

Market review into the supply  
of card-acquiring services:  
Final report

## **Annex 2**

### Pass-through analysis

November 2021

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

# Introduction

- 1.1** This annex describes the analysis we conducted on whether acquirers passed through the cost savings they made from the Interchange Fee Regulation (IFR) caps ('IFR savings') to merchants between 2014 and 2018. The main findings of this analysis are set out in Chapter 5 of the final report. Like the annex attached to the interim report, this document provides further details on the methodology, data, and sensitivity analysis conducted to test the robustness of the findings. In addition, this annex summarises the main stakeholder submissions on the pass-through analysis presented in our interim report, and our response to these submissions. This annex supplements Chapter 5 of the final report but can be read as a standalone document. It is aimed at a reader who wants to understand the technical detail of our analysis.
- 1.2** Pass-through measures the change in the price of a good or service in response to a change in input costs of this good or service. In a competitive market, in the long run, changes in input costs will be fully reflected in the output price. So, by studying the extent of pass-through, we can learn something about the competitive conditions in a market. For example, limited or slow pass-through can indicate that competition is weak unless there are other factors affecting price at the same time.<sup>1</sup>
- 1.3** The degree of pass-through in a market can be measured in different ways depending on the question being investigated. The degree of long-term pass-through can be measured by focusing on the relationship between changes in an input cost and the price of a good or service over an extended period of time (for example, years). Alternatively, it is possible to examine the degree of pass-through of a specific event such as whether a significant one-off reduction in an input cost is reflected in the price of a good or service in the periods following the cost reduction.
- 1.4** In this annex we present estimates of the long-term pass-through of changes in the interchange fee and the merchant service charge (MSC) over the period 2014 to 2018 (what we call 'general pass-through'), as well as estimates of the extent to which the significant input cost reduction associated with the IFR was passed through to merchants in the form of lower MSCs from January 2016 onwards (what we call 'IFR pass-through'). For the reasons set out below we think the IFR pass-through analysis provides us with better insights into the intensity of competition in the supply of card-acquiring services than the general pass-through rate. The IFR involved a substantial, market-wide one-off reduction in the interchange fee, and as such provides a useful natural experiment of how acquirers responded to such a change, and whether they felt under competitive pressure to pass on the significant IFR savings into lower prices for merchants.

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<sup>1</sup> The degree of long-term pass-through depends on several demand and supply factors. For more information see RBB Economics, *Cost pass-through: theory, measurement, and potential policy implications* (February 2014).

**1.5** In the context of our market review, we look at the relationship between the MSC and one of its input costs, interchange fees. As explained in Chapter 2 of the interim report, the MSC is the total amount that merchants served by acquirers pay for card-acquiring services. It comprises:

- interchange fees, which the acquirer pays to the issuer
- scheme fees, which the acquirer pays to the operator of the card payment system (see Annex 4 for more on scheme fees)<sup>2</sup>
- acquirer net revenue, to cover the other costs of providing card-acquiring services (such as regulatory, staff and technology costs) plus the acquirer's margin

**1.6** Specifically, we look at whether acquirers passed through IFR savings to merchants in the form of lower MSCs (IFR pass-through). As explained in Annex 1, the IFR capped interchange fees on consumer debit and credit card transactions where the acquirer and issuer are in the European Economic Area (EEA) ('capped transactions'). The IFR caps came into force on 9 December 2015 and aimed to reduce the costs of card payments for merchants and consumers, and help create an integrated and competitive market for payment services.

**1.7** The IFR did not cap the MSCs paid by merchants. Instead, the IFR relied on competition between acquirers to ensure that the IFR savings were passed through to merchants. The extent to which these IFR savings were passed through (IFR pass-through) is an indicator of the strength of competition in the supply of card-acquiring services: acquirers can hold on to savings if they don't feel under pressure to keep their prices down. We used the introduction of the IFR caps as an indicator for how well the supply of card-acquiring services is working.

**1.8** Using data obtained from the five largest<sup>3</sup> acquirers covering the period 2014 to 2018, we investigated whether:

- these five acquirers made savings following the IFR caps coming into force
- where acquirers did make IFR savings, they passed these through to merchants in the form of lower MSCs in the period after December 2015 (that is, the extent of IFR pass-through)
- the IFR pass-through rate varied between merchants in different groups defined by annual card turnover (our grouping follows the segmentation introduced in Chapter 4 of the final report, but with additional detail to allow us to examine any differences between levels of annual card turnover – see paragraph 1.27 to 1.32 of this annex)

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2 We use the term 'scheme fees' to refer to all fees acquirers pay to operators of card payment systems including fees for scheme services and fees for processing services.

3 The five largest acquirers accounted for nearly 90% of transactions by number and value at UK merchants in 2018. See Annex 1 for a description of the five largest acquirers.

**1.9** We also considered the possibility that acquirers may compete more intensively for new customers<sup>4</sup> by charging them lower prices, while charging existing customers higher prices. We also consider the possibility that the difference between the prices charged to new and longstanding customers may have widened after the IFR caps came into force. We investigate whether:

- acquirers' new customers pay less than longstanding customers (see paragraph 1.22 of this annex)
- merchants who signed up with an acquirer after the IFR caps came into force pay less than those who joined before

**1.10** The rest of this annex:

- details our methodology and explains how we responded to feedback from the stakeholders who participated in the confidentiality ring
- describes the data and sampling process
- presents descriptive statistics
- presents the econometric analysis
- summarises the results
- sets out, and responds to, stakeholder feedback on our interim report
- presents additional tables for reference

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4 New customers could include merchants that switched from other acquirers, as well as those who are new to accepting card payments.

# Methodology

**1.11** We consulted on our proposed approach to the pass-through analysis in February 2019. Since then, our approach has evolved, in response to our statistical findings and also to take account of responses to the interim report.<sup>5</sup>

## Baseline model

**1.12** In order to understand whether, where acquirers made IFR savings, they passed these through to merchants (the IFR pass-through rate), it is important to understand the general relationship between the MSC and its components:

- If interchange fees fall following IFR caps coming into force, and acquirers pass these savings through to merchants, we would expect to see the MSC falling in line with interchange fees.
- This picture will be complicated if scheme fees simultaneously increased and acquirers also passed these increases on to merchants, causing MSCs to rise.
- If cost decreases and increases are being fully reflected in the MSC (and there is no change in acquirers' other costs), acquirer net revenue will remain flat.

**1.13** It follows that there are several ways to analyse the question of whether acquirers passed through IFR savings to merchants:

- 1. Merchant service charge (MSC) (as a percentage of monthly card turnover) as the dependent variable:** We can examine whether MSC fell in line with interchange fees following the IFR caps coming into force. In this model, we need to control for other factors that may affect the MSC. Table 1 below summarises these factors.
- 2. Interchange fee margin as the dependent variable:** We define the interchange fee margin as MSC minus interchange fees. The remainder is the component of the MSC that is not related to interchange fees, including scheme fees. If acquirers are passing IFR savings through to merchants, we would expect to see the interchange fee margin remaining flat. In this model, we need to control for other variables that may affect the interchange fee margin, including scheme fees.
- 3. Acquirer net revenue as the dependent variable:** We can examine whether acquirer net revenue, defined as MSC minus interchange fees minus scheme fees, remained flat. In this model, we need to control for other variables that may impact acquirer net revenue.

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<sup>5</sup> PSR, *Market review into the supply of card-acquiring services: Pass-through methodology consultation* (2019).

**1.14** The three approaches are nested. Mathematically, the three models can be described as:

$$MSC_{it} = \alpha_i + \beta_1 IFR_t + \beta_2 IF_{it} + \beta_3 SF_{it} + \sum_k \gamma_k x_{kit} + \varepsilon_{it} \quad (1)$$

$$MSC_{it} - IF_{it} = \alpha_i + \beta_1 IFR_t + \beta_3 SF_{it} + \sum_k \gamma_k x_{kit} + \varepsilon_{it} \quad (2)$$

$$MSC_{it} - IF_{it} - SF_{it} = \alpha_i + \beta_1 IFR_t + \sum_k \gamma_k x_{kit} + \varepsilon_{it} \quad (3)$$

where

- $MSC_{it}$  is the MSC (as a percentage of monthly card turnover) for merchant  $i$  in month  $t$
- $IF_{it}$  are interchange fees (as a percentage of monthly card turnover) for merchant  $i$  in month  $t$
- $SF_{it}$  are scheme fees (as a percentage of monthly card turnover) for merchant  $i$  in month  $t$
- $\alpha_i$  capture merchant-specific time-invariant characteristics ('fixed effects')
- $IFR_t$  is a dummy variable, which is equal to 1 in the months after the IFR caps came into force on 9<sup>th</sup> December 2015, and 0 before
- $x_{kit}$  is a matrix of control variables; these are outlined in Table 1
- $\varepsilon_{it}$  is an error term which captures random noise

**1.15** Moving from model (1) to model (2) imposes the restriction that the coefficient on interchange fees is equal to one. This would hold under full general pass-through of interchange fees except the one-off IFR reduction. Moving from model (2) to model (3) imposes the additional restriction that the coefficient on scheme fees is equal to one. This would hold under full general pass-through of interchange and scheme fees except the one-off IFR reduction.

**1.16** Because we are using the IFR caps coming into force to investigate pass-through, we focus on model (2) with interchange fee margin as the dependent variable (the baseline model). This specification puts the focus directly on the impact of the IFR caps and the variable of interest, namely the gap between MSC and interchange fees. However, we also conduct analysis using acquirer net revenue – model (3) – and MSC itself – model (1) – as dependent variables to test alternative approaches. Model 1 is an important check on the assumption made in model 2 about general pass-through of interchange fees other than the one-off IFR reduction.

**1.17** We estimate all models using a fixed effects panel model.<sup>6</sup>

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<sup>6</sup> In our consultation on our proposed approach to the pass-through analysis, we suggested using a difference-in-difference model, where we compare merchants on standard and IC++ pricing before and after the IFR caps came into force. We focus on the reduced form model presented in paragraph 1.13. We enhance the reduced form model with a dummy variable which equals 1 after the IFR caps came into force and 0 otherwise. We then assess the impact of the IFR caps based on the coefficient on this dummy variable.

**Table 1: Other factors that may impact MSC as a percentage of monthly card turnover (control variables)**

<b>Control variable</b>	<b>How this impacts MSC as a percentage of monthly card turnover</b>
<b>Scheme fees</b>	Scheme fees are a component of the MSC. If increases in scheme fees are passed through in full, this will lead to increases in MSC.
<b>Value of transactions</b>	The effect of an increase in the value of transactions on MSC (as a percentage of the monthly card turnover) depends on the structure of pricing. If, for example, the merchant pays an ad valorem fee for card-acquiring services, MSC would remain unchanged as a percentage of monthly card turnover. If there are economies of scale – for example, if higher total transaction value is associated with a lower per transaction fee – MSC as a percentage of monthly card turnover could decrease as the total value of transactions increases. And vice versa, if there were diseconomies of scale.
<b>Volume of transactions</b>	As with value of transactions (see above), the effect of an increase in the volume of transactions (that is, an increase in the number of card transactions) on MSC as a percentage of monthly card turnover depends on the structure of pricing.
<b>Share of capped credit and debit card transactions</b>	Capped credit and debit card transactions incur lower interchange fees than other transactions. Share of capped credit and debit card transactions may affect the relationship between the MSC and the interchange fees.
<b>Share of face-to-face, e-commerce and other transaction types</b>	Different types of transactions attract different levels of interchange and scheme fees. Share of face-to-face (that is card-not-present), e-commerce and other transaction types may affect the relationship between the MSC and the interchange fees.
<b>Risk (proportion of chargebacks out of value of all transactions)</b>	Proportion of chargebacks serves as a proxy for a merchant’s riskiness: a high proportion of chargebacks can indicate that a merchant poses a higher credit risk to the acquirer. (For more information on credit risk, see Annex 1.) However, it should be noted that in some cases a merchant may show no or few chargebacks until it is insolvent, and proportion of chargebacks is therefore an imperfect proxy.
<b>Merchant fixed effects</b>	Merchant fixed effects capture merchant-specific time-invariant characteristics.



- 1.18** Another important determinant of MSC is merchant size. We split merchants into size groups based on annual card turnover and estimate the models set out in paragraph 1.14 separately for each group (see section on ‘merchant grouping’).
- 1.19** Finally, an important determinant of MSC is the pricing scheme a merchant faces. We distinguish merchants on ‘interchange plus plus’ (IC++) pricing from those on ‘standard’ pricing (see the sub-section entitled ‘data issues’ for a more detailed discussion of pricing options). Our data tracks merchants who switch from one pricing option to another while remaining with the same acquirer.<sup>7</sup> As explained in Annex 1, under IC++ pricing, acquirers automatically pass on at cost the interchange fees and scheme fees applicable to that transaction. We estimate the models set out in paragraph 1.14 separately for merchants on IC++ pricing, which we treat as a single, separate category to serve as a benchmark against which to compare merchants of different sizes on standard pricing. We would not expect merchants on standard pricing to show the same degree of pass-through as merchants on IC++ pricing. Nevertheless, this group serves as a useful comparison.
- 1.20** We do not control for acquirers’ other costs, such as regulatory, staff and technology costs. As explained in paragraph 1.5, acquirer net revenue includes the costs of providing card-acquiring services other than interchange fees and scheme fees, plus the acquirer’s margin.<sup>8</sup>

## New vs longstanding customers

- 1.21** Our core analysis focuses on the question of whether acquirers passed IFR savings through to merchants. In addition, we consider the questions of (1) whether acquirers’ new customers pay less than longstanding customers; and (2) whether merchants who signed up with an acquirer after the IFR caps came into force pay less than those who joined before.
- 1.22** In order to examine whether acquirers’ new customers pay less than longstanding customers, we define an indicator variable ‘age’, which equals 0 if an observation was recorded within a year of the merchant signing up with its acquirer; 1 if the observation is recorded between one and two years of it signing up with its acquirer; 2 if the observation is recorded between two and three years of it signing up with its acquirer; and 3 if the observation is recorded more than three years of it signing up with its acquirer.
- 1.23** To examine whether merchants who signed up with an acquirer after the IFR caps came into force pay less than those who joined before, we define a dummy that equals one if a merchant signed up with their acquirer after 9 December 2015.

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7 One of the five acquirers (Lloyds) could not provide historic tariff data for its merchants, therefore we cannot tell whether its merchants switched tariffs during the period.

8 We aimed to collect information on other costs as part of our financial review. However, acquirers were unable to provide the data requested (see Annex 3).

# Data and sampling

- 1.24** To perform the analysis, we requested data from the five largest acquirers. The choice of which acquirers to include in the analysis was driven by a desire to achieve high market coverage, while at the same time minimising the burden of an information request on the industry.
- 1.25** In June 2019, we issued an information request to the five largest acquirers, asking them to provide data at the merchant level. Box 1 outlines how merchants were sampled.

## Box 1: Our approach to sampling

For each acquirer, we collected four random samples of 2,000 merchants each. The four samples cover different, but overlapping, time periods (see Figure 1).

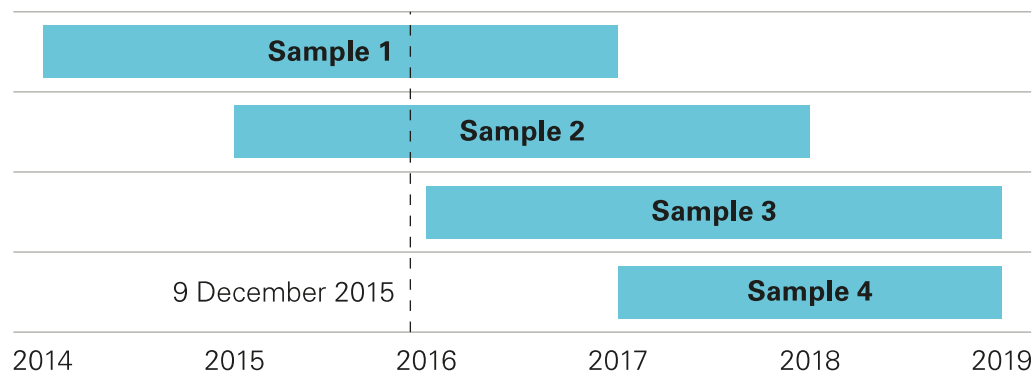
Each sample consists of a random selection of the merchants that buy card-acquiring services from a given acquirer at a given point in time (that is, the sample start date), and tracks those merchants for up to 36 months (or 24 months in the case of the fourth sample). Merchants drop out of the sample when they switch acquirer or stop accepting cards. This approach allows us to capture changes in the merchant population over time. The fourth sample allows us to capture additional merchants joining after the IFR caps came into force beyond those captured by the third sample.

As we collected samples of equal size from each of the five largest acquirers, each sub-sample consists of a random selection of merchants at a certain point in time. Therefore, equal weight is given to each merchant in the sample, regardless of their annual card turnover or their acquirer.

Our core analysis uses this unweighted sample, as we examine the supply of card-acquiring services from the merchant's perspective. However, we test the robustness of the findings by re-running the baseline model and weighting merchant observations according to the number of merchants their acquirer served in 2016 (see section on 'sensitivity checks').

Finally, we note that because samples 3 and 4 fall entirely within the post-IFR caps period, they do not contribute to the estimation of the IFR dummy. However, they contribute to the estimation of the effects of the control variables. Moreover, they feature in the analysis of new vs longstanding customers.

**Figure 1: Illustration of our approach to sampling**



**1.26** We requested monthly data for the period 2014 to 2018 to provide sufficient coverage of the periods before and after the IFR caps came into force on 9 December 2015: the 'pre-IFR period' (January 2014 to November 2015) and the 'post-IFR period' (December 2015 to December 2018). Our sample consists of over one million observations. The data we requested falls into three categories:

- 
- 1 Merchant service charge (MSC)** – the total amount the merchant paid to the acquirer for card-acquiring services
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- 2 Fees** that the acquirer pays for the merchant's transactional activity, broken down by transaction type<sup>9</sup>, comprising:
    - **interchange fees** paid by the acquirer to the issuer for the merchant's transactional activity
    - **scheme fees** paid by the acquirer to Visa and Mastercard for the merchant's transactional activity<sup>10</sup>
- 

9 We requested the data to be split out according to the transaction characteristics that determine the interchange fees and scheme fees transactions attract: card type, location (domestic UK, other domestic, intra-EEA, other) and channel (face-to-face, e-commerce, etc.).

10 Acquirers also pay scheme fees that are not directly attributable to transactions. We did not request fees that are not directly attributable to transactions, as they are immaterial. All references to scheme fees are to fees paid by acquirers to Mastercard and Visa.

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### 3 Merchant characteristics, including:

- volume of transactions, broken down by transaction type
  - value of transactions, broken down by transaction type
  - time since the merchant signed up with current acquirer
  - how the merchant was signed up (for example, via internal sales team, independent sales organisation)
  - the pricing option the merchant has (standard, IC+, IC++, fixed, other or unknown)<sup>11</sup>
  - merchant category code (MCC) (a four-digit code used to classify the merchant by the type of goods or services it provides)
  - fees for card acceptance products and certain value-added services (CAP)<sup>12</sup>
- 

## Merchant grouping

**1.27** Stakeholders were particularly concerned that acquirers had not passed through IFR savings to smaller merchants.<sup>13</sup> This prompted us to investigate whether there are significant differences between merchants in different size groups.

**1.28** We split merchants into size groups based on annual card turnover: up to £15,000, £15,000 to £180,000, £180,000 to £380,000, £380,000 to £1 million, £1 million to £10 million, £10 million to £50 million, more than £50 million. This grouping follows the segmentation introduced in Chapter 4 of the final report but with additional detail to allow us to examine any differences between merchants with varying levels of annual card turnover.

**1.29** In addition, we distinguish merchants on IC++ pricing from those on standard pricing. As explained in paragraph 1.19 and Annex 1, under IC++ pricing, acquirers automatically pass on at cost the interchange fees and scheme fees applicable to that transaction. We treat merchants on IC++ pricing as a single, separate category to serve as a benchmark against which to compare merchants of different sizes on standard pricing. We would not expect merchants on standard pricing to show the same degree of pass-through as merchants on IC++ pricing. Nevertheless, this group serves as a useful comparison. Merchants on IC++ pricing are predominantly large merchants with annual card turnover above £10 million.

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11 In the consultation and information request, we referred to 'tariff type' and to 'blended' rather than 'standard'.

12 We asked acquirers to provide data on how much merchants paid for hiring point-of-sale (POS) terminals and card readers, purchase of card readers, payment gateways, DCC and services to help them comply with the Payment Card Industry Data Security Standard ('PCI DSS').

13 Our assessment identifies two broad segments: large merchants, and small and medium-sized merchants. The term 'smaller merchants' was used by stakeholders.

**1.30** Table 2 provides an overview of the merchant groups as represented in our sample.

**Table 2: Overview of merchant groups**

Group	Turnover band	Number of merchants in sample group	Number of merchants in group as percentage of total	Group card turnover in 2018	Group card turnover in 2018 as percentage of total
<b>1</b>	£0 – £15,000	5,068	14.08%	6,622,975	0.03%
<b>2</b>	£15,000 – £180,000	20,571	57.17%	460,000,000	2.19%
<b>3</b>	£180,000 – £380,000	5,022	13.96%	461,000,000	2.19%
<b>4</b>	£380,000 – 1,000,000	3,181	8.84%	660,000,000	3.14%
<b>5</b>	£1,000,000 – £10,000,000	1,677	4.66%	1,580,000,000	7.51%
<b>6</b>	£10,000,000 – £50,000,000	184	0.51%	1,400,000,000	6.65%
<b>7</b>	>£50,000,000	52	0.14%	1,530,000,000	7.27%
<b>8 (IC++)</b>	Any	190	0.53%	14,700,000,000	69.85%
<b>Other</b>	Any	39	0.11%	247,000,000	1.17%
<b>Total</b>		35,984	100%	21,044,622,975	100%

Source: PSR analysis using data provided by the five largest acquirers.

**1.31** The sample is randomly drawn and sufficiently large that it approximates the true distribution of the underlying population of the merchants at each of the top five acquirers. Table 2 shows that the small minority of IC++ merchants (0.53%) accounted for the large majority of annual card turnover (69.85%) in 2018 in our sample.

**1.32** Table 3 provides an overview of the number of merchants who joined before and after the IFR caps came into force.

**Table 3: Overview of merchant groups by joining date**

Group	Joined pre-IFR caps	Joined post-IFR caps	Total
<b>1</b>	4,683	385	5,068
<b>2</b>	19,414	1,157	20,571
<b>3</b>	4,782	240	5,022
<b>4</b>	3,055	126	3,181
<b>5</b>	1,634	43	1,677
<b>6</b>	179	5	184
<b>7</b>	52	0	52
<b>8 (IC++)</b>	187	3	190
<b>Other</b>	36	3	39
<b>Total</b>	34,022	1,962	35,984

Source: PSR analysis using data provided by the five largest acquirers.

### Box 2: A spotlight on group 1

- Group 1, that is merchants with annual card turnover of less than £15,000, accounts for 14.08% of merchants, but only 0.03% of 2018 transaction value in our sample (see Table 2).
- The group comprises merchants whose monthly card turnover can vary significantly from month to month. Merchants in this group may have months with positive card turnover, followed by months of no card turnover. This affects the descriptive statistics we calculate. If a merchant pays fees for card-acquiring services even if it does not accept any card transactions, MSC as a percentage of monthly card turnover:
  - cannot be calculated in months with zero turnover
  - will be very high in months with lower turnover
  - will be low in months of higher turnover
- As a result, this group contains observations for MSC as a percentage of monthly card turnover that may appear to be outliers, but are legitimate observations. We find that the distribution for this group has a long right tail of high MSC. There is no correct way to treat these observations. Including them biases the group mean upward and skews the econometric analysis. Excluding them excludes legitimate observations and biases the group mean downward.

- We observe similar patterns for interchange fees as a percentage of monthly card turnover.
- For consistency with other merchant groups, and as explained in the section on data issues, we truncate the data at the 95th percentile.
- Because merchants in group 1 have monthly card turnover that can vary significantly from month to month, we need to be careful about making inferences for this group. In the section on descriptive analysis, we will present two sets of statistics, one which underpins the econometric analysis for the other merchant groups, and one which smooths the month-on-month fluctuations for group 1 and allows us to make sensible observations for that group. In the section on econometric analysis, we include the results for group 1 for completeness, but we do not place weight on the results.
- The issue described above only arises for merchants in group 1, because merchants with higher annual card turnover are very unlikely to have very large month-to-month fluctuations in MSC and interchange fees as a percentage of monthly card turnover.

## Data issues

- 1.33** This section provides an overview of the most important issues we found with the data the acquirers provided, how these issues are likely to impact the analysis, and steps we took to mitigate them. It incorporates data issues that were raised by stakeholders in their submission to the interim report.

### Concerns regarding data on scheme fees

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**Issue** Acquirers told us they had difficulty providing data on scheme fees at the desired level of disaggregation. In particular, they told us that they did not record data on scheme fees at the merchant level and so had to allocate and apportion data to individual merchants. There may also be discrepancies between acquirers in how they allocated and apportioned the data to individual merchants.

In response to the interim report, GPUK told us that there are problems with the missing scheme fees data which means we can't properly account for what is happening.<sup>14</sup>

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**Potential impact** The difficulties the acquirers faced proving data on scheme fees, as well as potential discrepancies between acquirers in how they allocated and apportioned the scheme fees to individual merchants, make this data less reliable. However, as a percentage of total MSC, scheme fees are small, so we do not think this issue significantly impacts on our ability to examine pass-through of IFR savings.

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<sup>14</sup> GPUK response, paragraphs 3.20 to 3.21.

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**Mitigation** While this does not impact the validity of our findings regarding pass-through of IFR savings, we note that the evidence regarding pass-through of scheme fees is less strong.

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## Missing data for one of the five largest acquirers ([X])

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**Issue** One of the five acquirers included in our sample was not able to provide data on some variables for the years 2014 and 2015. The variables affected are:

- scheme fees
- interchange fees – data could not be broken out by channel and location
- value of card transactions – data could not be broken out by channel and location

In response to the interim report, Worldpay’s advisers were critical of our approach to imputing the missing scheme fee data. They suggested that we should apply a simpler approach based on the average scheme fee as a proportion of transaction value for the four acquirers in the years 2014 and 2015, and use that in place of the missing data.<sup>15</sup>

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**Potential impact** **Scheme fees:** Scheme fees are a component of the MSC, which we include as a control in our econometric models. Missing values for 2014 and 2015 mean that all observations for this acquirer in the pre-IFR caps period would not be included in our regressions. As we are interested in the differences in outcomes before and after the IFR caps came into force, missing one-fifth of the data in the pre-IFR caps period would mean the results would not be representative of all five acquirers, but of the other four only.

**Interchange fees splits:** Only interchange fees on transactions where the acquirer and issuer are in the EEA were capped by the IFR. Interchange fees split by location are therefore required to calculate IFR savings. We are not able to do this calculation for this acquirer.

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**Mitigation** **Econometric analysis:** Scheme fees and value of card transactions splits are required to estimate our econometric models.

For the interim report we imputed the missing data using the multiple imputation by chained equations (MICE) technique.

In response to the submissions made on the interim report we applied a different approach to imputing scheme fees for the final report. We now use a model which regresses ‘card scheme operator fees’ on ‘interchange fees’ and the logarithm of the values of sales. The model includes fixed effects. The model fits have been used to impute values for one acquirer in 2014 and 2015.

The change in approach to imputing scheme fees does not materially change our findings, rather it allows for a more straightforward interpretation. We note also that on a merchant level, scheme fees

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15 Worldpay technical annex, paragraphs 4.11 to 4.12.



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are a small portion of the MSC and although their impact on pass-through is non-negligible, it is lower than the impact of other factors.

**Descriptive statistics:** When calculating certain descriptive statistics, we opt to exclude this acquirer's data for the years 2014 and 2015. We specify where we take this approach in the footnotes to the relevant graphs and tables.

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## Comparability of refund and chargeback transaction data across acquirers

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<b>Issue</b>	We found differences in how acquirers record the number and value of refund and chargeback transactions.
<b>Potential impact</b>	Difficulty in making like-for-like comparisons across acquirers.
<b>Mitigation</b>	Our analysis focuses on purchase transactions and excludes refund and chargeback transactions. We do not consider this impacts on our analysis because refund and chargeback transactions comprise only 1.47% and 0.04% of transactions, respectively, in our dataset.

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## Consistency of acquirers' allocation of merchants to pricing options

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<b>Issue</b>	We encountered some discrepancies in how acquirers allocated merchants to the pricing options we set out in the information request. We requested information on whether merchants were on 'IC++', 'IC+', 'blended', or 'other' pricing.
<b>Potential impact</b>	To conduct our analysis, we need to be able to separate merchants who automatically receive pass-through at cost of interchange fees (and scheme fees) from those that do not.
<b>Mitigation</b>	We had follow-up conversations with some acquirers to clarify our understanding of the pricing options and whether under these options for a given transaction the acquirer automatically passes through at cost interchange fees and scheme fees applicable to that transaction. Based on this engagement we allocated all merchants to one of the following pricing options <sup>16</sup> : <ul style="list-style-type: none"><li>• IC++ pricing, whereby for a given transaction the acquirer automatically passes on at cost the interchange fee and scheme fees applicable to that transaction.</li><li>• Standard pricing, whereby for any given transaction the acquirer does not automatically pass through at cost the interchange fee applicable</li></ul>

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16 We amended our definitions of the pricing options based on engagement with acquirers.

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to the transaction and the pricing option does not satisfy the criteria for IC+, IC++ or fixed pricing.<sup>17</sup>

- Other, if a merchant has IC+ pricing<sup>18</sup>, as well as merchants for which the pricing option was unknown. We merged the IC+ and other group because there were very few of them (43 merchants or 0.12% of observations) and they are not the focus of our analysis.

We focus our analysis on merchants allocated to the IC++ and standard pricing. Merchants on 'other' pricing are included in the analysis on the whole sample, but excluded from the analysis by merchant group.

We acknowledge that in making these allocations we have abstracted from some of the nuance in acquirers' pricing options.

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## Data outliers

**Issue** The data on merchant service charges, interchange fees and scheme fees contain significant outlying observations. This includes the following:

- Unusually high values for MSC as a percentage of monthly card turnover (either the result of data entry errors or because of months in which fixed costs are high and turnover is low – the latter is predominantly an issue for group 1 merchants with annual card turnover >£15,000, as explained in Box 2).
- Negative values (either the result of data entry errors or relatively rare circumstances of interchange fees being refunded to the acquirer).

In response to the interim report, Worldpay and their advisers told us that it was not necessary to remove some of the outliers and that by removing these outliers we had created a potentially biased dataset. They submitted that we had unnecessarily dropped some observations due to a rounding error and indicated that the outlier identification in different variables used an erroneous sequential process.<sup>19</sup>

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**Potential impact** Outliers can significantly skew the results. However, we need to exercise care in how we treat them, as they often represent legitimate observations (as opposed to errors in the data).

The treatment of outliers is particularly important for group 1 merchants with annual card turnover of less than £15,000 (see Box 2).

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17 For the purposes of the pass-through analysis we also allocated fixed pricing, whereby the merchant pays a fixed, periodic fee for card-acquiring services (the amount of which does not depend on the volume or value of transactions it accepts or the characteristics of these transactions, within specified limits) to standard pricing.

18 Interchange fee plus (IC+) pricing, whereby for any given transaction the acquirer automatically passes on at cost the interchange fee applicable to that transaction.

19 Worldpay's response paragraph 3.42 and Worldpay technical annex, paragraphs 3.4 to 3.5.

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**Mitigation** We agree that the approach to identifying outliers adopted in the interim report did result in some observations being dropped unnecessarily. We therefore changed our approach.

Outliers have been identified as: (a) observations with missing values; (b) observations out of a plausible range (outside a 0 – 100 interval); (c) observations in the top 5% percentile. This has been done for the following variables:

- MSC (as a percentage of monthly card turnover)
- interchange fees (as a percentage of monthly card turnover)
- scheme fees (as a percentage of monthly card turnover)

Outliers defined in this way have been removed from the sample (the only exception is for zeroes recorded in variable Scheme Fees (%), for which we use imputed values).

In addition, values of other explanatory variables defined as a share ('proportion of chargebacks'; 'share of face-to-face transactions'; 'share of capped credit'; 'share of capped debit'; and variables for the average interchange fees as a percentage of turnover) have been replaced with missings for any values outside the 0 – 100 range (hence keeping the observations in the sample but excluding them from any regression where the variables are being used). Variables for the average interchange fees as a percentage of turnover (reported in graphic form) have also been truncated at the 99th percentile given that they showed extreme observations.

As reported below, making these adjustments did not materially affect the results for Groups 2 to 6.

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### Issues with data on card acceptance products and certain value-added services (CAP)

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**Issue** Acquirers told us they had difficulty providing data on the total value of CAP for a given merchant in each month: only three acquirers were able to provide a complete dataset; one acquirer was not able to provide historic data due to problems with their database; another acquirer could not provide data for the years 2014 and 2015; [§<].

**Potential impact** We are not able to comprehensively test for the possibility that acquirers passed through IFR savings by lowering the price of other goods and services rather than the price of card-acquiring services (see section on additional robustness checks).

**Mitigation** In the interim report we tested the hypotheses using data from three acquirers only and presented this analysis as a sensitivity check.

We have removed this analysis from the final report because of concerns about collinearity between variables which made the model unreliable.

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# Descriptive statistics

**1.34** This section describes how the MSC and its components (interchange fees, scheme fees and acquirer net revenue) evolved over the period 2014 to 2018. We consider these variables at an aggregate level, as well as by merchant group. Each of these statistics is measured as a percentage of card turnover.

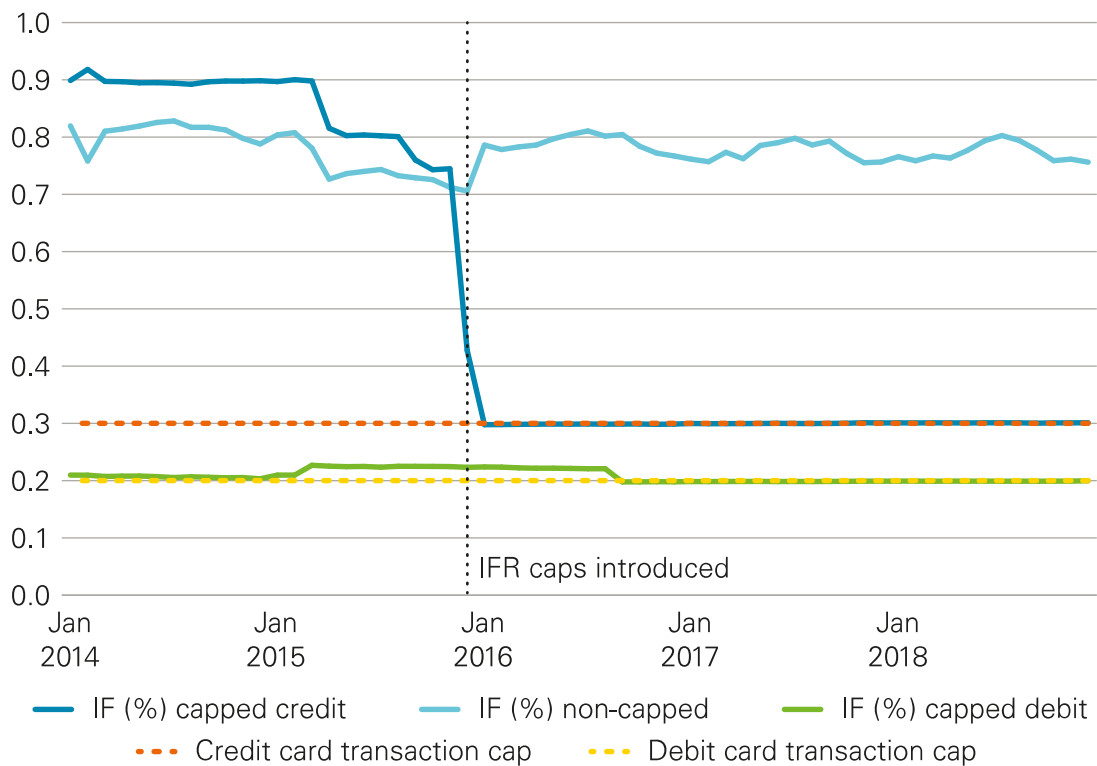
## Interchange fees – aggregate view

**1.35** We first describe interchange fees, which on average represent the largest component of the MSC. We examine how average interchange fees, calculated as total interchange fees paid in a month over total card turnover in a month evolved over the period 2014 to 2018 at an aggregate level. We separate interchange fees incurred on domestic and intra-EEA consumer credit card transactions (capped at 0.3% by the IFR), domestic and intra-EEA consumer debit card transactions (capped at 0.2% by the IFR<sup>20</sup>), and all other transactions (not capped). Figure 2 shows this evolution. The majority of debit card transactions at UK merchants involve Visa cards, while the majority of credit card transactions involve Mastercard cards.

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20 As set out in Annex 1, the Treasury permitted operators of card payment systems to apply a weighted average interchange fee to UK consumer debit card transactions. The weighted average cap was set at 0.2% of the average value of all domestic debit card transactions made within a card payment system in the previous year. It meant that interchange fees could be more than or less than 0.2% of the value of an individual transaction.

**Figure 2: Monthly average interchange fees as a percentage of card turnover**



Source: PSR analysis using data submitted by the five largest acquirers.<sup>21</sup>

- 1.36** The vertical line in Figure 2 marks the IFR caps coming into force in December 2015. The dotted horizontal lines mark the level of the caps for credit (0.3%) and debit (0.2%) cards.
- 1.37** Overall, Figure 2 shows that average interchange fees for domestic and intra-EEA consumer credit and debit card transactions fell to the levels of the caps in the period after December 2015.
- 1.38** Figure 2 shows that average interchange fees incurred on capped credit card transactions fell sharply upon the IFR caps coming into force in December 2015 – from 0.75% immediately before, to the level of the cap immediately after, where they stayed for the remaining period.
- 1.39** Figure 2 also shows that average interchange fees on capped credit card transactions fell slightly (by 0.1 percentage points) nine months before the IFR caps came into force, around March 2015. This is mainly driven by Mastercard lowering their interchange fee rates on consumer credit cards issued in the UK over the course of 2015 in the lead up to the IFR caps coming into force.

21 One of the acquirers from which we requested data could not separate out the interchange fees by location of transaction for the years 2014 and 2015. 2014 and 2015 figures in this chart are based on data from the other four acquirers.

**1.40** Figure 2 shows average interchange fees on capped debit card transactions. We observe that:

- prior to the IFR caps coming into force in December 2015, average interchange fees on debit card transactions that were subsequently capped by the IFR were already at a level close to that of the IFR caps (0.22%)
- average interchange fees on capped debit card transactions didn't drop to the level of the IFR cap until September 2016

**1.41** The evolution from 2014 to 2016 of average interchange fees on debit card transactions subsequently capped by the IFR is explained by changes Visa made to its interchange fee rates during this period:

- Prior to March 2015, the weighted average of interchange fees for Visa UK domestic debit card transactions was already close to 0.2%.
- In March 2015, prior to the IFR coming into force, Visa introduced a weighted average interchange fee for UK domestic consumer debit card transactions set as follows: £0.01 plus 0.2% (capped at £0.50) for secure transactions and £0.11 plus 0.2% (capped at £1) for non-secure transactions. We observe a small change in average interchange fees for debit card transactions that were subsequently capped by the IFR in March 2015 when Visa introduced a weighted average interchange fee. Visa continued to apply a weighted average interchange fee until September 2016.
- As set out in Annex 1, the IFR caps interchange fees on domestic and intra-EEA consumer debit card transactions at 0.2% of the value of the transaction. However, the IFR permitted Member States to apply a weighted average interchange fee on domestic consumer debit card transactions for five years after the caps came into force. In the UK, the Treasury exercised this Member State discretion in the Payment Card Interchange Fee Regulations 2015. The weighted average cap was set at 0.2% of the average value of all domestic debit card transactions made within a card payment system in the previous year. It meant that interchange fees could be more than or less than 0.2% of the value of an individual transaction. Visa was the only operator of a card payment system operating in the UK to apply a weighted average interchange fee.<sup>22</sup>
- In September 2016, Visa replaced the weighted average interchange fee with a flat rate of 0.2% for nearly all UK domestic debit card transactions. We observe the impact of this change in Figure 2 as the average interchange fees for capped debit card transactions falls to 0.2%.

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22 While Figure 2 does not show average interchange fees on domestic debit card transactions falling to 0.2% from December 2015 (when the IFR caps came into force), our dataset does not include all domestic debit card transactions made within the Visa card payment system and does not show the overall weighted average interchange fee for that system.

- Other changes were made to the interchange fees that apply to capped debit card transactions in 2015 and 2016 (in addition to Visa introducing and later replacing the weighted average interchange fee in March 2015 and September 2016 respectively). For example, in January 2015, Visa introduced the Cross-Border Domestic Interchange Programme (CBDIP) following commitments given in the context of competition law investigations carried out by the European Commission. The CBDIP enabled cross-acquirers to elect between either the domestic debit or credit interchange fee rate applicable to a transaction or an interchange fee rate of 0.2% or 0.3% – for debit and credit cards respectively – provided certain conditions were met. The CBDIP meant that acquirers were able to lower the interchange fees they paid for certain transactions in countries that had higher domestic debit or credit interchange fee rates. In practice, the applicable conditions meant that the CBDIP was most likely to apply to transactions involving a small number of large merchants that met specific criteria, for example because only transactions involving merchants with IC++ pricing could qualify. We do not observe the impact of CBDIP in Figure 2, probably because none of the merchants eligible for the programme are included in our dataset.

**1.42** In Figure 2, the outcomes from large merchants dominate the averages and so the averages largely represent outcomes for large merchants. As we will see in the next section which looks at interchange fees by merchant group, prior to the IFR caps coming into force, average interchange fees on capped debit card transactions varied across merchant groups.

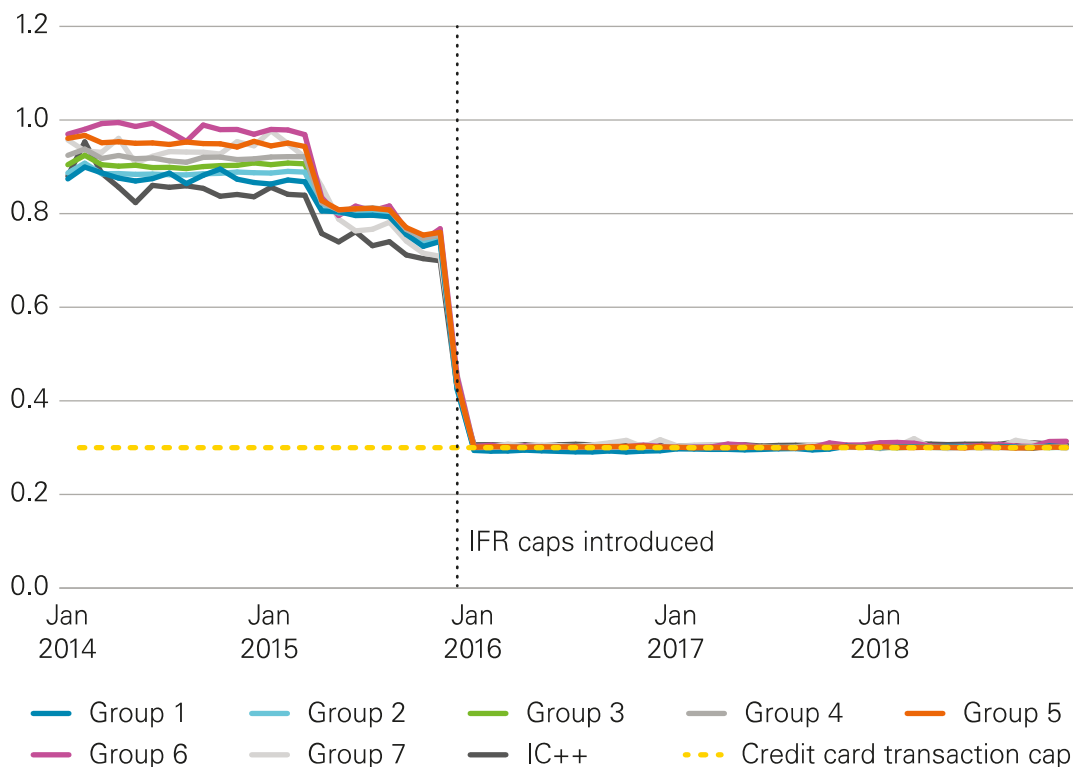
## Interchange fees – by merchant group

**1.43** We examine how average interchange fees as a percentage of monthly card turnover evolved over the period 2014 to 2018 for each merchant group. We consider average interchange fees incurred on capped credit card transactions and average interchange fees incurred on capped debit card transactions in turn.

### Average interchange fees incurred on capped credit card transactions

**1.44** Figure 3 shows the evolution of average interchange fees incurred on capped credit card transactions by merchant group. It shows all merchant groups following a similar trend to that observed at the aggregate level.

**Figure 3: Monthly average interchange fees on capped credit cards as a percentage of card turnover, by merchant group**



Source: PSR analysis using data submitted by the five largest acquirers.<sup>23</sup>

### Average interchange fees incurred on capped debit card transactions

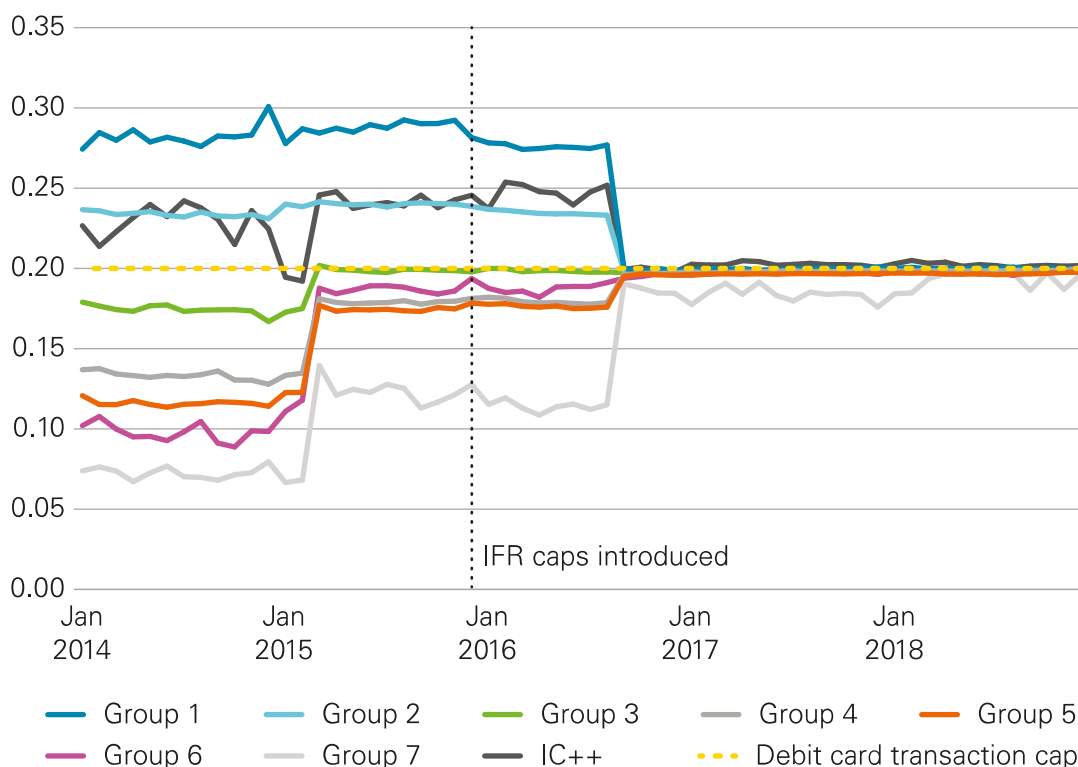
**1.45** Figure 4 shows the evolution of average interchange fees incurred on capped debit card transactions by merchant group. It shows significant differences across merchant groups over the period January 2014 to September 2016, after which average interchange fees for all merchant groups converged to the level of the cap. As discussed in paragraph 1.41, this is explained by changes Visa made to its interchange fees during this period.

**1.46** We note that average interchange fees for group 7, that is the largest merchants with standard pricing that have annual card turnover greater than £50 million, increased significantly after September 2016. This appears to be because group 7 merchants have a high proportion of high-value debit card transactions. After Visa replaced the weighted average interchange fee on UK domestic debit card transactions, secure transactions with a value of around £250 and non-secure transactions with a value of around £500 incurred a higher interchange fee than previously.

<sup>23</sup> One of the acquirers from which we requested data could not separate out the interchange fee by location of transactions for the years 2014 and 2015. 2014 and 2015 figures in this chart are based on data from the other four acquirers.



**Figure 4: Monthly average interchange fees on capped debit cards, by merchant group**



Source: PSR analysis using data submitted by the five largest acquirers.<sup>24</sup>

## Difference in average interchange fees – by merchant group

**1.47** We calculate the difference in average interchange fees by merchant group following the IFR caps coming into force. As indicated in Box 2, we calculate two sets of descriptive statistics. We explain how these are calculated below. The first set follows on from the analysis presented above, and underpins the econometric analysis in the next section. The second set aims to smooth the month-on-month fluctuations in group 1, and is the basis for the summary statistics in Table 2 in Chapter 5 of the interim report.

**1.48** The first set of descriptive statistics, presented in Table 4, is calculated by dividing interchange fees for a given merchant in each month by card turnover for the same merchant in the same month. We then average these observations across the pre-IFR caps period and the post-IFR caps period, and subtract the latter from the former. We call this the ‘merchant-period average’.

<sup>24</sup> One of the acquirers from which we requested data could not separate out the interchange fee by location of transactions for the years 2014 and 2015, therefore the data underlying this chart shows interchange fees for the other four acquirers only for years 2014 and 2015.

- 1.49** The second set of descriptive statistics, presented in Table 5, is calculated by:
- adding all observations relevant to the calculation being made (all merchants and all months for a particular group) for interchange fees that fall into the pre-IFR caps period
  - adding all relevant observations (all merchants and all months) for transactions values that fall into the pre-IFR caps period
  - dividing the former by the latter
  - doing the same calculation for the post-IFR caps period
  - subtracting pre-IFR caps period from the post-IFR caps period. We call this the 'aggregate-group ratio'
- 1.50** Note that this calculation produces averages that weight merchants by turnover. As explained in paragraph 1.47, the primary reason for calculating this alternative set of descriptive statistics is to smooth the month-on-month fluctuations in group 1 and hence produce sensible results for this group.
- 1.51** Table 4 and Table 5 confirm that average interchange fees did – broadly – fall after the IFR caps came into force. For group 7 – merchants with annual card turnover greater than £50 million – Table 4 and Table 5 show only a relatively small effect of the IFR (with the sign depending on how the averaging was done).<sup>25</sup> As explained in paragraphs 1.41 and 1.46, because of the change in Visa's interchange fee rates, the merchants in group 7 – who have a high proportion of high-value debit card transactions – saw an increase in interchange fees on debit card transactions following the IFR caps coming into force.

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25 The two sets of descriptive statistics produce different results for group 7. As explained in paragraphs 1.48 and 1.49, the calculation of aggregate-group ratios (presented in Table 5) weights merchants by card turnover, whereas the calculation of merchant-period-averages (presented in Table 4) weights merchants equally. Group 7 includes merchants with turnover greater than £50 million, but merchants in this group are not uniformly distributed, as this group has no upper limit (see Box 3). Hence, calculations with and without weights will produce different results.

**Table 4: Merchant-period average for interchange fees before and after the IFR caps came into force, by merchant group**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	0.48	0.46	0.44	0.45	0.45	0.44	0.32	0.49	0.46
<b>Post-IFR</b>	0.30	0.29	0.28	0.29	0.30	0.31	0.24	0.31	0.29
<b>Difference</b>	-0.19	-0.17	-0.16	-0.16	-0.15	-0.13	-0.07	-0.18	-0.17

Source: PSR analysis using data submitted by the five largest acquirers. Note that figures are rounded and may lead to minor discrepancies between the pre-IFR period minus the post-IFR period and what we report under 'difference'.

**Table 5: Aggregate-group ratios for interchange fees before and after the IFR caps came into force, by merchant group**

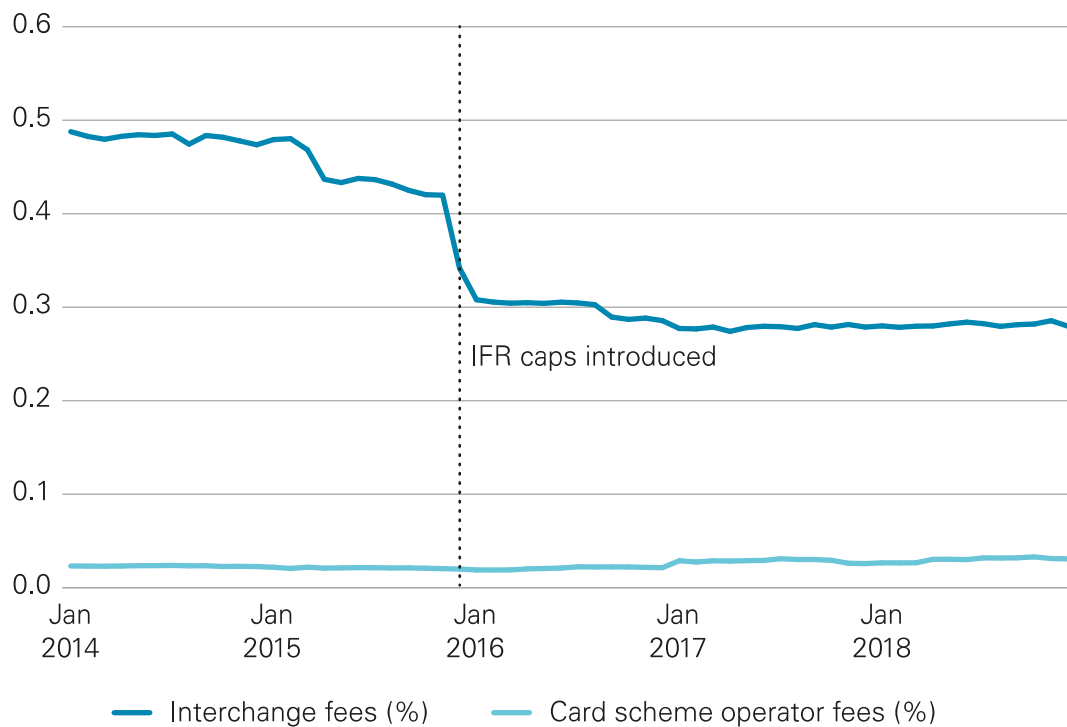
	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	0.48	0.45	0.44	0.45	0.45	0.47	0.13	0.39	0.27
<b>Post-IFR</b>	0.30	0.28	0.28	0.29	0.30	0.31	0.21	0.25	0.25
<b>Difference</b>	-0.18	-0.17	-0.16	-0.16	-0.15	-0.16	0.07	-0.15	-0.02

Source: PSR analysis using data submitted by the five largest acquirers. Note that figures are rounded and may lead to minor discrepancies between the pre-IFR period minus the post-IFR period and what we report under 'difference'.

## Scheme fees

- 1.52** We have described interchange fees, which on average represent the largest component of the MSC. We now briefly describe scheme fees, which on average represent the second largest component of the MSC. We look at scheme fees in more detail in Annex 4.
- 1.53** Scheme fees made up a significantly smaller proportion of the MSC than interchange fees, over the period between 2014 and 2018. However, during that period, the share of the MSC relating to scheme fees rose, whereas the share relating to interchange fees reduced (see Chapter 5 of the interim report and Annex 3).
- 1.54** We examine how average scheme fees, calculated as total scheme fees paid in a month over total card turnover in a month, evolved over the period 2014 to 2018 at an aggregate level.
- 1.55** Figure 5 shows that average scheme fees increased by 0.012 percentage points when the post-IFR period came into force. We look at the evolution of scheme fees over the period 2014 to 2018 in more detail in Annex 4.

**Figure 5: Monthly average interchange fees and scheme fees as a percentage of card turnover**



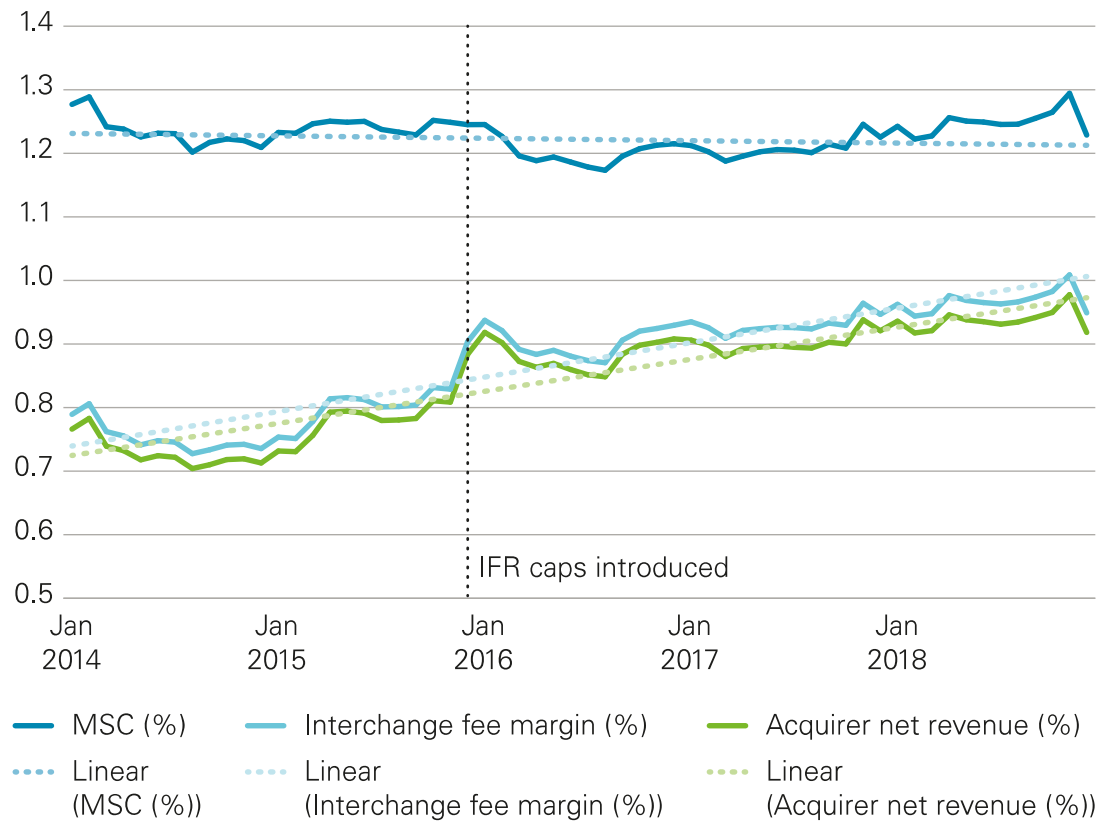
Source: PSR analysis using data submitted by the five largest acquirers.<sup>26</sup>

## MSC, acquirer net revenue and interchange fee margin

- 1.56** We have described how interchange fees and scheme fees evolved over the period 2014 to 2018. We now look at how the MSC itself, as well as acquirer net revenue (calculated as MSC minus interchange fees minus scheme fees) and the interchange fee margin (calculated as MSC minus interchange fees) evolved over this period. As explained in paragraph 1.13, these three variables capture different ways of measuring pass-through.
- 1.57** Figure 6 shows the evolution of average MSC as a percentage of monthly card turnover over the period 2014 to 2018 at an aggregate level. The vertical line in Figure 6 marks the IFR caps coming into force in December 2015.
- 1.58** Figure 6 shows that MSC remained relatively flat over the period 2014 to 2018. On the other hand, acquirer net revenue and interchange fee margin increased following the IFR caps coming into force.

<sup>26</sup> One of the acquirers from which we requested data could not provide data for monthly scheme fees paid by its merchants in the years 2014 and 2015, therefore the data underlying this chart shows average scheme fees using imputed data for that acquirer for the years 2014 and 2015.

**Figure 6: Monthly average MSC, acquirer net revenue and interchange fee margin as a percentage of card turnover**



Source: PSR analysis using data submitted by the five largest acquirers.<sup>27</sup>

27 One of the acquirers from which we requested data could not provide data for monthly scheme fees paid by its merchants in the years 2014 and 2015, therefore the data underlying this chart shows average scheme fees using imputed data for that acquirer for the years 2014 and 2015.

- 1.59** We calculate average MSC, average acquirer net revenue, and average interchange fee margin for the entire pre-IFR caps period and the entire post-IFR caps period, and the differences between the periods, for each merchant group according to the two approaches described in paragraphs 1.48 and 1.49. Table 6 and Table 7 summarise the results:
- Merchants on IC++ pricing saw their average MSC decrease by 0.20 to 0.14 percentage points, and the interchange fee margin remain flat, indicating pass-through.
  - Average MSC for merchants with annual card turnover between £15,000 and £10 million (groups 1 to 6) remained flat, changing between -0.04 and 0.00 percentage points. The interchange fee margin, on the other hand, increased by 0.13 to 0.16 percentage points, indicating no pass-through.
  - For the smallest merchants with annual card turnover below £15,000 (group 1), the results vary substantially depending on how we calculate the descriptive statistics. As explained in Box 2, the reason we calculate two sets of descriptive statistics is because of the volatility in this group. The second calculation (of aggregate-group ratios) smooths this volatility, and for group 1, we place more weight on this set of descriptive statistics. Table 7 shows that average MSC for merchants with annual card turnover below £15,000 fell slightly, changing by -0.05 percentage points. The interchange fee margin, on the other hand, increased by 0.13 percentage points, indicating no pass-through.
- 1.60** Overall, these results indicate that, on average, merchants with annual card turnover between £15,000 and £50 million receive little or no pass-through of IFR savings. This is indicated both by the MSC remaining flat and the interchange fee margin increasing. The aggregate-group ratios for group 1 tell a similar story. However, the average MSC may also have been affected by other variables over the period 2014 to 2018 (see Table 1), including the characteristics of merchants within each size group, changes in scheme fees, volume of transactions and the mix of transactions, or proportion of chargebacks. To draw conclusions about whether IFR savings have been passed through or not, we need to rule out these alternative explanations. To do this, we used econometric analysis, which we present below.

**Table 6: Merchant-period average for MSC, interchange fee margin and acquirer net revenue before and after the IFR caps came into force by merchant group**

**MSC (%)**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	1.96	1.32	0.98	0.90	0.83	0.68	0.46	0.75	1.24
<b>Post-IFR</b>	1.93	1.30	0.98	0.90	0.82	0.70	0.40	0.55	1.21
<b>Difference</b>	-0.03	-0.02	0.00	-0.00	-0.02	0.01	-0.07	-0.20	-0.02

**Interchange fee margin (%)**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	1.47	0.86	0.54	0.45	0.38	0.24	0.15	0.27	0.78
<b>Post-IFR</b>	1.63	1.01	0.70	0.61	0.51	0.38	0.15	0.24	0.93
<b>Difference</b>	0.16	0.15	0.16	0.16	0.13	0.14	0.01	-0.02	0.14

**Acquirer net revenue (%)**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	1.45	0.84	0.52	0.43	0.36	0.22	0.13	0.24	0.76
<b>Post-IFR</b>	1.61	0.99	0.68	0.58	0.49	0.36	0.13	0.21	0.90
<b>Difference</b>	0.16	0.15	0.16	0.15	0.13	0.14	0.00	-0.03	0.14

Source: PSR analysis using data submitted by the five largest acquirers.<sup>28</sup>

28 One of the acquirers from which we requested data could not provide data for monthly scheme fees paid by its merchants in the years 2014 and 2015, therefore the data underlying this chart shows average scheme fees using imputed data for that acquirer for the years 2014 and 2015.

**Table 7: Aggregate group ratios for MSC, interchange fee margin and acquirer net revenue before and after the IFR caps came into force by merchant group**

**MSC (%)**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	1.88	1.18	0.96	0.89	0.81	0.67	0.18	0.46	0.40
<b>Post-IFR</b>	1.83	1.17	0.96	0.88	0.77	0.67	0.30	0.32	0.45
<b>Difference</b>	-0.05	-0.01	0.00	-0.01	-0.04	0.00	0.13	-0.14	0.05

**Interchange fee margin (%)**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	1.40	0.73	0.52	0.44	0.36	0.21	0.04	0.07	0.13
<b>Post-IFR</b>	1.54	0.88	0.68	0.59	0.47	0.36	0.10	0.08	0.20
<b>Difference</b>	0.13	0.15	0.16	0.15	0.12	0.15	0.05	0.00	0.07

**Acquirer net revenue (%)**

	1	2	3	4	5	6	7	IC++	All
<b>Pre-IFR</b>	1.39	0.71	0.50	0.43	0.34	0.19	0.03	0.05	0.11
<b>Post-IFR</b>	1.51	0.86	0.66	0.57	0.45	0.33	0.08	0.05	0.17
<b>Difference</b>	0.13	0.15	0.15	0.14	0.11	0.14	0.04	-0.01	0.06

Source: PSR analysis using data submitted by the five largest acquirers.<sup>29</sup>

29 One of the acquirers from which we requested data could not provide data for monthly scheme fees paid by its merchants in the years 2014 and 2015, therefore the data underlying this chart shows average scheme fees using imputed data for that acquirer for the years 2014 and 2015.



### Box 3: A spotlight on the largest merchants

As explained in paragraph 1.49, the aggregate-group ratios in Table 5 and Table 7 are calculated from the aggregates in each group of interchange fees, scheme fees, MSC and transactions. However, they do not add up to an aggregate that is representative of the sector as a whole. The 'All' columns in these tables are therefore not comparable with the accounting figures in Figure 11 of Chapter 5 of the interim report and are included here only for completeness.

The reason for this is that Table 5 and Table 7 are compiled from data sampled from the population of merchants of the five largest acquirers for the purpose of conducting the pass-through analysis. The approach to sampling detailed in Box 1 above was designed to result in a random sample in which each merchant has an equal probability of being entered into the sample so that the statistics illustrate the experience of typical merchants.

The sample is therefore not representative of the transactions distributed across the sector as a whole. The size distribution of merchants is skewed, with many more merchants towards the lower end of each group than towards the upper end. This effect is particularly strong in groups 7 and 8 which have no upper limits, so that the descriptive statistics for these groups will be quite sensitive to which particular large merchants are picked up in the random sample. The five largest merchants among the customers of the five largest acquirers accounted in 2018 for over £100 billion of transactions, that is 14% of total transactions, and none of these merchants are in our sample. The largest merchant in our sample had just under £6 billion of card transactions in 2018.

In addition, we sampled the same number of merchants from each of the five largest acquirers even though the acquirers have unequal shares of supply; and the elimination of a small proportion of outliers from the data set may not have had the same impact in each size group in our sample. But these effects will be small compared with the effect of the sample not including any merchants with annual card turnover above £6 billion.

Finally, merchants with very high levels of annual card turnover (above £6 billion) will be on IC++ pricing. Separately, we find full pass-through of IFR savings to IC++ merchants and make no adverse finding about the supply of card-acquiring services to the largest merchants, so the fact that our sample does not include any of the merchants with very high levels of annual card turnover has no implications for our conclusions.

## Direct impact of the IFR caps

- 1.61** Before we turn to the econometric analysis, we calculate cost savings directly attributable to the IFR caps ('IFR savings') that will help us interpret the econometric results.
- 1.62** The changes in interchange fees shown in Tables 4 and 5 are not entirely the result of the IFR caps. They may be partly explained by changes in interchange fees on uncapped transactions, or by shifts in the mix of transactions between uncapped transactions, capped credit card transactions, and capped debit card transactions. To isolate the effect of the IFR caps, we calculate the change in the interchange fee for each merchant group that is accounted for by capped transactions, holding transaction shares constant (at their post-IFR caps levels).
- 1.63** Specifically, we do an alternative calculation of the difference in average interchange fees before and after the IFR caps came into force only on the transactions that were capped by the IFR (that is, domestic and intra-EEA consumer debit and credit card transactions). The differences between average interchange fees on capped transactions before and after the IFR caps came into force are then weighted by the post-IFR caps shares of domestic and intra-EEA consumer debit and credit card transactions. Table 8 and Table 9 summarise the results (for the two sets of descriptive statistics explained in paragraphs 1.49 and 1.50, respectively). (Table 18 in the *Additional tables for reference* section of this annex presents the difference in interchange fees per transaction type.)
- 1.64** Table 8 and Table 9 confirm that the IFR caps did – broadly – result in savings for the acquirers. Again, the exception is group 7 with merchants with annual card turnover greater than £50 million, which saw close to no change in interchange fees. Merchants with lower annual card turnover saw a bigger impact from the IFR caps coming into force (for example, a fall of 0.17 and 0.19 percentage points for merchants with annual card turnover less than £15,000, compared with a fall of 0.11 and 0.12 percentage points for large merchants with annual card turnover between £10 million and £50 million). Finally, merchants on IC++ pricing saw a smaller fall of 0.10 and 0.08 percentage points.

**Table 8: Merchant-month average IFR savings, by merchant group**

	1	2	3	4	5	6	7	IC++	All
<b>IFR savings</b>	0.17	0.14	0.13	0.13	0.11	0.11	0.01	0.10	0.11

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 9: Aggregate-group ratio IFR savings, by merchant group**

	1	2	3	4	5	6	7	IC++	All
<b>IFR savings</b>	0.19	0.16	0.14	0.13	0.12	0.12	-0.01	0.08	0.04

Source: PSR analysis using data submitted by the five largest acquirers.

# Econometric analysis

- 1.65** One interpretation of the descriptive statistics presented in the previous section is that (except for the largest merchants who did not see a fall in average interchange fees following the IFR caps coming into force) acquirers did not pass through IFR savings to merchants with standard pricing. This is indicated both by the MSC remaining flat and the interchange fee margin increasing. However, the average MSCs may also have been affected by other variables over the period 2014 to 2018, including the characteristics of merchants within each size group, changes in scheme fees, volume of transactions, changes in the mix of transactions, or proportion of chargebacks. To draw conclusions about whether IFR savings have been passed through or not, we need to rule out these alternative explanations. To do this, we used econometric analysis.
- 1.66** In this section we first discuss the results of our preferred model (the baseline model) before discussing the results of alternative models which use different definitions of the dependent variable.

## Baseline model – interchange fee margin as dependent variable

- 1.67** As discussed above at paragraph 1.7, we used the introduction of the IFR caps as an indicator for the strength of competition in the supply of card-acquiring services. The extent to which these IFR savings were passed through to merchants (IFR pass-through) is an indicator of the strength of competition in the supply of card-acquiring services. Our baseline model focuses specifically on IFR pass-through by looking at changes in the interchange fee margin, MSC-IF, calculated by subtracting interchange fees (as a percentage of monthly card turnover) in each month from MSC (as a percentage of monthly card turnover) in each month, as the dependent variable.
- 1.68** We regress the interchange fee margin on the IFR dummy and other control variables.
- 1.69** The IFR dummy is our main variable of interest. It equals 1 in the post-IFR period, and zero in the pre-IFR period. This breaks the data into two periods – pre- and post-IFR caps. The coefficient on this dummy gives us the impact of the IFR caps on the interchange fee margin. The value of the coefficient is the estimated shift (in percentage points) of the interchange fee margin because of the IFR caps. A coefficient close to zero indicates that the interchange fee margin remained flat following the IFR caps coming into force because average MSC fell in line with average interchange fees, which in turn indicates that IFR savings were passed through. On the other hand, a positive coefficient would indicate that the margin increased, which is to say average MSC did not fall in line with interchange fees and there was not full pass-through of IFR savings.

**1.70** We control for merchant fixed effects, scheme fees, the number of purchase transactions (measured in logarithms to smooth the variance), the share of e-commerce transactions, the share of capped debit card transactions, the share of capped credit card transactions, and the proportion of chargebacks transactions (see Table 1 for a description of the control variables). Table 10 presents the results for the analysis by merchant group and for the whole sample.

**Table 10: Regression results, interchange fee margin as dependent variable, by merchant group**

	1	2	3	4	5	6	7	IC++	All sample
<b>IFR DUMMY<sup>30</sup></b>	0.2226 ***	0.1821 ***	0.1601 ***	0.1542 ***	0.1248 ***	0.1465 ***	0.0519 ***	-0.0200 *	0.1717 ***
<b>Scheme fees</b>	3.1314 ***	1.7958 ***	1.7806 ***	1.4956 ***	2.0110 ***	2.4251 ***	1.6580 ***	2.4351 ***	1.8600 ***
<b>Log of transaction volume</b>	-0.2319 ***	-0.1985 ***	-0.0767 ***	-0.0610 ***	-0.0546 ***	-0.0394 ***	-0.0074 ***	-0.0036	-0.1586 ***
<b>Proportion of chargebacks</b>	0.0109 ***	0.0151 ***	0.0106 ***	0.0095 ***	0.0207 ***	0.0194	-0.0012 *	0.0226 **	0.0131 ***
<b>Share of face-to-face transaction</b>	0.0007 ***	0.0010 ***	0.0003 ***	0.0009 ***	0.0007 ***	0.0010 ***	-0.0006 ***	0.0006	0.0008 ***
<b>Share of capped credit</b>	0.0014 ***	0.0032 ***	0.0044 ***	0.0042 ***	0.0024 ***	0.0051 ***	0.0046 ***	0.0014*	0.0030 ***
<b>Share of capped debit</b>	-0.0012 ***	-0.0027 ***	-0.0034 ***	-0.0036 ***	-0.0040 ***	-0.0012 **	-0.0003	-0.0008	-0.0024 ***
<b>Constant</b>	1.9698 ***	1.6812 ***	0.9874 ***	0.8120 ***	0.8403 ***	0.4442 ***	0.1164 ***	0.2043 **	1.4861 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0805	0.1392	0.2101	0.2001	0.1866	0.2833	0.3969	0.0234	0.1225
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**1.71** Table 10 shows that:

- For merchants on IC++ pricing, which are typically the largest merchants, the value of the IFR dummy is close to zero (-0.020 with low significance). It indicates that for this group of merchants, the interchange fee margin remained flat, and that there was full pass-through of IFR savings. The result for this group is consistent with the IC++ pricing structure, under which acquirers automatically pass through at cost interchange

<sup>30</sup> In chapter 5, the IFR dummy is referred to as the IFR effect.

fees (and scheme fees). For this reason, and as explained in paragraph 1.19, this group serves as a comparator for merchants of different sizes on standard pricing.

- For the largest merchants on standard pricing with annual card turnover greater than £50 million, the value of the IFR effect is also close to zero (0.519) but positive and statistically significant. However, for the reasons explained in paragraph 1.64, the interchange fee savings for this group were also very small – there was little IFR saving to pass through. We do not think it appropriate to come to a finding on the basis of the comparison of these two small numbers for an idiosyncratic group of merchants. Our sample also reveals a significant reduction in the number of largest merchants on standard pricing after the IFR caps came into force, and a corresponding increase in merchants on IC++ pricing, suggesting many of these could have benefited from the IFR caps by moving pricing option.
- For merchants with annual card turnover between £15,000 and £50 million, the IFR dummy is between 0.12 (group 5) and 0.18 (group 2), and higher than or not significantly different from the average reduction in their interchange fees, between 0.12 (group 6) and 0.16 (group 2), indicating that, on average, these merchants received little or no pass-through of the IFR savings.
- For completeness, we include the results for merchants with annual card turnover up to £15,000. However, for the reasons explained in Box 2, we do not place weight on the econometric results and make no finding about the degree of IFR pass-through for merchants up to £15,000.

**1.72** Overall, these results indicate that, on average, merchants with turnover between £15,000 and £50 million received little or no pass-through of IFR savings and that the supply of card-acquiring services is not working well for this group.

#### **Box 4: Calculating the annual benefit of the IFR caps**

Our analysis shows that merchants on IC++ pricing received full pass-through of IFR savings, while merchants on standard pricing did not. Our statistics on interchange fees show that average interchange fees on capped consumer credit card transactions fell significantly following the IFR coming into force, while average interchange fees on consumer debit card transactions were already at a level close to that of the IFR caps.

We therefore calculate the annual benefit of the IFR by estimating the value (in 2018) of the IFR savings on capped consumer credit card transactions that were passed through to merchants on IC++ pricing.

We did this calculation in three steps:

1. The customer lists obtained from the five largest acquirers for the merchant survey gave us total card turnover in 2018 in each of the merchant groups we used for the pass-through analysis (see paragraph 1.8). The samples supplied by the five largest acquirers for the pass-through analysis gave us an estimate of the proportion of merchants on IC++ pricing in each of the merchant size segments. As we have set out in Box 3, the pass-through samples did not include merchants with very high levels of annual card

turnover (above £6 billion), so we have assumed that all merchants with annual card turnover over £500 million have IC++ pricing (or would have had full pass-through in any event). Putting these two sets of estimates together gives us an estimate of £507 billion as the 2018 card turnover of IC++ merchants (77% of the total £659 billion turnover in 2018 of all merchants listed on the customers lists).

2. Data provided by acquirers and payment facilitators showed that 22% of card turnover arose from capped consumer credit cards, so we therefore estimate that the value of capped consumer credit card transactions accepted by IC++ merchants in 2018 was £111 billion.
3. The samples supplied by the five largest acquirers for the pass-through analysis allowed us to estimate the average reduction in interchange fees on capped consumer credit card transactions involving IC++ merchants between 2014 and 2017 as 0.56%. If this reduction was passed through to these merchants in full in 2018 (on the turnover of £111 billion) this gives us our estimate of the annual value of the IFR savings as **£617 million**.

We recognised that the underrepresentation of merchants with very high levels of annual card turnover in our sample could have affected the third step of this calculation, so we compared our 0.56% estimate of the interchange fee reduction with the 0.40% estimate in the European Commission's report on the application of the IFR. The European Commission's estimate was based on data from Mastercard and Visa so it has the strength of being based on virtually the whole market rather than a sample. It was for all merchants and all credit cards and for the period 2015 to 2016. Applying our methodology to all merchants in the sample and to all credit cards for 2015 to 2016 gave us an estimate of the interchange fee reduction of 0.40% which gave us confidence in the reliability of our methodology.

We considered two alternative estimates.

Our estimate of the IFR savings of 0.56% was for IC++ merchants only, while for all merchants in the sample the estimate was 0.60%. Merchants with very high levels of annual card turnover were not included in either sample and using the lower estimate of the IFR reduction raises our estimate of the value to **£665 million**.

Our data comes from the five largest acquirers who accounted for nearly 90% of transactions by number and value at UK merchants in 2018. If all other acquirers had the same share of merchants on IC++ pricing, our estimate of the total value of the IFR reduction would rise by 12% to **£691 million**.

Both adjustments together would give an estimate of **£745 million**. These sensitivity checks, together with the fact that we include no gains for debit card transactions, show that our main estimate may be conservative.

## Alternative specifications

**1.73** As explained in the section on methodology, there are several ways to approach the question of whether acquirers passed through IFR savings to merchants. In the previous section, we presented in more detail the results presented in Chapter 5 of the final report, based on econometric analysis in which the interchange fee margin is the dependent variable (the baseline model). To check the sensitivity of our results, we now present the results of three alternative analyses:

- Using acquirer net revenue as the dependent variable (model 3 in paragraph 1.14 above).
- Using MSC as the dependent variable (model 1 in paragraph 1.14 above).
- Using MSC as the dependent variable but not including an IFR dummy (referred to as model 4 in paragraph 1.82 below).

### Acquirer net revenue as the dependent variable (model 3)

**1.74** We explain above that if acquirers are passing IFR savings through to merchants, we would expect to see the interchange fee margin remaining flat. In this model, we need to control for other variables that may impact the interchange fee margin, including scheme fees.

**1.75** To check the sensitivity of the findings from our baseline model, we conduct analysis using acquirer net revenue, defined as MSC minus interchange fees minus scheme fees, as the dependent variable. If cost decreases and increases are being fully reflected in the MSC (and there is no change in acquirers' other costs), acquirer net revenue will remain flat.

**1.76** Table 20 in the additional tables for reference section summarises the findings from this analysis. The results for the IFR dummy are consistent with the findings from the analysis using the interchange fee margin as a dependent variable (the baseline model). This specification implies an assumption that the coefficient of the scheme fees is equal to 1. However, for most groups in the baseline model and model 1 the coefficient of the scheme fees is significantly greater than 1, so on statistical grounds the baseline model (with the interchange fee margin as the dependent variable) or model 1 (with MSC as the dependent variable) are preferred to model 3 (in which acquirer net revenue is the dependent variable). All three models however imply that scheme fee changes are fully passed through.

### MSC as a percentage of turnover as the dependent variable with an IFR dummy (model 1)

**1.77** Because we are using the introduction of the IFR caps to investigate pass-through, our baseline model focuses on interchange fee margin as the dependent variable (see paragraph 1.16). Using MSC as a percentage of turnover as the dependent variable instead has the advantage that we can examine the relationship between MSC and interchange

fees and the relationship between MSC and scheme fees separately. This allows us to examine whether there has been asymmetric pass-through, where cost *increases* (in scheme fees) are passed through, while cost *decreases* (in interchange fees) are not, as well as providing an estimate of general pass-through of interchange fees.

**1.78** We regress MSC as a percentage of turnover on average interchange fees, average scheme fees, the IFR dummy and other control variables. The findings are presented in Table 21 in the *Additional tables for reference* section. This specification allows for the coefficient of the interchange fees and scheme fees to vary. For most groups, the coefficients of the interchange fee and scheme fees variable are close to 1.

**1.79** The IFR dummy is close to the dummy in the baseline model. The impact of the IFR caps on MSC is calculated by adding the coefficient on the IFR dummy and the interchange fee variable and multiplying this with IFR savings (presented in Table 8). The results do not contradict the findings from the analysis using the interchange fee margin as a dependent variable and, on average, merchants with turnover between £15,000 and £50 million received little or no IFR pass-through.

**1.80** In addition, we find that increases in scheme fees appear to be passed through in full for all merchant groups. This points to asymmetric pass-through in the sense that increases in scheme fees over time and changes over time in interchange fees (except the IFR reduction) both seem to be passed through, but the step reduction in interchange fees associated with the IFR was not passed through. We look at pass-through of scheme fees in more detail in the section entitled 'pass-through of scheme fees'.

**1.81** As discussed below, in response to our interim report Worldpay and GPUK told us that we should have focused on this model rather than our baseline model. Worldpay noted that the results of Model 1 presented in Table 20 of the interim report (Table 21 below) showed that there were high levels of pass-through during the period. We respond to this submission at paragraph 1.124 below.

### MSC as a percentage of turnover as the dependent variable with no IFR dummy (model 4)

**1.82** As discussed at paragraph 1.118 below, in response to the interim report GPUK's advisers and Worldpay said that we should have used a model without an IFR dummy variable and which had the MSC as the dependent variable.<sup>31</sup> While for the reasons set out below we do not think this is an appropriate way to investigate the IFR pass-through rate, for completeness, we include the results of models where the MSC is the dependent variable but which do not include an IFR dummy variable.<sup>32</sup>

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31 GPUK technical annex, page 5-6. Worldpay's response paragraphs 3.41 to 3.45.

32 This model is the one used to estimate scheme fees pass-through in the interim report with the results presented in Table 15.



**1.83** We can estimate the general pass-through rate in a model with the MSC as a dependent variable. The general pass-through rate can be determined by the coefficient in front of the interchange fee variable.

**1.84** Mathematically, this model can be described as:

$$MSC_{it} = \alpha_i + \beta_1 IF_{it} + \beta_3 SF_{it} + \sum_k \gamma_k x_{kit} + \varepsilon_{it} \quad (4)$$

**1.85** Tables 15, 23 and 24 present the results of three models: one which assumes that changes in the interchange fee are instantaneously passed through to merchants through changes in the MSC (Table 15); another model which assumes that pass-through is more gradual and occurs over three periods (Table 23); and a model with six lags of the interchange fee (Table 24). Lags have been added to account for potential delays in the pass-through of the interchange fees.

**1.86** Table 15 shows that the instantaneous general pass-through rate of interchange fees for merchant groups 1-6 is between 0.42 and 0.64, while it is 0.79 for merchants in Group 7 and 1.06 for merchants on an IC++ tariff. Including three lags decreases the general pass-through rate for merchants in Groups 1 to 5, with merchants in Groups 1 and 2 having markedly lower rates than merchants on an IC++ tariff (0.32, 0.40 and 1.02 respectively, calculated as the sum of the four interchange fee coefficients for each group, as reported in Table 23).

**1.87** These models estimate the *general* pass-through rate of changes in the interchange fee and changes in the MSC. For the reasons set out at paragraphs 1.118 to 1.120 below, we do not think that the *general* pass-through rate provides useful information for the core question we are interested in which is whether the one-off significant IFR reduction was passed through to merchants.

## Additional sensitivity checks

**1.88** This section describes the sensitivity checks we conducted to test the robustness of our findings.

### Weighted regression

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**Issue**

- As explained in Box 1, we draw samples of an equal number of merchants from each of the five largest acquirers.
  - Because we draw samples of equal size from each of the five largest acquirers, each sub-sample consists of a random selection of merchants at a certain point in time. Therefore, equal weight is given to each merchant in the sample, regardless of their annual card turnover or acquirer.
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<b>Alternative approach</b>	<ul style="list-style-type: none"><li>• We re-run our baseline model and weight the observations according to the acquirers' share in the total merchant population in 2016 based on data collected by the PSR.</li></ul>
<b>Findings</b>	<ul style="list-style-type: none"><li>• Table 25 in the additional tables for reference section summarises the results.</li><li>• Looking across groups 1 to 8, we find that the IFR dummy drops slightly. However, these changes are not material, indicating that our baseline correctly identifies the impact of the IFR caps.</li></ul>

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## Seasonality

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<b>Issue</b>	<ul style="list-style-type: none"><li>• Our regressions may be affected by seasonality. Seasonal effects can be correlated with both the dependent and independent variables and may make it more difficult to identify the impact of the IFR caps.</li></ul>
<b>Alternative approach</b>	<ul style="list-style-type: none"><li>• To account for seasonality, we re-run our baseline model and include three quarterly dummies (quarter 1 is the baseline).</li></ul>
<b>Findings</b>	<ul style="list-style-type: none"><li>• Table 26 in the <i>Additional tables for reference</i> section summarises the results.</li><li>• The three quarterly dummies are significant in the regressions for groups 2 to 5, and lose significance from group 6 onwards. This indicates seasonality impacts merchants with lower annual card turnover only.</li><li>• Moreover, we find that the coefficient on the IFR dummy does not change materially, indicating that our baseline correctly identifies the impact of the IFR caps.</li></ul>

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## Delayed pass-through – quarterly lags

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<b>Issue</b>	<ul style="list-style-type: none"><li>• We find that acquirers did not pass IFR savings through to merchants on standard pricing. However, it may be that merchants may not receive pass-through immediately, but with a delay.</li><li>• If it is true that pass-through did occur with a delay, we may see the interchange fee margin increasing initially, then decreasing back to its original level as delayed pass-through takes effect. Alternatively, we may see MSC remaining flat initially, then decreasing.</li><li>• In addition, it is possible that acquirers started lowering the MSC in anticipation of the IFR caps. Assuming these decreases were not passed through, we may see interchange fees increasing before the IFR caps came into force.</li></ul>
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**Alternative approach**

- We enhance our baseline model with two dummies that signify the two quarters immediately prior to December 2015 (to capture lead effects), and four dummies that signify the four quarters after December 2015 (to capture lag effects).
- Note that in a regression with, for example, one post-IFR caps quarterly dummy, the IFR dummy gives us the difference in the interchange fee margin when comparing the entire pre-IFR caps period with the entire post-IFR caps period, except the quarter after the IFR caps came into force. The difference in the interchange fee margin in the first quarter after the IFR caps came into force is obtained by adding the coefficient on that dummy to the coefficient on the IFR dummy. A negative coefficient indicates that the IFR margin increased over time.
- In a regression with, for example, one pre-IFR caps quarterly dummy, the IFR dummy gives us the difference in the interchange fee margin when comparing the entire pre-IFR caps period, except the first quarter prior to the IFR caps coming into force with the entire post-IFR caps period. The difference in the interchange fee margin in the first quarter before the IFR caps came into force is given by the coefficient on that dummy. We do not need to add it to the coefficient on the IFR dummy because in the pre-period the IFR dummy equals 0. A positive coefficient indicates that the IFR margin started increasing before the IFR caps came into force.
- Generally, the more quarterly dummies we include around the IFR caps, the more the IFR dummy will be picking up effects at the beginning and end of our overall period.

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**Findings**

- Table 27 in the *Additional tables for reference* section summarises the results with quarterly dummies.
  - The coefficients on the four lag quarterly dummies are negative. This indicates that the interchange fee margin increased over time. The coefficients on the two lead quarterly dummies are small and positive, indicating that the interchange fee margin started increasing slightly before the IFR caps came into force.
  - Overall, these results suggest that the interchange fee margin started increasing immediately before the IFR caps came into force, then saw a step change around the time the IFR caps came into force, and then, some quarters later, increased further by a little. A possible explanation is that interchange fees fell in anticipation of the IFR caps, but that this decrease was not passed through; and that the margin increased further over time for reasons we haven't controlled for.
  - Overall, the findings do not indicate that pass-through was delayed. However, we only consider a period of up to one year after the IFR caps came into force. In the next sensitivity check, we consider a longer adjustment period.
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## Delayed pass-through – annual lags

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**Issue**

- We examined whether pass-through of IFR savings might be delayed by up to four quarters – a year. We find that this is not the case. However, it is possible that pass-through was delayed by more than a year.

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**Alternative approach**

- To allow for a longer adjustment period, we enhance our baseline model with four annual dummies that capture year-specific effects. Annual dummies give the maximum time possible to see any slow adjustment.
- Note that in a model with year dummies, we do not include the IFR dummy. The coefficient on each year dummy tells us the percentage point increase in the interchange fee margin in that year relative to the base year, 2014, that cannot be attributed to other explanatory variables. A positive coefficient indicates that the IFR margin increased between that year and the base year, so a delayed pass-through would show as the coefficients for subsequent years declining.

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**Findings**

- Table 28 in the *Additional tables for reference* section summarises the results with year dummies. The coefficients on the year dummies are positive and statistically significant for all merchant groups on standard pricing. Moreover, the size of the coefficients increases over the years. This indicates that relative to 2014, the interchange fee margin increases further with each passing year. We do not see evidence of competitive pressures taking time to deliver pass-through. On the contrary, we see the interchange fee margin increasing over time.
- Merchants on an IC++ pricing did not see an increase in margin in any year, which is consistent with our findings.

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## Robust standard errors

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**Issue**

- Our model may be affected by heteroscedasticity and serial correlation, which affects the variance of the ordinary least squares estimator, which is no longer the best linear unbiased estimator (BLUE).

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**Alternative approach**

- We re-run our baseline model with robust standard errors that correct for heteroscedasticity and serial correlation.

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**Findings**

- Table 29 in the additional tables for reference section presents the results for the full sample.

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- We find that the results do not change, as our findings are significant after applying the robust standard error fix. Our key finding of no pass-through for merchants on standard pricing still holds.
  - We also run the model by merchant group, and find that the results do not change.
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## Alternative analysis to address missing data from one acquirer ([X])

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### Issue

- As highlighted in the section 'data issues', one of the acquirers in the sample ([X]) was unable to provide some data at the level of granularity we requested, so there are missing data for several variables in the pre-IFR caps period, 2014 and 2015.
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### Alternative approach

- We address the problem of missing data in our baseline model using an imputation of the data based on other variables (see section on 'data issues').
  - We also do two additional sensitivity checks:
    - We re-run our models excluding these variables.
    - We re-run our baseline model on the four acquirers for which we have complete data, excluding the acquirer with missing data ([X]).
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### Findings

- Tables 30 to 32 in the *Additional tables for reference* section summarise the results excluding the variables with missing data.
  - We find that the results do not change materially for merchants on standard pricing. Our key finding of no pass-through for merchants on standard pricing still holds.
  - Table 33 in the *Additional tables for reference* section summarises the results excluding the acquirer with missing data.
  - We find that the IFR dummy variable for group 1 increases substantially; however, as discussed in Box 2, we do not place weight on the econometric results for group 1. In groups 2 to 8, we find that the results do not change, indicating that our baseline correctly identifies the impact of the IFR caps.
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# New versus longstanding merchants

- 1.89** We examined whether acquirers passed through IFR savings, and found that, for merchants with annual card turnover between £15,000 and £50 million, they did not. This finding indicates that the supply of card-acquiring services may not be working well for these merchants.
- 1.90** We now consider the possibility that acquirers may compete more intensively for new customers<sup>33</sup> by charging them lower prices, while charging longstanding customers higher prices. We also consider the possibility that this may be further intensified after the IFR caps came into force.
- 1.91** To understand whether new customers have a lower MSC than longstanding customers, we compare MSC as a percentage of monthly card turnover across merchants who have been with their acquirers for different lengths of time.
- 1.92** To understand whether competition for new customers intensified after the IFR caps came into force, we compare MSC as a percentage of monthly card turnover across merchants who signed up before and after the IFR caps came into force.<sup>34</sup>

## Length of time with acquirer

- 1.93** As explained in the section 'data and sampling', we requested data on the month and year in which the acquirer first acquired a card transaction for the merchant, that is the month and year the merchant signed up with its current acquirer. We use this information to define an indicator variable, 'customer age', which equals:
- 0 if an observation was recorded within a year of the merchant signing up with its current acquirer
  - 1 if the observation is recorded between one and two years of the merchant signing up with its current acquirer
  - 2 if the observation is recorded between two and three years of the merchant signing up with its current acquirer

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33 New customers could include merchants that switched from other acquirers, as well as those who are new to card payments.

34 For merchants who had left, but later re-joined the acquirer, one of the five largest acquirers (Lloyds) records the date they first contracted with the merchant rather than the date when they contracted with the merchant on their return.

- 3 if the observation is recorded more than three years of the merchant signing up with its current acquirer

**1.94** Table 11 presents the distribution of the customer age. Approximately 70% of merchants in our sample have been with their current acquirer for more than three years.

**Table 11: Distribution of age variable**

Age indicator	Frequency	%	Cumulative %
0	33,335	3.9	3.9
1	97,703	11.42	15.32
2	131,939	15.43	30.75
3	592,329	69.25	100
<b>Total</b>	<b>855,306</b>	<b>100</b>	

Source: PSR analysis using data submitted by the five largest acquirers.

**1.95** To understand whether new customers have a lower MSC than longstanding customers, we regress MSC as a percentage of monthly card turnover on customer age. We include the full set of control variables. As we are primarily interested in the effect of customer age, we do not include the IFR dummy but we introduce this in a second regression as a sensitivity check.

**1.96** Table 12 summarises the findings for the whole sample and by merchant group, respectively.

**1.97** The coefficients on the customer age indicator variables are positive and significant. Moreover, the size of the coefficients increases with customer age. It indicates that the longer a merchant has been with its provider, the higher the MSC they pay. Merchants who have been with their acquirer between one and two years paid 0.07 percentage points more than merchants who have been with their acquirer for less than a year. This increases to 0.14 and 0.21 percentage points for merchants who have been with their acquirers two to three years, and more than three years, respectively.

**Table 12: Regressions with age indicator variable, MSC as dependent variable, by merchant group**

	1	2	3	4	5	6	7	IC++	All sample
<b>Interchange fees</b>	0.5660 ***	0.7273 ***	0.6874 ***	0.6478 ***	0.5414 ***	0.4622 ***	0.7954 ***	1.0417 ***	0.6914 ***
<b>Scheme fees</b>	3.5716 ***	2.0683 ***	2.2102 ***	2.0342 ***	2.5082 ***	2.9133 ***	2.4006 ***	2.4789 ***	2.2173 ***
<b>Log of transaction volume</b>	-0.2258 ***	-0.2009 ***	-0.0794 ***	-0.0639 ***	-0.0583 ***	-0.0450 ***	-0.0105 ***	-0.0026	-0.1605 ***
<b>Proportion of chargebacks</b>	0.0103 ***	0.0148 ***	0.0107 ***	0.0098 ***	0.0195 ***	0.0200	-0.0012*	0.0228 ***	0.0129 ***
<b>Share of face-to-face transactions</b>	0.0006 ***	0.0009 ***	0.0004 ***	0.0010 ***	0.0007 ***	0.0009 ***	-0.0007 ***	0.0006	0.0008 ***
<b>Share of capped credit</b>	0.0011 ***	0.0030 ***	0.0043 ***	0.0040 ***	0.0021 ***	0.0034 ***	0.0037 ***	0.0015 *	0.0028 ***
<b>Share of capped debit</b>	-0.0024 ***	-0.0035 ***	-0.0044 ***	-0.0048 ***	-0.0058 ***	-0.0051 ***	-0.0019 ***	-0.0006	-0.0034 ***
<b>Age indicator</b>									
<b>1</b>	0.1188 ***	0.0781 ***	0.0571 ***	0.0236 ***	0.0368 ***	-0.0196	0.0122	-0.0099	0.0730 ***
<b>2</b>	0.1790 ***	0.1521 ***	0.1135 ***	0.0762 ***	0.0904 ***	0.0342*	0.0336 **	-0.0752 **	0.1388 ***
<b>3</b>	0.2454 ***	0.2309 ***	0.1743 ***	0.1381 ***	0.1116 ***	0.0748 ***	0.0488 ***	-0.0736 *	0.2083 ***
<b>Constant</b>	2.1591 ***	1.7824 ***	1.1200 ***	1.0007 ***	1.1103 ***	0.9834 ***	0.3112 ***	0.2169 **	1.6098 ***
<b>Observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.1034	0.2014	0.3049	0.2876	0.2750	0.2826	0.8052	0.2936	0.1833
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**1.98** The above results suggest that acquirers compete more intensively for new customers. However, there is a possibility that this finding is driven by merchants who signed up with their current acquirer after the IFR caps came into force. To test the sensitivity of the finding, we add in the IFR dummy. Table 13 summarises the findings for the whole sample and by merchant group.

**1.99** Adding in the IFR dummy does not change the finding. The coefficients on the customer age indicator variables for small and medium-sized merchants remain positive and significant, indicating that the longer a small and medium-sized merchant has been with its provider, the higher the MSC they pay. Customer age continues to have a stronger impact on merchants with lower annual card turnover.



**1.100** We consider that our findings regarding customer age are robust for small and medium-sized merchants. However, looking at Table 12 and Table 13 together, the results for customer age are not robust for merchants in Group 6, Group 7 or those on IC++ pricing.

**1.101** Compared with the model without the customer age variable presented as part of our core econometric analysis, the coefficient of the IFR dummy has decreased significantly. This indicates that the lack of pass-through can to some extent (but not completely) be explained by the length of time a merchant has been with their provider and points to a problem of merchant inertia.

**Table 13: Regressions with age indicator variable, interchange fee margin as dependent variable, by merchant group**

Variable	1	2	3	4	5	6	7	IC++	All sample
<b>IFR DUMMY</b>	0.1849 ***	0.1523 ***	0.1440 ***	0.1399 ***	0.1167 ***	0.1415 ***	0.0529 ***	-0.0103	0.1470 ***
<b>Scheme fees</b>	2.9728 ***	1.6053 ***	1.6586 ***	1.3730 ***	1.8939 ***	2.3141 ***	1.6782 ***	2.5416 ***	1.6893 ***
<b>Log of transaction volume</b>	-0.2341 ***	-0.2015 ***	-0.0784 ***	-0.0619 ***	-0.0554 ***	-0.0403 ***	-0.0074 ***	-0.0026	-0.1609 ***
<b>Proportion of chargebacks</b>	0.0107 ***	0.0149 ***	0.0106 ***	0.0095 ***	0.0205 ***	0.0201 ***	-0.0013 *	0.0225 **	0.0130 ***
<b>Share of face-to-face transactions</b>	0.0007 ***	0.0010 ***	0.0003 ***	0.0009 ***	0.0007 ***	0.0011 ***	-0.0007 ***	0.0006	0.0008 ***
<b>Share of capped credit</b>	0.0014 ***	0.0032 ***	0.0044 ***	0.0041 ***	0.0025 ***	0.0050 ***	0.0046 ***	0.0014 *	0.0030 ***
<b>Share of capped debit</b>	-0.0012 ***	-0.0027 ***	-0.0034 ***	-0.0036 ***	-0.0040 ***	-0.0013 **	-0.0003	-0.0008	-0.0024 ***
<b>Age indicator</b>									
<b>1</b>	0.1105 ***	0.0644 ***	0.0455 ***	0.0099 *	0.0295 ***	-0.0262	0.0058	-0.0083	0.0614 ***
<b>2</b>	0.1531 ***	0.1219 ***	0.0881 ***	0.0502 ***	0.0782 ***	0.0138	0.0137	-0.0730 **	0.1130 ***
<b>3</b>	0.1911 ***	0.1565 ***	0.1041 ***	0.0722 ***	0.0766 ***	0.0255	0.0024	-0.0700 *	0.1415 ***
<b>Constant</b>	1.8494 ***	1.5873 ***	0.9161 ***	0.7704 ***	0.7814 ***	0.4461 ***	0.1130 ***	0.2503 ***	1.3964 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0831	0.1433	0.2148	0.2041	0.1923	0.2869	0.3995	0.0281	0.1261
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

## Merchants joining after the IFR caps

- 1.102** Finally, we examine whether merchants who signed up with their acquirers after the IFR caps came into force get a better deal by regressing MSC on the usual explanatory variables,<sup>35</sup> plus a dummy that equals 1 if a merchant signed up with their acquirer after December 2015. For this analysis, we only use the two samples starting at January 2016 and January 2017.
- 1.103** Table 14 summarises the findings for the whole sample and by merchant group. The coefficient on the dummy is negative, indicating that merchants who signed up with their provider after the IFR caps came into force pay 0.14 percentage points less. This is true across all merchant groups. Finally, our sample does not contain any group 7 merchants who joined after December 2015. This suggests that many of the largest merchants with annual card turnover of above £50 million were able to benefit from the IFR caps by moving to IC++ pricing.
- 1.104** We also find that merchants who were on IC++ pricing and joined after the IFR caps came into force did not pay a lower MSC (%) than those who joined before, which is in line with the finding that all merchants on IC++ pricing received full pass-through of the IFR savings.

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35 But no merchant fixed effects because here we are looking at inter-merchant differences.

**Table 14: Regressions with dummy for merchants who joined after the IFR caps came into force, MSC as dependent variable, by merchant group**

Variable	1	2	3	4	5	6	7	IC++	All sample
<b>Joined after IFR Dummy</b>	-0.1980 ***	-0.1899 ***	-0.1163 ***	-0.0883 ***	-0.0750 ***	-0.0148		-0.0825 *	-0.1413 ***
<b>Interchange fee (%)</b>	0.6343 ***	1.0350 ***	0.9572 ***	1.2192 ***	1.0995 ***	0.9917 ***	1.1424 ***	0.8390 ***	1.1270 ***
<b>Scheme fee (%)</b>	5.7945 ***	9.8830 ***	5.7598 ***	4.6276 ***	5.7137 ***	1.2892 ***	0.2155	4.5504 ***	11.8541 ***
<b>Log of transaction volume</b>	-0.0110 *	-0.0583 ***	0.0582 ***	0.0314 ***	0.0129 ***	0.0348 ***	0.0134 ***	-0.0161 ***	-0.1283 ***
<b>Proportion of chargebacks (%)</b>	0.0018	0.0085 ***	0.0152 ***	0.0058 **	0.0376 ***	0.0107	-0.0000	0.0134 ***	0.0060 ***
<b>Share of value of face-to-face transactions</b>	0.0003 *	-0.0001	-0.0019 ***	-0.0021 ***	-0.0014 ***	-0.0014 ***	-0.0011 ***	-0.0005 ***	0.0007 ***
<b>Share of capped credit transactions</b>	0.0025 ***	0.0007 ***	0.0004 ***	0.0017 ***	0.0007 ***	0.0036 ***	0.0031 ***	0.0017 ***	0.0008 ***
<b>Share of capped debit transactions</b>	-0.0013 ***	-0.0026 ***	-0.0050 ***	-0.0026 ***	-0.0036 ***	-0.0004	0.0005	-0.0013 **	-0.0011 ***
<b>Constant</b>	1.6415 ***	1.1619 ***	0.7088 ***	0.4977 ***	0.5166 ***	0.0079	-0.0838	0.3105 ***	1.1914 ***
<b>Number of observations</b>	27,893	213,059	58,902	38,472	18,939	2,019	466	1,817	362,066
<b>R-squared</b>	0.0444	0.1628	0.3361	0.3743	0.4590	0.6175	0.5829	0.4102	0.2226

Source: PSR analysis using data submitted by the five largest acquirers.

# Pass-through of scheme fees

- 1.105** Our core analysis focuses on pass-through of IFR savings, that is, decreases in interchange fees specifically related to the coming into force of the IFR caps in December 2015. Stakeholders also told us that scheme fees have increased significantly in recent years. This represents an increase in acquirers' costs. If acquirers passed these increases on to merchants, while at the same time holding on to IFR savings – that is, they passed through cost increases and decreases through *asymmetrically* – this could constitute further evidence that the supply of card-acquiring services is not working well for merchants because it would suggest that acquirers did not face competitive pressures to absorb cost increases or to pass through cost decreases.
- 1.106** Annex 4 assesses whether scheme fees have increased and finds that they increased significantly over the period 2014 to 2018. In this section of this annex, we consider whether increases in scheme fees were passed through to merchants.
- 1.107** We re-run the regression using MSC as the dependent variable, but do not include the IFR dummy. A positive, significant coefficient on scheme fees would indicate they were passed through to merchants.
- 1.108** Table 15 summarises the results for the whole sample and by merchant group, respectively. It shows acquirers passed through increases in scheme fees in full to merchants in all groups.
- 1.109** However, as noted in the section on 'data issues', we have some concerns around the data on scheme fees, and the evidence is therefore less strong.

**Table 15: Regressions without IFR dummy, MSC as dependent variable, by merchant group (pass-through of scheme fees)**

Variable	1	2	3	4	5	6	7	IC++	All sample
<b>Interchange fees</b>	0.5036 ***	0.6421 ***	0.6036 ***	0.5729 ***	0.4926 ***	0.4208 ***	0.7940 ***	1.0678 ***	0.6128 ***
<b>Scheme fees</b>	3.9464 ***	2.5838 ***	2.6436 ***	2.4583 ***	2.8197 ***	3.2600 ***	2.6023 ***	2.3048 ***	2.6947 ***
<b>Log of transaction volume</b>	-0.2219 ***	-0.1958 ***	-0.0766 ***	-0.0625 ***	-0.0574 ***	-0.0434 ***	-0.0117 ***	-0.0037 ***	-0.1567 ***
<b>Proportion of chargebacks</b>	0.0105 ***	0.0149 ***	0.0107 ***	0.0099 ***	0.0198 ***	0.0187 ***	-0.0013 *	0.0230 ***	0.0130 ***
<b>Share of face-to-face transactions</b>	0.0006 **	0.0009 ***	0.0003 ***	0.0010 ***	0.0007 ***	0.0008 ***	-0.0007 ***	0.0006 ***	0.0008 ***
<b>Share of capped credit</b>	0.0010 ***	0.0030 ***	0.0043 ***	0.0040 ***	0.0020 ***	0.0034 ***	0.0039 ***	0.0015 *	0.0028 ***
<b>Share of capped debit</b>	-0.0026 ***	-0.0038 ***	-0.0046 ***	-0.0049 ***	-0.0060 ***	-0.0051 ***	-0.0018 ***	-0.0005 ***	-0.0036 ***
<b>Constant</b>	2.3699 ***	1.9847 ***	1.2910 ***	1.1334 ***	1.2279 ***	1.0407 ***	0.3496 ***	0.1491 ***	1.7976 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0986	0.1915	0.2914	0.2745	0.2659	0.2707	0.8004	0.2900	0.1745
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

# Stakeholder responses to the interim report

- 1.110** We received a range of feedback on our pass-through analysis in the interim report. The specific submissions made, and our responses, are set out below.
- 1.111** Before doing this we think it useful to set out our approach to the econometric exercise, and to explain why we think that the baseline model is the most appropriate way of investigating the extent to which the IFR reduction was passed through to merchants in the form of lower MSCs.
- 1.112** As discussed above at paragraphs 1.7 and 1.67, we used the extent to which the savings associated with the introduction of the IFR caps were passed through to merchants (IFR pass-through) as an indicator of the strength of competition in the supply of card-acquiring services.
- 1.113** The descriptive statistics presented in Tables 6 and 7 above appear to show a step *increase* in the IF margin coincident with the IFR reduction for small and medium-sized merchants (groups 2 to 6). In other words, they show that acquirers' margins increased, rather than remaining constant, after the IFR caps were introduced which suggests that the IFR reductions were not passed through to merchants.
- 1.114** The econometric analysis is essentially a robustness check on the descriptive statistics. In order to capture the step effect of the IFR (that is, the significant one-off reduction in an input cost) we decided that the best way was to use a model that included an 'IFR dummy' to measure this apparent step effect. The IFR dummy takes the value of zero in the periods prior to December 2015, and 1 in the periods after January 2016.
- 1.115** As discussed below, we have given careful consideration to the arguments advanced by some stakeholders about our approach and, in particular, our preference for the use of the baseline model over other models. However, our judgement is that the statistical evidence supports an approach which:
1. Separates the one-off *IFR* pass-through from *general* pass-through of other interchange fee changes; and
  2. Assumes that *general* pass-through of other IF changes is set at 100%, as this allows us to focus specifically on the extent to which the significant one-off reduction in interchange fees associated with the IFR was passed through (*IFR* pass-through effect).

## Specific submissions on methodology and approach

### Use of the pass-through analysis to assess the intensity of competition

- 1.116** GPUK and Worldpay told us that in their view the pass-through analysis cannot be used to assess the intensity of competition.<sup>36</sup> GPUK's advisers and Worldpay noted as an example that the extent to which cost increases are passed through to prices can depend on the demand and supply conditions.<sup>37</sup> Worldpay told us that it is not possible to conclude what level of pass-through is consistent with competition problems.
- 1.117** *Our response:* We agree that there are specific and limited circumstances in which non-pass through of cost reductions could be consistent with a high degree of competition (for example, where other forces are driving up costs at the same time). However, no specific evidence was provided to us that these circumstances were relevant to the current exercise which focuses on the assessment of whether a cost *reduction* associated with the IFR was passed through to merchants.

### IF margin model vs MSC model without an IFR dummy

- 1.118** Worldpay and GPUK both told us that we should have focused our attention on model 4 (which focuses on changes in the merchant service charge) rather than on our baseline model (which focuses on changes in the interchange fee margin).<sup>38</sup>
- 1.119** *Our response:* As explained, the purpose of the econometric exercise was not to estimate the *general* level of pass-through, but rather to investigate how the MSC changed in response to the significant reduction in the level of interchange fees associated with the IFR (*IFR* pass-through). Given the substantial reduction in interchange fees associated with the IFR, understanding whether it resulted in lower MSCs provides useful insights into the state of competition in the card-acquiring market.
- For the reasons already outlined above (see paragraphs 1.4 and 1.67) we consider that the baseline model is the most appropriate model to use for the core question we are interested in for the following reasons: First, models which include an IFR dummy variable perform better than models where it is excluded. This can be seen by comparing the results in Table 21 which includes an IFR dummy with Table 15 which does not. The IFR dummy is highly significant, and the coefficients on the IF variable showing general pass-through are higher than in Table 15 which does not include an IFR dummy. While both of these models have MSC as the dependent variable, a comparison of Table 21 (model with an IFR dummy) and the baseline

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36 GPUK response, paragraph 3.5 and Worldpay's response, paragraph 3.52.

37 GPUK technical annex, section 2. Worldpay's response, footnote 214.

38 See footnote 31.

model (Table 10) is essentially presentational – one model has general IF pass-through close to 1, the other just assumes it is 1.

- Second, the baseline model focuses on the evolution of the difference between the MSC and interchange fees ('the interchange fee margin'). This is a useful way to look at the relationship between the MSC and interchange fees because it allows for straightforward interpretation – if the interchange fee margin remains flat over time (after controlling for other factors that affect the MSC), it indicates that the MSC and interchange fees moved in parallel with each other. This in turn indicates pass-through of IFR savings in the form of lower MSCs. On the other hand, models that focus on changes in the MSC over the period do not tell us about the 'IFR pass-through rate'.

**1.120** For completeness we have presented alternative ways of modelling the relationship between changes in interchange fees and changes in the MSC in this annex. While these alternative models provide insights into general levels of pass-through none of the alternative models changes our assessment about whether the IFR reductions were passed through to small and medium-sized merchants in the form of lower MSCs (that is, the IFR pass-through rate).

### The assumption of 100% pass-through in the baseline model

**1.121** GPUK were also critical of the baseline model used by the PSR noting that it assumes pass-through was 100% and that, in their view, it is therefore the wrong model on which to draw conclusions about pass-through.<sup>39</sup>

**1.122** *Our response:* We agree that it is correct that the baseline model assumes 100% general pass-through. The reason we make this assumption is that it allows us to separate our focus on *IFR* pass-through from *general* pass-through. In other words, the baseline model allows us to focus on the specific question of whether the significant one-off reduction in interchange fees associated with the IFR was reflected in changes in the interchange fee margin, assuming that the general or long-term level of pass-through of interchange fee is one. The degree of IFR pass-through in the baseline model is indicated by the regression coefficient in front of the IFR dummy variable.

### High levels of general pass-through

**1.123** Another criticism made by GPUK and Worldpay of the pass-through analysis presented in the interim report is that the results of models without an IFR dummy actually show high levels of *general* pass-through.<sup>40</sup>

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39 GPUK's response, paragraph 3.10.

40 GPUK's response, paragraph 1.4.1. Worldpay's response, paragraphs 3.33 to 3.40.



- 1.124** *Our response:* We agree that the results of these alternative specifications show regression coefficients on the interchange fee (IF) variable that are significantly larger than 0 implying partial pass-through (for example, Table 15), and indeed as explained above, we assume full general pass-through in our preferred baseline model. However, as discussed above we do not consider that a model without an IFR dummy is the best way to describe the data (see paragraph 1.119).
- 1.125** We think that the best way to describe the relationship between interchange fees and MSC is that up to the end of 2015 and then from the start of 2016 onwards, changes in MSC seem to reflect changes in interchange fees (including the changes in debit card interchange fees in early 2015 and mid 2016) and our baseline model takes this on board by assuming full pass-through. However, the one-off step change in credit card interchange fees at the end of 2015 (the IFR reduction) is not reflected in the MSC, and the associated change in the interchange fee margin is measured by the IFR dummy.

## PSR consultation on the baseline model

- 1.126** Worldpay in its submission was critical of the fact that, in its view, the PSR did not consult on the baseline model at the start of the project.<sup>41</sup>
- 1.127** *Our response:* In our view the baseline model is a natural evolution of the model that was consulted on that allows us to focus specifically on whether the IFR reduction was passed through to merchants: the IFR pass-through rate.
- 1.128** In any event, our consultation document published in February 2019 did not set out a preferred model. Rather it sets out our current thinking, at that time, on the econometric methodology we proposed to follow, but specifically noted that the approach would be refined and updated as the analysis progressed, and that as a consequence, the final analysis might depart significantly from what we set out in that consultation document. We also noted that we would explain how the analysis has evolved in the interim report of our market review.
- 1.129** Among the approaches discussed was one '[which] seeks to determine how the level of MSC responded to changes to the interchange fees by looking at the difference in the level of the MSC between groups of merchants. We would expect one category (merchants paying interchange plus plus tariffs) to enjoy full pass-through of the IFR caps, noting that, under full pass-through, we would expect the difference between the two groups of merchants to be largely the same before and after the IFR caps.'

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41 Worldpay response, paragraph 3.31.

## The dummy variable approach does not capture the fact that interchange fees on debit card transactions did not change in December 2015

- 1.130** Worldpay told us that the dummy variable approach we have adopted does not measure IFR pass-through as over [X]% of transactions (capped debit card and non-capped card transactions) in the interim report's analysis experienced no change in interchange fees in December 2015. They note that capped debit card transactions account for [X]% of all transactions and that interchange fees on debit card transactions changed in March 2015 and in September 2016 following changes by Visa to its interchange fee rates, not December 2015.<sup>42</sup>
- 1.131** *Our response:* While it is correct that the dummy variable used in our modelling takes a value of 1 from the period after December 2015, we note that the largest reduction in interchange fees associated with the IFR was for capped credit cards (see Figures 2 and 3 above) and that the reductions in interchange fees for debit cards was much less significant (Figures 2 and 4). In addition, the analysis does capture changes in the debit card interchange fees in the general pass-through rate.
- 1.132** To ensure the robustness of our analysis we have run sensitivity tests that have involved moving the dummy variable to capture the reduction in debit card interchange fees in September 2016. This does not materially change the results.

## Assumption about whether interchange fee reductions are instantaneously passed through to merchants

- 1.133** Worldpay told us that we wrongly assume that the IFR reductions are instantaneously passed through to merchants. They state that some customers' MSCs may be set in contracts and will not change until the contract is renegotiated.<sup>43</sup> In their adviser's view, the analysis should have included lag variables up to six months to reflect the gradual reduction in prices.<sup>44</sup>
- 1.134** *Our response:* We do not agree that we did not take account of the fact that there may be timing effects associated with the pass-through of the IFR reduction. As described under *Additional sensitivity checks* above, we applied quarterly and annual 'lags' to the IFR dummy to the baseline model to take account of the fact that IFR reductions may have been delayed.
- 1.135** Specifically, our modelling has sought to capture the fact that there may be timing effects associated with the pass-through of the IFR by including 'quarterly lags' and 'annual lags'. Tables 27 and 28 below show the results of the baseline model which includes 'quarterly lags' and 'annual lags', respectively. These quarterly and annual 'lags' are additional dummy variables introduced into the baseline model to supplement the IFR dummy

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42 Worldpay's response, paragraphs 3.20 to 3.24.

43 Worldpay's response, paragraph 3.41b.

44 Worldpay technical annex, paragraphs 4.22 to 4.24.

(they are not therefore traditional 'lag' variables, which are simply lagged explanatory variables). We include these dummy variables to investigate whether there was delayed pass-through of the IFR effect – the quarterly dummies model investigates whether there was a short delay (or anticipation) in the passing through of the IFR reductions; the annual dummies model investigates the possibility that competitive pressures in the market might have taken a longer period of time to feed the IFR changes through.

- 1.136** Our approach differs to what has been proposed by Worldpay which is based on lagging the IF variable in models where the MSC is the dependent variable and with no IFR dummy (Model 4 above, see Table 15). However, for completeness we have included three- and six-month lags of the IF explanatory variable to Model 4 as suggested by Worldpay and report the results in Tables 23 and 24 below. These show generally smaller overall pass-through rates for interchange fees than the estimates without lags.
- 1.137** In summary, while adding lag variables to Model 4 shows us how *general* pass-through of changes in the IF relate to the MSC over time, they do not provide us with information about how the one-off IFR reduction was fed through to MSC over time (the IFR pass-through). In contrast, our approach presented in Tables 27 and 28 is based on lagged IFR dummy variables and focuses on the IFR pass-through, providing us with better estimates of the full extent of IFR pass-through.

### The need to include time trend or cost trend variables in the models

- 1.138** GPUK and Worldpay told us that the analysis in the interim report was flawed because it did not include all relevant explanatory variables related to transaction type, cost and time trend. As such, in their advisers' view, changes in the supply of card-acquiring services over time (for example, increasing demand for card payments) are partially captured by the IFR dummy. A time trend will also capture cost increases over time.<sup>45</sup>
- 1.139** *Our response:* We did not include a time trend variable in the models for the following reasons.
- First, for the reasons described above, our focus in the baseline model was on the effect of the IFR reduction (a step change) on the dependent variable (the IF margin) and not factors which may have led to general changes in the IF margin over time. Including a time trend variable in the baseline model would capture any changes in the dependant variable regardless of their origin, over the four-year period.
  - Second, we were not provided with a convincing explanation for why a time trend variable is needed (for example, what might explain why interchange fee margins increased over time?). Similarly, as discussed at paragraph 1.148, while we were provided with broad estimates of costs – some of which were from 2018 onwards – no specific evidence was presented on why unit costs might have generally increased over the four-year period examined.

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<sup>45</sup> GPUK's response paragraphs 3.11 and 3.23. Worldpay's response, paragraph 3.28d. Worldpay technical annex paragraph 2.9. GPUK technical annex, section 3.3.

- Third, even if we assumed that IFR margins or costs increased over the four-year period no explanation was provided for why the increases only affected the IF margins for smaller and medium-sized merchants but not merchants on IC++ pricing.
- Fourth, we modelled changes in IF margin and MSC as a percentage of transaction values. We have not been provided with evidence to support the proposition that costs have been driven up by rising demand, and certainly not that they have been driven up more than transactions value.
- Finally, a time dummy variable and a time trend measure similar effects: one focuses on a step change and another on more gradual changes. This can be seen by simply looking at the correlation coefficient between both variables which is 0.8. Given such collinearity between the variables it is not surprising that the inclusion of the trend reduces the coefficient of the IFR dummy because in essence both variables are measuring similar sources of variation in the data. In other words, if there is a step already captured by the IFR dummy, adding to the model a time trend variable will undoubtedly pick up some of the unexplained changes and reduce the estimated step effect.

**1.140** Notwithstanding these points, to assess the impact of this we estimated several regressions including a time trend variable to the previously estimated models. The results show that inclusion of the trend halves the IFR coefficient for some groups, but the statistical significance of the coefficient is maintained. We believe that the effects of including a trend do not contradict our main conclusions and are simply masking the impacts estimated for the IFR coefficient.

### Focusing the analysis only on consumer cards

**1.141** GPUK and Worldpay told us that because the IFR only applied to consumer cards, PSR needed to only conduct analysis on capped consumer cards, and not include commercial card transactions.<sup>46</sup>

**1.142** *Our response:* We focused on capped and uncapped card transactions because we wanted to understand how competition was working in the sector as a whole, and not just a sub-segment. We used the implementation of the IFR as a natural experiment to make inferences about the competitive state of the supply in the card-acquiring market.

**1.143** More practically, we do not have data on the MSC disaggregated into consumer and commercial card transactions for all acquirers. Performing our analysis on the data of only a limited number of acquirers means that (<math>[<math>]%)</math> of our data is excluded in a non-random way, and that the share of supply covered by our analysis drops significantly.

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46 See GPUK's response, paragraph 3.22. Worldpay's response, paragraph 3.41, 3.45.

## Focusing the analysis on transaction volumes rather than values

**1.144** Barclays indicated that we should have used transaction volumes rather than values in order to account for declining average transaction values.<sup>47</sup>

**1.145** *Our response:* We do not consider that Barclays provided sufficient supporting evidence that we should have used transaction volumes rather than values. For instance, [redacted].<sup>48</sup>

## Control variables for chargeback risk and the proportion of face-to-face transactions in the models

**1.146** Worldpay's advisers told us that we should not have included chargebacks as proxy for merchant risk as this risk is already captured in the fixed effects.<sup>49</sup> One acquirer told us that it did not consider that the share of face-to-face transactions is a key determinant of the MSC.<sup>50</sup>

**1.147** *Our response:* We do not agree that we should remove these two control variables for the following reasons:

- First, the fixed effects are merchant-specific dummy variables, which means that *inter-merchant* differences in the data do not contribute to our reported estimates. Worldpay is correct to note that such inter-merchant differences are accounted for by the fixed effects; however, the purpose of including these two control variables (share of face-to-face and chargeback risk) is to capture *intra-merchant* differences over time. That is, whether a specific merchant processes more (or less) face-to-face transactions over the period examined, or whether the chargeback risk faced by a merchant changed over the period examined.
- Second, the results of baseline model presented in Table 10 show that both of these variables (chargeback risk and face-to-face transactions) were in most, though not all, cases statistically significant. It appears therefore that merchants whose chargeback rates increased over time or whose proportion of online sales increased over time faced, other things equal, higher merchant service charges. Omitting these variables could bias the estimates of the other variables (notably the IFR dummy and the IF variable).
- Finally, we have re-run our analysis excluding chargeback risk and the share of face-to-face transactions as control variables from the models used in the final report. This has limited impact on the results.

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47 Barclays' response, paragraph 23.

48 [redacted]

49 Worldpay's response, paragraph 3.42. Worldpay technical annex, paragraphs 3.32 to 3.40.

50 [redacted].

## Changes in 'other costs' and quality

- 1.148** Worldpay told us that PSR has not appropriately taken account of quality changes in the analysis.<sup>51</sup> GPUK told us that the modelling does not take account of changes in other costs,<sup>52</sup> while Barclays submitted that the analysis does not take account of the very large investments made in the acquiring business.<sup>53</sup>
- 1.149** *Our response:* We would expect firms to invest in improved/new services in the ordinary course of business, particularly as service quality is an important factor for merchants' choice of provider. We also note that firms would have to make investments in their services in order to achieve compliance with new regulatory requirements, for example the new IFR obligations introduced during the period we were concerned with. However, in this instance, limited evidence was provided to us to show how specific investments led to improved/new services during the period under investigation. For instance, in their responses to the interim report, Barclays and GPUK both refer to investments made during 2018 or 2019, [3<]. Furthermore, it is not clear to what extent the IFR savings made by acquirers directly led to improved/new services. Accordingly, we consider that the acquirers have not clearly shown the extent to which the costs of specific investments could explain the increases in the interchange fee margin over the period 2014 to 2018. We therefore do not consider that investments in improved/new services explain the lack of pass-through of the IFR savings to merchants with annual card turnover up to £50 million.

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51 Worldpay's response, paragraph 3.5c, 3.117.

52 GPUK's response, paragraph 3.23.

53 Barclays' response, paragraph 33-34.

# Changes to results of baseline model

- 1.150** For the purposes of comparison between the interim report and the final report Table 16 sets out the values of the coefficients for the IFR dummy for the baseline model in the two reports. This shows the impact on the results of the revised approaches we have adopted in the final report to outliers and imputing the missing scheme fees. This table shows that, with the exception of Group 1 merchants, most results do not materially change.
- 1.151** As described in Box 2 above, Group 1 merchants have unique characteristics: their monthly card turnover can fluctuate from month to month and some merchants in this group may have months with positive card turnover, followed by months of no card turnover. The bills of these merchants also tend to consist of a disproportionately high fixed cost component, which raises their MSC (%). Given these characteristics we suspect that much of the change to the results for Group 1 between the interim and final reports is a result of the adjustments we have made to outliers which creates a more standard distribution of the MSC (%) for these merchants but may underestimate the importance of the fixed cost element. In any event as discussed above we make no finding in respect of IFR pass-through for Group 1 merchants.

**Table 16: Comparison of the IFR dummy coefficient in baseline model in interim report and final report**

	<b>Baseline Model (interim report)</b>	<b>Baseline Model (final report)</b>
<b>Group 1</b>	0.3261 ***	0.2226 ***
<b>Group 2</b>	0.1742 ***	0.1821 ***
<b>Group 3</b>	0.1390 ***	0.1601 ***
<b>Group 4</b>	0.1367 ***	0.1542 ***
<b>Group 5</b>	0.1141 ***	0.1248 ***
<b>Group 6</b>	0.1218 ***	0.1465 ***
<b>Group 7</b>	0.0459 ***	0.0519 ***
<b>IC++</b>	-0.0225 ***	-0.0200 *
<b>All sample</b>	0.1864 ***	0.1717 ***



# New vs longstanding analysis

- 1.152** In response to the interim report, GPUK and Worldpay challenged our approach to this analysis and suggested that it is not possible to estimate the gains from switching using the available data. They also questioned whether the approach we adopted was robust.<sup>54</sup> GPUK's advisers submit that the analysis does not distinguish between those merchants who are taking up payments for the first time and those that have switched. They also suggest the model should include controls for year.<sup>55</sup> Worldpay's advisers suggest that the interim report's findings can be explained by a time trend and that controlling for start-year shows that there is no price differential.<sup>56</sup>
- 1.153** *Our response:* We accept that it is not possible for us to differentiate between merchants who are new and those which are switching suppliers and the analysis cannot be used to directly estimate the benefits of switching.
- 1.154** The purpose of our analysis was to better understand how prices varied between different types of merchant. We did not differentiate between merchants that are new to card payments and those that are switching provider, so cannot precisely estimate the gains from switching, and it is also possible that merchants who have already switched were those who could gain more from switching. Nevertheless, the analysis shows that small and medium-sized merchants who signed up with their acquirer recently pay less compared to those that have been with their acquirer for several years. Merchants that joined their acquirer after the IFR caps came into force pay less than those that joined before. These results are strongly indicative that many merchants on standard pricing could get better deals by switching.

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54 GPUK's response paragraph 3.16. Worldpay's response, paragraph 4.51.

55 GPUK technical annex, section 4.

56 Worldpay technical annex, section 5.

# Summary

- 1.155** We investigated whether
- the five largest acquirers made savings following the IFR caps coming into force
  - where acquirers did make IFR savings, whether they passed these through to merchants in the form of lower MSCs
  - the pass-through rate varied between different merchant groups
- 1.156** We find that merchants on IC++ pricing received full pass-through of the IFR savings. They are very few in number but account for 70% of transaction value. We estimate the annual benefit to these merchants was around £600 million. Our analysis also reveals a significant reduction in the number of largest merchants on standard pricing after the IFR caps came into force, and a corresponding increase in merchants on IC++ pricing, suggesting that some of the largest merchants may also have benefited from switching to IC++ pricing after the IFR caps came into force.
- 1.157** The statistical evidence indicates that, on average, merchants with annual card turnover up to £50 million got little or no pass-through of the IFR savings.
- 1.158** Moreover, the econometric analysis allows us to control for changes in the characteristics of merchants within each size group, changes in the mix of transactions, and changes in scheme fees. It confirms that, on average, merchants with annual card turnover between £15,000 and £50 million got little or no pass-through of the IFR savings. Because the econometric results for merchants with annual card turnover below £15,000 are not robust we make no finding for this group.
- 1.159** Taken together, the statistical and econometric analysis provide robust evidence that, on average, merchants with annual card turnover between £15,000 and £50 million got little or no pass-through – indicating that the supply of card-acquiring services is not working well for these merchants. The evidence is slightly less clear for merchants with annual card turnover less than £15,000, as we rely only on the evidence of the descriptive statistics for this group.

**1.160** We find that the results hold even after we test the sensitivity of our findings by:

- estimating alternative models with MSC (with and without an IFR dummy) and acquirer net revenue as the dependent variable
- weighting the data by acquirers
- testing for seasonal effects
- checking for delayed pass-through
- re-running the baseline model using robust standard errors
- addressing the issue of missing data for one acquirer

**1.161** Our analysis also shows that small and medium-sized merchants with annual card turnover up to £10 million, on average, pay less if they are a new customer.

**1.162** While our core analysis focuses on pass through of IFR savings, we also considered whether increases in scheme fees were passed through to merchants. For merchants in all groups, scheme fees are passed through by acquirers in full. However, we have some concerns around the data on scheme fees, and the evidence is therefore less strong.

# Additional tables for reference

## Descriptive statistics

**Table 17: Total MSC, interchange fees, scheme fees and value of purchase transactions before and after the IFR caps came into force (in £'000)**

### Total MSC

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All
<b>Pre-IFR</b>	369	10,700	8,359	11,200	24,500	17,500	34,400	47,800	158,000
<b>Post-IFR</b>	774	26,500	21,200	28,800	59,800	42,000	38,200	162,000	384,000
<b>Difference</b>	405	15,800	12,841	17,600	35,300	24,500	3,800	114,200	226,000

### Total interchange fees

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All
<b>Pre-IFR</b>	94	4,117	3,840	5,665	13,700	12,100	25,900	40,200	108,000
<b>Post-IFR</b>	125	6,457	6,193	9,427	23,200	19,300	26,000	123,000	216,000
<b>Difference</b>	31	2,340	2,353	3,762	9,500	7,200	100	82,800	108,000

### Total scheme fees

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All
<b>Pre-IFR</b>	3	156	136	192	546	485	1,827	2,126	5,617
<b>Post-IFR</b>	10	578	538	765	2,005	1,904	2,464	16,000	24,600
<b>Difference</b>	7	422	402	573	1,459	1,419	637	13,874	18,983

### Total value of purchase transactions

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All
<b>Pre-IFR</b>	19,600	909,000	869,000	1,260,000	3,020,000	2,600,000	19,600,000	10,300,000	39,800,000
<b>Post-IFR</b>	42,200	2,270,000	2,200,000	3,270,000	7,730,000	6,280,000	12,600,000	50,000,000	86,000,000
<b>Difference</b>	22,600	1,361,000	1,331,000	2,010,000	4,710,000	3,680,000	7,000,000	39,700,000	46,200,000

Source: PSR analysis using data submitted by the five largest acquirers.<sup>57</sup>

57 One of the acquirers from which we requested data could not provide data for monthly scheme fees paid by its merchants in the years 2014 and 2015, therefore the data underlying this chart shows average scheme fees using imputed data for that acquirer for the years 2014 and 2015.

**Table 18: Average interchange fees on capped and non-capped transactions before and after the IFR caps came into force**

**Fees on capped debit card transactions**

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
Pre-IFR	0.29	0.24	0.19	0.16	0.15	0.15	0.10	0.23	0.22
Post-IFR	0.22	0.21	0.20	0.19	0.19	0.19	0.16	0.21	0.21
Difference	-0.06	-0.03	0.01	0.04	0.04	0.05	0.07	-0.02	-0.01

**Fees on capped credit card transactions**

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
Pre-IFR	0.83	0.84	0.85	0.86	0.88	0.89	0.86	0.79	0.84
Post-IFR	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.30
Difference	-0.53	-0.54	-0.55	-0.56	-0.57	-0.58	-0.56	-0.48	-0.54

**Fees on non-capped card transactions**

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
Pre-IFR	0.77	0.78	0.75	0.77	0.76	0.77	0.66	1.00	0.77
Post-IFR	0.74	0.76	0.79	0.82	0.82	0.86	0.75	0.91	0.78
Difference	-0.03	-0.01	0.04	0.05	0.06	0.08	0.09	-0.09	0.01

Source: PSR analysis using data submitted by the five largest acquirers.<sup>58</sup>

**Table 19: Shares of value of card transactions before and after the IFR caps came into force (as %)**

**Scheme fees**

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
Pre-IFR	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02
Post-IFR	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.03
Difference	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00

**Shares of capped debit card transactions**

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
Pre-IFR	64.84	63.82	60.49	56.27	53.53	59.57	71.33	62.21	61.88
Post-IFR	65.92	66.57	63.89	59.41	56.94	59.40	72.30	64.61	64.71
Difference	1.08	2.75	3.40	3.14	3.41	-0.17	0.97	2.40	2.84

58 One of the acquirers from which we requested data could not separate out the interchange fee for domestic, intra-EEA and international transactions for the years 2014 and 2015. 2014 and 2015 figures in this table are based on data from the other four acquirers.

### Share of face-to-face transactions

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
<b>Pre-IFR</b>	44.32	57.08	57.03	51.29	44.47	36.15	37.21	37.96	54.42
<b>Post-IFR</b>	59.86	69.79	68.17	62.13	49.59	36.82	37.86	41.98	66.35
<b>Difference</b>	15.54	12.71	11.14	10.84	5.12	0.67	0.65	4.02	11.93

### Shares of chargebacks

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
<b>Pre-IFR</b>	0.03	0.03	0.03	0.04	0.03	0.04	0.37	0.03	0.03
<b>Post-IFR</b>	0.03	0.03	0.03	0.04	0.04	0.05	0.17	0.12	0.03
<b>Difference</b>	-0.00	0.00	0.00	0.00	0.02	0.01	-0.20	0.09	0.00

### Shares of capped credit card transactions

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
<b>Pre-IFR</b>	22.35	22.38	25.16	26.99	26.80	24.46	17.99	22.65	23.61
<b>Post-IFR</b>	23.59	22.74	24.84	26.70	25.48	23.54	17.04	23.73	23.73
<b>Difference</b>	1.25	0.36	-0.33	-0.29	-1.32	-0.91	-0.95	1.08	0.12

### Volume of transactions

Time	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	Total
<b>Pre-IFR</b>	29	153	399	673	2,865	18,565	305,484	225,356	2,297
<b>Post-IFR</b>	29	173	465	759	3,099	24,876	133,810	506,755	3,888
<b>Difference</b>	0	20	66	86	234	6,311	171,673	281,398	1,591

Source: PSR analysis using data submitted by the five largest acquirers.<sup>59</sup>

59 One of the acquirers from which we requested data could not separate out the interchange fee for domestic, intra-EEA and international transactions, as well as the scheme fees for the years 2014 and 2015. 2014 and 2015 figures in this table are based on data from the other four acquirers.

## Econometric analysis – alternative specifications

**Table 20: Regressions with acquirer net revenue as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.2258 ***	0.1838 ***	0.1618 ***	0.1557 ***	0.1285 ***	0.1537 ***	0.0548 ***	-0.0161 *	0.1737 ***
<b>Log of transaction volume</b>	-0.2281 ***	-0.1971 ***	-0.0754 ***	-0.0605 ***	-0.0539 ***	-0.0384 ***	-0.0078 ***	-0.0042	-0.1573 ***
<b>Proportion of chargebacks</b>	0.0110 ***	0.0151 ***	0.0107 ***	0.0096 ***	0.0212 ***	0.0243 *	-0.0012 *	0.0217 **	0.0131 ***
<b>Share of face-to-face transactions</b>	0.0007 ***	0.0010 ***	0.0003 ***	0.0009 ***	0.0007 ***	0.0012 ***	-0.0005 **	0.0008	0.0008 ***
<b>Share of capped credit</b>	0.0014 ***	0.0032 ***	0.0044 ***	0.0041 ***	0.0023 ***	0.0043 ***	0.0043 ***	0.0010	0.0030 ***
<b>Share of capped debit</b>	-0.0012 ***	-0.0027 ***	-0.0035 ***	-0.0037 ***	-0.0042 ***	-0.0020 ***	-0.0007 *	-0.0011	-0.0025 ***
<b>Constant</b>	2.0183 ***	1.6977 ***	1.0042 ***	0.8239 ***	0.8683 ***	0.5319 ***	0.1573 ***	0.2765 ***	1.5038 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R2</b>	0.0769	0.1369	0.2036	0.1931	0.1719	0.2491	0.3383	0.0092	0.1194
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 21: Regressions with MSC as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.1584 ***	0.1565 ***	0.1409 ***	0.1333 ***	0.0799 ***	0.1118 ***	0.0461 ***	-0.0145	0.1422 ***
<b>Interchange fee</b>	0.6252 ***	0.8370 ***	0.8717 ***	0.8600 ***	0.6862 ***	0.7276 ***	0.9042 ***	1.0387 ***	0.8086 ***
<b>Scheme fees</b>	3.6208 ***	2.0071 ***	1.9465 ***	1.6710 ***	2.2880 ***	2.5391 ***	1.8854 ***	2.3861 ***	2.1067 ***
<b>Log of transaction volume</b>	-0.2241 ***	-0.1977 ***	-0.0769 ***	-0.0615 ***	-0.0563 ***	-0.0413 ***	-0.0089 ***	-0.0035	-0.1579 ***
<b>Proportion of chargebacks</b>	0.0106 ***	0.0150 ***	0.0106 ***	0.0097 ***	0.0199 ***	0.0176	-0.0012 *	0.0229 ***	0.0131 ***
<b>Share of face-to-face transactions</b>	0.0006 ***	0.0009 ***	0.0003 ***	0.0009 ***	0.0007 ***	0.0011 ***	-0.0007 ***	0.0006	0.0008 ***
<b>Share of capped credit</b>	0.0011 ***	0.0030 ***	0.0043 ***	0.0041 ***	0.0022 ***	0.0044 ***	0.0042 ***	0.0015 *	0.0028 ***
<b>Share of capped debit</b>	-0.0023 ***	-0.0033 ***	-0.0039 ***	-0.0041 ***	-0.0054 ***	-0.0032 ***	-0.0011 **	-0.0005	-0.0031 ***
<b>Constant</b>	2.2016 ***	1.7899 ***	1.0711 ***	0.9047 ***	1.0637 ***	0.7088 ***	0.2204 ***	0.1684 *	1.6112 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.1056	0.2078	0.3251	0.3099	0.2853	0.3321	0.8241	0.2904	0.1902
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 22: Regressions using IFR dummy only, MSC as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++
<b>IFR DUMMY</b>	0.0229 ***	0.0070 ***	-0.0006	-0.0049 **	-0.0232 ***	0.0156 **	0.0158 *	-0.1486 ***
<b>Constant</b>	1.9216 ***	1.3029 ***	0.9826 ***	0.9015 ***	0.8398 ***	0.6809 ***	0.4096 ***	0.7132 ***
<b>Number of observations</b>	64,648	500,162	138,751	90,522	48,443	5,245	1,428	4,933
<b>R-squared</b>	0.0002	0.0000	0.0000	0.0001	0.0027	0.0021	0.0036	0.0677
<b>Number of merchants</b>	5,068	20,571	5,022	3,181	1,678	184	52	207

Source: PSR analysis using data submitted by the five largest acquirers.



**Table 23: General pass-through instantaneous interchange fee and three lags, MSC as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>Interchange fees</b>	0.5303 ***	0.7557 ***	0.7836 ***	0.7224 ***	0.5895 ***	0.4754 ***	0.8993 ***	0.9649 ***	0.7382 ***
<b>Interchange fees Lag 1</b>	-0.1181 ***	-0.1523 ***	-0.1644 ***	-0.1329 ***	-0.1023 ***	-0.1628 ***	-0.0216 ***	-0.0348 ***	-0.1465 ***
<b>Interchange fees Lag 2</b>	-0.0358	-0.1167 ***	-0.1016 ***	-0.0763 ***	-0.0347 **	-0.0271	-0.0863 ***	-0.0071	-0.0993 ***
<b>Interchange fees Lag 3</b>	-0.0541 *	-0.0855 ***	-0.0641 ***	-0.0518 ***	0.0289 **	0.1451 ***	-0.0326	0.0922 ***	-0.0700 ***
<b>Scheme fees</b>	3.8807 ***	2.1780 ***	2.2085 ***	2.1393 ***	2.5720 ***	3.0620 ***	2.4457 ***	2.0407 ***	2.2663 ***
<b>Log of volume transactions</b>	-0.2058 ***	-0.1873 ***	-0.0754 ***	-0.0623 ***	-0.0545 ***	-0.0394 ***	-0.0127 ***	0.0061	-0.1437 ***
<b>Proportion of chargebacks</b>	0.0064 *	0.0154 ***	0.0094 ***	0.0142 ***	0.0213 ***	0.0575 ***	-0.0019 **	0.0049	0.0131 ***
<b>Share of face-to-face transactions</b>	0.0006 *	0.0008 ***	0.0006 ***	0.0010 ***	0.0008 ***	0.0011 ***	-0.0003	0.0006	0.0008 ***
<b>Share of capped credit</b>	0.0007 **	0.0032 ***	0.0047 ***	0.0041 ***	0.0022 ***	0.0035 ***	0.0047 ***	0.0000	0.0032 ***
<b>Share of capped debit</b>	-0.0033 ***	-0.0034 ***	-0.0039 ***	-0.0045 ***	-0.0054 ***	-0.0065 ***	-0.0010 *	-0.0012 *	-0.0035 ***
<b>Constant</b>	2.3601 ***	2.0146 ***	1.2782 ***	1.1471 ***	1.1699 ***	1.0863 ***	0.2893 ***	0.1561 **	1.7677 ***
<b>Observations</b>	29,178	367,665	111,741	73,559	39,541	4,210	1,160	3,329	631,324
<b>R-squared</b>	0.1073	0.1949	0.3021	0.2804	0.2696	0.3024	0.8060	0.4833	0.1908
<b>Number of merchants</b>	2,746	18,445	4,760	3,069	1,604	180	50	188	31,062

**Table 24: General pass-through instantaneous interchange fee and six lags, MSC as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>Interchange fees</b>	0.4939 ***	0.7656 ***	0.7869 ***	0.7292 ***	0.5755 ***	0.4768 ***	0.9007 ***	0.9198 ***	0.7471 ***
<b>Interchange fees Lag 1</b>	-0.1405 ***	-0.1419 ***	-0.1528 ***	-0.1268 ***	-0.1074 ***	-0.1796 ***	-0.0361 ***	-0.0544 ***	-0.1403 ***
<b>Interchange fees Lag 2</b>	-0.0162	-0.1034 ***	-0.0847 ***	-0.0637 ***	-0.0340 **	-0.0481	-0.0882 **	-0.0618	-0.0874 ***
<b>Interchange fees Lag 3</b>	-0.0149	-0.0605 ***	-0.0261 ***	-0.0298 **	0.0275 *	0.1086 *	-0.0199	0.0640	-0.0434 ***
<b>Interchange fees Lag 4</b>	0.0081	-0.0568 ***	-0.0277 ***	-0.0189 *	0.0205	0.0233	0.0576 *	0.1356 ***	-0.0392 ***
<b>Interchange fees Lag 5</b>	-0.0535 *	-0.0380 ***	-0.0402 ***	-0.0251 **	0.0150	0.0236	-0.0378	0.0279	-0.0333 ***
<b>Interchange fees Lag 6</b>	0.0306	-0.0356 ***	-0.0320 ***	-0.0258 **	-0.0186	0.0598	-0.0158	-0.0054	-0.0261 ***
<b>Scheme fees</b>	3.5695 ***	1.9926 ***	2.1109 ***	1.9568 ***	2.4138 ***	2.9455 ***	2.2214 ***	2.3554 ***	2.0770 ***
<b>Log of volume transactions</b>	-0.1820 ***	-0.1822 ***	-0.0749 ***	-0.0627 ***	-0.0523 ***	-0.0370 ***	-0.0122 ***	0.0086	-0.1362 ***
<b>Proportion of chargebacks</b>	0.0068	0.0163 ***	0.0084 ***	0.0142 ***	0.0221 ***	0.0577 ***	-0.0020 ***	0.0127	0.0138 ***
<b>Share of face-to-face transactions</b>	0.0009 **	0.0007 ***	0.0004 ***	0.0008 ***	0.0008 ***	0.0011 ***	-0.0002	0.0006	0.0007 ***
<b>Share of capped credit</b>	-0.0002	0.0032 ***	0.0048 ***	0.0040 ***	0.0024 ***	0.0042 ***	0.0046 ***	-0.0001	0.0032 ***
<b>Share of capped debit</b>	-0.0039 ***	-0.0035 ***	-0.0038 ***	-0.0045 ***	-0.0055 ***	-0.0070 ***	-0.0012 *	-0.0021 ***	-0.0036 ***
<b>Constant</b>	2.3219 ***	2.0378 ***	1.2924 ***	1.1784 ***	1.1620 ***	1.0730 ***	0.3051 ***	0.1885 **	1.7586 ***
<b>Observations</b>	19,462	305,031	96,933	64,125	34,561	3,624	1,005	2,762	528,351
<b>R-squared</b>	0.0993	0.1939	0.3013	0.2843	0.2743	0.3269	0.7947	0.4743	0.1936
<b>Number of merchants</b>	1,873	16,930	4,590	2,978	1,548	165	49	167	28,323

## Econometric analysis – additional sensitivity checks

**Table 25: Baseline regressions weighted by share of number of merchants per acquirer, interchange fee margin as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.2458 ***	0.2012 ***	0.1694 ***	0.1561 ***	0.1287 ***	0.1488 ***	0.0570 ***	-0.0297 ***	0.1870 ***
<b>Scheme fees</b>	1.2458 ***	-0.5624 ***	0.0592	0.2661 ***	0.9206 ***	2.1744 ***	1.1233 ***	2.5865 ***	-0.1531 ***
<b>Log of transaction volume</b>	-0.2012 ***	-0.1581 ***	-0.0576 ***	-0.0454 ***	-0.0403 ***	-0.0244 ***	-0.0051 ***	-0.0007	-0.1306 ***
<b>Proportion of chargebacks</b>	0.0069 **	0.0130 ***	0.0088 ***	0.0063 ***	0.0162 ***	-0.0046	-0.0011 **	0.0158 **	0.0108 ***
<b>Share of face-to-face transactions</b>	0.0003 *	0.0007 ***	0.0001	0.0007 ***	0.0010 ***	0.0015 ***	-0.0000	0.0014 *	0.0006 ***
<b>Share of capped credit</b>	0.0011 ***	0.0018 ***	0.0024 ***	0.0028 ***	0.0015 ***	0.0046 ***	0.0041 ***	0.0012 *	0.0017 ***
<b>Share of capped debit</b>	-0.0018 ***	-0.0047 ***	-0.0053 ***	-0.0048 ***	-0.0054 ***	-0.0027 ***	0.0001	-0.0008	-0.0040 ***
<b>Constant</b>	1.9064 ***	1.6694 ***	1.0668 ***	0.8457 ***	0.8335 ***	0.3829 ***	0.0479 *	0.1302 *	1.4995 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0739	0.1416	0.2175	0.2087	0.1931	0.3136	0.3496	0.0294	0.1202
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 26: Baseline regressions with quarterly seasonal dummies, interchange fee margin as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.2209 ***	0.1800 ***	0.1586 ***	0.1529 ***	0.1234 ***	0.1452 ***	0.0516 ***	-0.0201 *	0.1700 ***
<b>Scheme fees</b>	3.1202 ***	1.7735 ***	1.7065 ***	1.4509 ***	1.9617 ***	2.4577 ***	1.7012 ***	2.4978 ***	1.8226 ***
<b>Log of volume transactions</b>	-0.2324 ***	-0.1992 ***	-0.0778 ***	-0.0611 ***	-0.0543 ***	-0.0396 ***	-0.0074 ***	-0.0035	-0.1592 ***
<b>Proportion of chargebacks</b>	0.0109 ***	0.0150 ***	0.0106 ***	0.0095 ***	0.0205 ***	0.0183	-0.0012 *	0.0228 ***	0.0131 ***
<b>Share of face-to-face transactions</b>	0.0007 ***	0.0009 ***	0.0003 ***	0.0009 ***	0.0006 ***	0.0010 ***	-0.0006 ***	0.0006	0.0008 ***
<b>Share of capped credit</b>	0.0014 ***	0.0032 ***	0.0045 ***	0.0042 ***	0.0025 ***	0.0050 ***	0.0045 ***	0.0014 *	0.0030 ***
<b>Share of capped debit</b>	-0.0012 ***	-0.0027 ***	-0.0034 ***	-0.0035 ***	-0.0040 ***	-0.0013 **	-0.0003	-0.0008	-0.0024 ***
<b>Quarter 2</b>	-0.0308 ***	-0.0358 ***	-0.0335 ***	-0.0264 ***	-0.0244 ***	-0.0105 *	0.0032	0.0100	-0.0321 ***
<b>Quarter 3</b>	-0.0158 *	-0.0282 ***	-0.0176 ***	-0.0157 ***	-0.0176 ***	-0.0125 **	-0.0011	0.0050	-0.0220 ***
<b>Quarter 4</b>	-0.0271 ***	-0.0216 ***	-0.0131 ***	-0.0136 ***	-0.0158 ***	-0.0176 ***	-0.0021	-0.0020	-0.0180 ***
<b>Constant</b>	1.9927 ***	1.7089 ***	1.0107 ***	0.8276 ***	0.8527 ***	0.4606 ***	0.1190 ***	0.1964 **	1.5098 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0810	0.1407	0.2137	0.2028	0.1900	0.2859	0.3984	0.0242	0.1238
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 27: Baseline regressions with quarterly dummies before and after the IFR caps came into force, interchange fee margin as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.3611 ***	0.2629 ***	0.2206 ***	0.1933 ***	0.1598 ***	0.1662 ***	0.0492 ***	-0.0569 ***	0.2444 ***
<b>Scheme fees</b>	2.3968 ***	1.2711 ***	1.2767 ***	1.2718 ***	1.8502 ***	2.5253 ***	1.9779 ***	3.0256 ***	1.3513 ***
<b>Log of transaction volume</b>	-0.2307 ***	-0.1982 ***	-0.0766 ***	-0.0606 ***	-0.0548 ***	-0.0400 ***	-0.0076 ***	-0.0043 ***	-0.1582 ***
<b>Proportion of chargebacks</b>	0.0107 ***	0.0149 ***	0.0105 ***	0.0095 ***	0.0207 ***	0.0224 *	-0.0012 *	0.0238 ***	0.0130 ***
<b>Share of face-to-face transactions</b>	0.0007 ***	0.0009 ***	0.0003 ***	0.0010 ***	0.0008 ***	0.0010 ***	-0.0004 *	0.0006 ***	0.0008 ***
<b>Share of capped credit</b>	0.0014 ***	0.0032 ***	0.0044 ***	0.0041 ***	0.0025 ***	0.0055 ***	0.0047 ***	0.0014 *	0.0030 ***
<b>Share of capped debit</b>	-0.0012 ***	-0.0027 ***	-0.0035 ***	-0.0036 ***	-0.0040 ***	-0.0009 ***	-0.0001 ***	-0.0007 ***	-0.0024 ***
<b>1st Quarter pre-IFR</b>	0.1404 ***	0.1017 ***	0.0803 ***	0.0643 ***	0.0683 ***	0.0717 ***	0.0208 ***	-0.0147 ***	0.0937 ***
<b>2nd Quarter pre-IFR</b>	0.0804 ***	0.0690 ***	0.0607 ***	0.0489 ***	0.0570 ***	0.0458 ***	0.0234 ***	-0.0172 ***	0.0650 ***
<b>1st Quarter post-IFR</b>	-0.1164 ***	-0.0568 ***	-0.0389 ***	-0.0073 **	0.0003 ***	0.0169 *	0.0261 ***	0.0484 ***	-0.0474 ***
<b>2nd Quarter post-IFR</b>	-0.1388 ***	-0.0795 ***	-0.0559 ***	-0.0300 ***	-0.0294 ***	-0.0010 ***	0.0106 *	0.0391 ***	-0.0691 ***
<b>3rd Quarter post-IFR</b>	-0.1483 ***	-0.0758 ***	-0.0525 ***	-0.0368 ***	-0.0285 ***	-0.0177 *	0.0034 ***	0.0347 **	-0.0680 ***
<b>4th Quarter post-IFR</b>	-0.0927 ***	-0.0366 ***	-0.0266 ***	-0.0143 ***	0.0066 *	0.0205 **	0.0084 ***	0.0386 ***	-0.0335 ***
<b>Constant</b>	1.9168 ***	1.6492 ***	0.9616 ***	0.7885 ***	0.8104 ***	0.3955 ***	0.0777 **	0.2008 **	1.4553 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0891	0.1470	0.2228	0.2084	0.2008	0.3027	0.4222	0.0304	0.1298
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 28: Baseline regressions with annual dummies, interchange fee margin as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>Scheme fees</b>	2.3101 ***	1.0289 ***	0.9689 ***	0.9897 ***	1.4919 ***	2.5428 ***	1.7700 ***	3.2857 ***	1.0884 ***
<b>Log of transaction volume</b>	-0.2293 ***	-0.1995 ***	-0.0779 ***	-0.0617 ***	-0.0557 ***	-0.0380 ***	-0.0073 ***	-0.0057 ***	-0.1590 ***
<b>Proportion of chargebacks</b>	0.0107 ***	0.0149 ***	0.0105 ***	0.0092 ***	0.0203 ***	0.0214 *	-0.0013 *	0.0242 ***	0.0129 ***
<b>Share of face-to-face transactions</b>	0.0007 ***	0.0009 ***	0.0003 ***	0.0009 ***	0.0008 ***	0.0010 ***	-0.0003 ***	0.0007 ***	0.0008 ***
<b>Share of capped credit</b>	0.0015 ***	0.0032 ***	0.0044 ***	0.0041 ***	0.0024 ***	0.0058 ***	0.0047 ***	0.0014 *	0.0030 ***
<b>Share of capped debit</b>	-0.0012 ***	-0.0027 ***	-0.0035 ***	-0.0036 ***	-0.0041 ***	-0.0008 ***	-0.0002 ***	-0.0007 ***	-0.0024 ***
<b>2015</b>	0.1402 ***	0.0994 ***	0.0726 ***	0.0622 ***	0.0693 ***	0.0752 ***	0.0270 ***	0.0227 ***	0.0905 ***
<b>2016</b>	0.2960 ***	0.2387 ***	0.1999 ***	0.1919 ***	0.1697 ***	0.1954 ***	0.0711 ***	0.0035 ***	0.2233 ***
<b>2017</b>	0.4297 ***	0.2937 ***	0.2388 ***	0.2129 ***	0.1830 ***	0.1980 ***	0.0605 ***	-0.0469 **	0.2736 ***
<b>2018</b>	0.4688 ***	0.3777 ***	0.2992 ***	0.2533 ***	0.2157 ***	0.1803 ***	0.0652 ***	-0.0427 *	0.3416 ***
<b>Constant</b>	1.8510 ***	1.6157 ***	0.9498 ***	0.7795 ***	0.8029 ***	0.3458 ***	0.0755 **	0.1791 *	1.4266 ***
<b>Number of observations</b>	57,816	463,895	130,364	85,036	45,858	4,973	1,351	4,173	794,532
<b>R-squared</b>	0.0896	0.1502	0.2244	0.2072	0.1948	0.2883	0.4090	0.0342	0.1317
<b>Number of merchants</b>	4,747	20,069	4,940	3,150	1,664	183	52	204	35,030

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 29: Baseline regression with and without robust standard errors, interchange fee margin as dependent variable, by merchant group**

VARIABLES	Standard errors	Robust standard errors
	Margin over IF	Margin over IF
<i>IFR DUMMY</i>	0.1717*** (0.0010)	0.1717*** (0.0023)
<b>Scheme fees</b>	1.8600*** (0.0375)	1.8600*** (0.0812)
<b>Log of transaction volume</b>	-0.1586*** (0.0008)	-0.1586*** (0.0026)
<b>Proportion of chargebacks</b>	0.0131*** (0.0004)	0.0131*** (0.0012)
<b>Share of face-to-face transactions</b>	0.0008*** (0.0000)	0.0008*** (0.0001)
<b>Share of capped credit</b>	0.0030*** (0.0000)	0.0030*** (0.0001)
<b>Share of capped debit</b>	-0.0024*** (0.0000)	-0.0024*** (0.0001)
<b>Constant</b>	1.4861*** (0.0052)	1.4861*** (0.0156)
<b>Observations</b>	794,532	794,532
<b>R-squared</b>	0.1225	0.1225
<b>Number of merchants</b>	35,030	35,030

Standard errors in parentheses. \*\*\* p<0.001, \*\* p<0.01, \* p<0.05  
Source: PSR analysis using data submitted by the five largest acquirers.

**Table 30: Baseline regressions excluding transaction mix, interchange fee margin as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++
<b>IFR DUMMY</b>	0.1864 ***	0.1648 ***	0.1466 ***	0.1401 ***	0.1127 ***	0.1357 ***	0.0485 ***	-0.0074
<b>Scheme fees</b>	3.5088 ***	2.3131 ***	2.2101 ***	1.8572 ***	2.1052 ***	2.3948 ***	2.3346 ***	2.3444 ***
<b>Log of transaction volume</b>	-0.2323 ***	-0.1971 ***	-0.0817 ***	-0.0626 ***	-0.0630 ***	-0.0393 ***	-0.0107 ***	-0.0031
<b>Proportion of chargebacks</b>	0.0107 ***	0.0144 ***	0.0104 ***	0.0103 ***	0.0200 ***	0.0136	-0.0025 ***	0.0157 *
<b>Constant</b>	1.9704 ***	1.6305 ***	0.9263 ***	0.7778 ***	0.7726 ***	0.5384 ***	0.1777 ***	0.1985 ***
<b>Number of observations</b>	64,610	499,513	138,429	90,193	47,937	5,096	1,421	4,308
<b>R-squared</b>	0.0680	0.0956	0.1026	0.1089	0.1298	0.2497	0.3023	0.0149
<b>Number of merchants</b>	5,065	20,570	5,022	3,177	1,676	184	52	204

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 31: Regressions excluding transaction mix, acquirer net revenue as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++
<b>IFR DUMMY</b>	0.1872 ***	0.1658 ***	0.1477 ***	0.1415 ***	0.1159 ***	0.1426 ***	0.0561 ***	-0.0044
<b>Log of transaction volume</b>	-0.2281 ***	-0.1949 ***	-0.0798 ***	-0.0618 ***	-0.0624 ***	-0.0387 ***	-0.0124 ***	-0.0034
<b>Proportion of chargebacks</b>	0.0108 ***	0.0144 ***	0.0105 ***	0.0104 ***	0.0208 ***	0.0193	-0.0025 ***	0.0148 *
<b>Constant</b>	2.0239 ***	1.6537 ***	0.9438 ***	0.7912 ***	0.7924 ***	0.5648 ***	0.2164 ***	0.2430 ***
<b>Number of observations</b>	64,610	499,513	138,429	90,193	47,937	5,096	1,421	4,308
<b>R-squared</b>	0.0642	0.0927	0.0947	0.1010	0.1155	0.2137	0.1971	0.0015
<b>Number of merchants</b>	5,065	20,570	5,022	3,177	1,676	184	52	204

Source: PSR analysis using data submitted by the five largest acquirers.



**Table 32: Regressions excluding transaction mix, MSC as dependent variables, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.1603 ***	0.1742 ***	0.1642 ***	0.1523 ***	0.0935 ***	0.1131 ***	0.0470 ***	-0.0085	0.1593 ***
<b>Interchange fee</b>	0.8439 ***	1.0597 ***	1.1181 ***	1.0811 ***	0.8673 ***	0.8306 ***	0.9779 ***	0.9928 ***	1.0222 ***
<b>Scheme fees</b>	3.7704 ***	2.2191 ***	2.0246 ***	1.7422 ***	2.2396 ***	2.5577 ***	2.3924 ***	2.3563 ***	2.2588 ***
<b>Log of transaction volume</b>	-0.2294 ***	-0.1972 ***	-0.0811 ***	-0.0620 ***	-0.0646 ***	-0.0420 ***	-0.0114 ***	-0.0031	-0.1599 ***
<b>Proportion of chargebacks</b>	0.0107 ***	0.0144 ***	0.0104 ***	0.0102 ***	0.0200 ***	0.0128	-0.0024 ***	0.0156 *	0.0127 ***
<b>Constant</b>	2.0292 ***	1.6068 ***	0.8763 ***	0.7411 ***	0.8400 ***	0.6334 ***	0.1901 ***	0.2017 ***	1.4512 ***
<b>Number of observations</b>	64,610	499,513	138,429	90,193	47,937	5,096	1,421	4,308	852,655
<b>R-squared</b>	0.1018	0.1771	0.2409	0.2367	0.2281	0.2963	0.7444	0.2626	0.1612
<b>Number of merchants</b>	5,065	20,570	5,022	3,177	1,676	184	52	204	35,971

Source: PSR analysis using data submitted by the five largest acquirers.

**Table 33: Baseline regression excluding acquirer with missing data ([X]), interchange fee margin as dependent variable, by merchant group**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	IC++	All sample
<b>IFR DUMMY</b>	0.2209 ***	0.1789 ***	0.1583 ***	0.1525 ***	0.1233 ***	0.1466 ***	0.0509 ***	-0.0200 *	0.1690 ***
<b>Scheme fees</b>	4.5770 ***	3.2291 ***	2.5375 ***	2.0453 ***	2.4067 ***	2.4192 ***	1.8450 ***	2.4359 ***	3.0171 ***
<b>Log of transaction volume</b>	-0.2279 ***	-0.2084 ***	-0.0811 ***	-0.0652 ***	-0.0571 ***	-0.0398 ***	-0.0095 ***	-0.0040	-0.1633 ***
<b>Proportion of chargebacks</b>	0.0111 ***	0.0144 ***	0.0107 ***	0.0096 ***	0.0223 ***	0.0207 ***	-0.0001	0.0296 ***	0.0128 ***
<b>Share of face-to-face transactions</b>	0.0010 ***	0.0011 ***	0.0004 ***	0.0010 ***	0.0006 ***	0.0010 ***	-0.0009 ***	0.0006	0.0009 ***
<b>Share of capped credit</b>	0.0009 ***	0.0030 ***	0.0046 ***	0.0042 ***	0.0025 ***	0.0051 ***	0.0046 ***	0.0014 *	0.0029 ***
<b>Share of capped debit</b>	-0.0013 ***	-0.0022 ***	-0.0031 ***	-0.0033 ***	-0.0039 ***	-0.0013 **	-0.0003	-0.0008	-0.0021 ***
<b>Constant</b>	1.9636 ***	1.6852 ***	0.9833 ***	0.8134 ***	0.8493 ***	0.4566 ***	0.1469 ***	0.2072 **	1.4797 ***
<b>Number of observations</b>	46,035	398,658	114,658	74,734	41,754	4,664	1,227	4,111	686,709
<b>R-squared</b>	0.0829	0.1399	0.2086	0.1995	0.1907	0.2846	0.4195	0.0239	0.1248
<b>Number of merchants</b>	3,594	16,410	4,150	2,652	1,469	170	45	200	28,701

Source: PSR analysis using data submitted by four out of the five largest acquirers.

PUB REF: MR18/1.8 Annex 2

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