, V6m and V7m respectively in accordance with paragraph 7.59b.

7.136 Table 25 shows models including 'the share of commercial' explanatory variable. V8m is our baseline model V3m with 'the share of commercial' included. V9m excludes explanatory variables from V8m that are not significant at the 5% level. These changes to the model result in a slightly lower estimate, between [✂]% and [✂]%, for the increase in mandatory fee levels between 2019 and 2023.[112] Our results did not find a statistically significant change in mandatory fees between 2018 and 2019.

Table 25: Additional models for Visa mandatory fees only: Card Type

Variable	V8m	V9m
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
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<0.01, ** p<0.05, *p<0.1

112 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V8m and V9m respectively in accordance with paragraph 7.59(b).

7.137 Table 26 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. V10m is our baseline model V3m with credit or debit CNP transactions included. V11m is our baseline model V3m with domestic or cross-border CNP transaction variables included. V12m and V13m excludes explanatory variables from V10m and V11m that are not significant at the 5% level respectively. We estimate a wider but similar range of increases in average mandatory fees to acquirers, ranging from [✂]% to [✂]%, between 2019 and 2023 on this basis.[113] (Our results did not find a statistically significant change in mandatory fees between 2018 and 2019.)

Table 26: Additional models for Visa mandatory fees only: CNP Transactions

Variable	V10m	V11m	V12m	V13m
2018	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2020	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2021	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2022	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
2023	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – domestic	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – EEA cross-border	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – ROW cross-border	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – Credit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of CNP – Debit	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]	[✂]	[✂]
N	[✂]	[✂]	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

113 This is based on our fee increase calculations of [✂]% = [✂], [✂]% = [✂], [✂]% = [✂] and [✂]% = [✂] for models V10m, V11m, V12m and V13m respectively in accordance with paragraph 7.59(b).

7.138 Table 27 below shows models estimated without weighting data points by transaction value – that is, without giving greater weight to larger acquirers in our dataset. V14m is our baseline model V3m on an unweighted basis. V15m excludes explanatory variables from V14m that are not significant at the 5% level. We estimate higher statistically significant increases in mandatory fees for 2023 relative to 2019 of between [✂]% and [✂]% in models V14m and V15m on this basis.[114] (Our results did not find a statistically significant change in mandatory fees between 2018 and 2019.)

Table 27: Additional models for Visa mandatory fees only: Unweighted data

Variable	V14m	V15m
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
Share of Credit	[✂]	[✂]
	[✂]	[✂]
Share of CNP	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]
	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1

114 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V14m and V15m respectively in accordance with paragraph 7.59(b).

7.139 Table 28 shows the models estimated using the dependent variable measured on an absolute-level basis (that is, acquirer fees as a percentage of transaction value). V16m is our baseline model V3m on an absolute-level basis. V17m excludes explanatory variables from V16m that are not significant at the 5% level.[115] We are not considering results on an absolute-level basis in our main results for the reasons set out in paragraphs 7.37 to 7.41. Even so, we do estimate a statistically significant increase in mandatory fees in 2023 relative to 2019 on an absolute-level basis. (Our results did not find a statistically significant change in mandatory fees between 2018 and 2019.)

Table 28: Additional models for Visa mandatory fees only: Absolute-level dependent variable

Variable	V16m	V17m
2018	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
Share of Credit	[✂]	[✂]
	[✂]	[✂]
Share of CNP	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]
	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

115 If we were to assume that fee levels were [✂] for mandatory fees in 2019, our estimates for models V16m and V17m would suggest an increase of [✂]. This is based on calculated fee increases of [✂] and [✂] respectively for V16m and V17m.

7.140 Table 29 shows the models estimated using 2018 as the base year to estimate the mandatory fee increase over the period from 2018 to 2023. V18m is our baseline model V3m estimated using 2018 as the base year. V19m excludes explanatory variables from V18m that are not significant at the 5% level. As discussed in paragraph 7.59b, 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 [✂]% and [✂]% between 2018 to 2023 when 2018 is used as the base year. [116,117]

Table 29: Additional mandatory fees only models for Visa: Models calculated using the 2018 base year

Variable	V18m	V19m
2019	[✂]	[✂]
	[✂]	[✂]
2020	[✂]	[✂]
	[✂]	[✂]
2021	[✂]	[✂]
	[✂]	[✂]
2022	[✂]	[✂]
	[✂]	[✂]
2023	[✂]	[✂]
	[✂]	[✂]
Share of Credit	[✂]	[✂]
	[✂]	[✂]
Share of CNP	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – EEA	[✂]	[✂]
	[✂]	[✂]
Share of Cross-border – RoW	[✂]	[✂]
	[✂]	[✂]
Acquirer fixed effects	[✂]	[✂]
N	[✂]	[✂]
Adjusted R-squared	[✂]	[✂]

Source: PSR analysis of data provided by Visa. Standard errors reported in parentheses, ***p<0.01, ** p<0.05, *p<0.1.

7.141 Across all our model sensitivities for Visa's mandatory fees, we find statistically significant estimated mandatory fee increases, either between 2019 and 2023, or between 2018 and 2023 for models V19 and V20 in Table 22, at the 10% level.

116 However, we also note that in further sensitivities which use 2018 as the base year, such as our baseline models estimated on an unweighted basis, we no longer estimate a statistically significant increase in fees.

117 This is based on our fee increase calculations of [✂]% = [✂] and [✂]% = [✂] for models V18m and V19m respectively in accordance with paragraph 7.59b.

Summary of results

7.142 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 2017-2023 and 2018-2023 respectively.

7.143 By using regression analysis to control for the main transaction characteristics affecting Mastercard's and Visa's acquirer fee revenues, we find that:

a. Across our main results for overall fees,[118] average acquirer gross fee revenues (expressed as a share of transaction value) increased by around ([✂]% to [✂]%) for Mastercard between 2017 and 2023. However, given that services described by Mastercard as optional account for [✂]% to [✂]% of Mastercard's total annual acquirer gross fee revenues and this share has been rising over time, 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, so we have also looked at the increase in mandatory fees only. When estimating the main results of our regression analysis on mandatory acquirer gross fee revenues only[119], we estimate a slightly lower increase in mandatory acquirer gross fee revenues (expressed as a share of transaction value) of [✂]% to [✂]% between 2017 and 2021,[120] and find no evidence that fees have fallen between 2021 and 2023.

b. Across our main results for overall fees[121], average acquirer gross fee revenues (as a share of transaction value) increased by around [✂]% to [✂]% for Visa between 2019 and 2023 (with no significant change between 2018 and 2019). When estimating the main results of our regression analysis on mandatory acquirer gross fee revenues only[122], we estimate a similar increase in acquirer gross fee revenues (expressed as a share of transaction value), of [✂]% to [✂]% between 2019 and 2023.

118 Models M3 to M8 in Table 4.
119 Models M3m to M8m in Table 9.
120 That is [✂] than the [✂] estimated for the sum of mandatory and optional fees.
121 Models V3 and V4 in Table 14.
122 Models V2m and V3m in Table 23.

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