

Consumer Payment Preferences, Network Externalities, and Merchant Card Acceptance: An Empirical Investigation ¹

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This version: September 21, 2015

Abstract

The two-sided market theory holds that consumer adoption and merchant acceptance of payment cards are interdependent. However, empirical evidence on such network externalities is scarce, especially for the merchant side. This paper uses a logit model to explain merchant card acceptance in France. We exploit shopping diary data to construct a novel and fine-grained measure of French consumers' payment preferences and match these with data from a nationwide merchant survey. Controlling for, among other factors, cost, degree of competition, and customer characteristics, we find that the higher the probability that the average basket of a merchant is paid for by card in shops in the same sector and region, the higher the probability that the merchant will accept cards. In other words, we find that consumer preferences drive merchant card acceptance, which underpins the existence of network externalities on the merchant side of the payment card market. Words: 147

JEL codes: E42; L81; D4

Keywords: consumer preferences; merchants; network externalities; payment cards; retail payments; two-sided markets

¹ An earlier version of this paper circulated under the title « Merchant acceptance of payment cards in France: le client est roi! ».

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1. Introduction

In many developed countries, consumer penetration rates of certain types of payment cards today reach 90 per cent and beyond (Bagnall et al., 2014). The same cannot be said about merchant acceptance. For example, according to the survey among French retailers that we build upon in this paper, in 2008 only 68 per cent accepted cards.⁵ Taken together, these two observations suggest that, at least in some countries, the bottleneck for increased card usage – and further cash displacement – lies primarily with merchants. Yet there is little empirical research into the reasons behind the often low merchant acceptance of cards – perhaps because such an analysis requires a specific approach that integrates both sides of the market.

Indeed, payment cards are subject to network externalities, so that merchant benefits depend on consumer uptake: the higher the number of customers who pay by card, the higher the utility of a terminal for merchants. In addition, there may be an element of ‘must-take’ (Rochet and Tirole, 2011). Merchants who refuse to accept cards stand to lose business to rival retailers. Whatever the reason, there is some evidence in the payments literature that consumer card usage effectively drives merchant card acceptance. However, this evidence is mostly of an indirect nature.

The present paper tries to come up with more direct evidence, for the case of France. We mainly rely on a 2008 nation-wide survey among 4,601 merchants, but in addition we also match these merchant data with consumer data from two large-scale shopping diary surveys. Specifically, in the binary logit model that we use to explain merchant acceptance of debit and credit cards we include a proxy for the externality and/or pressure exerted by card-paying consumers. This proxy is based on the diary surveys and is very fine-grained: we have statistics on the card usage of French consumers for 5 intervals of transactions, across 9 sectors and up to 96 regions. We find that these revealed payment preferences indeed drive card acceptance.

Our paper has two main contributions. In terms of methodology, we are the first to match individual merchants with consumer payment preferences in their geographic location, in their sector, and for their average transaction size. Bagnall et al. (2014, p. 29-30) see this as a promising avenue for future research. On the empirical level, we provide evidence of the

⁵ This number excludes hypermarkets; see Section 4.1 for details. In Germany, card acceptance would seem to be even lower: according to payment diary data from 2011 collected by the Bundesbank, in 40 per cent of all payment situations consumers could only pay cash (Eschelbach and Schmidt, 2015, p. 2). This is not to say that the situation is all-pervasive. Recent figures for the Netherlands put acceptance of debit cards at 94 per cent of merchants (DNB, 2015).

existence of indirect network externalities on the merchant side of the payment card market. Up to now, this evidence was – as our literature review will show – either indirect (Arango and Taylor, 2008; Jonker, 2011), biased (Loke, 2007), or based on higher-level, i.e. bank-level data (Carbó-Valverde et al., 2012).

In what follows, we first review the literature and point out its limitations. Section 3 then provides an introduction to the French payment market. In Section 4 we describe the data that we subsequently, in Section 5, use to construct our variables. Section 6 presents our results and Section 7 concludes.

2. Related literature

Network externalities have become a central tenet of the payments literature, especially with the surge of interest in two-sided markets. In a two-sided market, two distinct groups of economic agents interact through a platform that manages the externalities, which are of an indirect (or inter-group) nature.⁶ In the case of payment cards, the utility for a consumer of adopting a card increases with the number of merchants who accept it (and *vice versa*), and the platform is called a ‘payment card scheme’.

Card schemes are payment networks that bring together commercial banks (or other financial institutions) under a common brand and technical standards. In so-called four-party schemes – such as Visa, MasterCard, and, in France, Cartes Bancaires – issuing banks provide cards to consumers and set the cardholder fees, whereas acquiring banks affiliate merchants, process payments on their behalf, and set the ‘merchant discount fees’ or ‘merchant service charges’.

Empirical papers on the card market have tended to concentrate on consumer adoption and usage (Koulayev et al., 2015). Some of these papers pay explicit attention to network externalities. Rysman (2007), for example, establishes a positive regional correlation between consumer usage and merchant acceptance within the four major card networks in the U.S.

By contrast, there is far less research about merchants. The theoretical literature on two-sided markets proffers several reasons why merchants accept cards. Rochet and Tirole (2002; 2011) and Wright (2011) suggest that merchants try to lure away consumers who prefer to pay by card from rivals who do not accept cards. From a defensive perspective, merchants may feel compelled to accept cards simply to not lose business. Chakravorti and To (2007), for their part,

⁶ Direct (or intra-group) network externalities exist when the value of a good for a user depends directly on the number of other users, as in communication networks.

insist on the features of credit cards that enable consumers to overcome liquidity constraints and allow merchants to guarantee sales.

Turning to empirical studies, there are only two papers in the economics literature that – like ours – deal directly with merchant acceptance and, moreover, do so based on survey data. However, we first briefly discuss a paper that provides *indirect* evidence as well as a paper that uses bank-level data.

Arango and Taylor (2008) exploit a Canadian merchant survey and find that the acceptance levels of payment instruments do not reflect merchants' relative preferences. For example, when merchants who accept *all three* instruments surveyed (cash, debit and credit) were asked which one they prefer consumers to use the most often, only 5 per cent favoured credit cards – whereas they do accept them. Arango and Taylor also find that as customers use an instrument more intensively, merchants increasingly value their choice. For example, the more cash-oriented a merchant's business, the lower he will rank debit and credit cards (o.c., p. 16). In short, Arango and Taylor find indications that, within certain limits, merchants will accommodate consumer preferences.

Carbó-Valverde et al. (2012), for their part, examine the feedback loop effects between cardholders and merchants by using quarterly bank-level information for the two biggest Spanish card networks over the period 1997-2007. The authors simultaneously estimate consumer demand for the cards of bank i and merchant demand for the point-of-sale terminals of the same bank. For the merchant side they find that a 1% increase in the number of cardholders of the network for which bank i is an acquirer – either Euro6000 or Servired – in the region(s) where the bank is active produces a 2.7% increase in merchant demand for the terminals of that bank.

The Carbó-Valverde et al. paper is clearly differently inspired compared to ours. Also, precisely because they use bank-level rather than merchant data, they can only include, next to their core 'infrastructure variables', one single control variable – for costs. Carbó-Valverde et al. (o.c., p. 7) acknowledge that “survey-type [...] databases may provide comprehensive information” but argue, with reason, that compared to the existing literature their approach has the benefit of studying the two sides of the market in an integrated way.

Our goal in the present paper was to combine, as much as possible, the best of both worlds. That is, we wanted to explicitly take into account the impact that the consumer side of the market may have on the merchant side, and at the same time include a fuller set of explanatory

variables than Carbó-Valverde et al. The papers that come closest to our endeavours are those by Jonker (2011) and Loke (2007).

Jonker (2011) finds that Dutch merchants who perceive debit cards as expensive are less likely to accept them, whereas merchants who face competition and/or have wealthy customers are more likely to do so. Jonker's model also contains a proxy of consumer demand for card services, namely the logarithm of the average regional income. The coefficient is positive and significant but, as Jonker admits, it is "a rather crude measure" (o.c., p. 15). Jonker also experiments with variables based on a separate consumer survey, namely perceived safety, ease of use, and costs for consumers. Merchants active in a specific province-urbanisation combination were assigned the average values for consumers living there. However, none of the variables proved significant.

Compared to Jonker, Loke (2007) addresses the externalities issue far more explicitly but, unfortunately, not in the best possible way. Loke exploits a survey conducted among 385 merchants in two cities in Malaysia. She explains the probability of credit card acceptance by merchants' personal backgrounds, the nature of their business, as well as network externalities. For the latter, Loke uses merchants' perception of customers' card usage. Loke finds that "the odds for a merchant who agrees that 'customers prefer to use credit cards for payments whenever possible' to accept credit cards [...] is 2.1 times higher than a merchant who thinks otherwise" (o.c., p. 488). This would seem to demonstrate that merchants are sensitive to consumer preferences.

However, the research set-up has two weaknesses. First, unlike Jonker (2011), Loke does not control for the costs of card acceptance (or perceptions thereof). Second, Loke's network externality measure is subjective and clearly endogenous: a merchant may claim that 'customers prefer to use cards whenever possible' precisely because she already accepts them.

Our paper builds upon the two papers just discussed, but extends them in two ways. First, following Jonker's earlier attempt, we exploit two consumer surveys to build a direct and more robust measure of consumer preferences. Second, we build a better control variable for costs. Specifically, we estimate a discount fee for merchants who do not accept cards as well as for merchants who do but who failed to answer our survey questions about fees. This is an improvement over both Loke (who does not control for costs) and Jonker (who uses a subjective measure and relies on the imputation algorithm in Stata to generate an expected value for the merchants who did not proffer an opinion).

3. The French card market at a glance

France is a country with very few unbanked people and with a mature card market. In 2008 – when the merchant data that we use in this paper were collected – 99 per cent of the French population had a bank account (Fédération Bancaire Française, 2008). Cheques are free of charge for consumers and merchants alike⁷, and are therefore still widely used (see Section 4). The main card scheme is Carte Bancaire (CB). In 2014 CB counted 130 members (either banks or payment institutions), 1.4 million merchants, 63 million cardholders, and it was good for more than 9.1 billion payments.⁸ The 63 million implies a consumer penetration rate of over 90 per cent, which explains why in France ‘carte bancaire’ (without capital letters) has become a generic name for ‘payment card’.

Crucially, the term ‘carte bancaire’ refers to *all* cards that carry the CB logo. CB cards can be ‘immediate’ debit cards, but also deferred debit cards (‘charge cards’ that require the balance to be paid in full each month), and even ‘real’ credit cards (cards with a credit line). A peculiarity of the French card market is that merchants who accept CB cards will make no distinction between ‘plain vanilla’ debit cards and the other types. Merchants do not need to because the merchant service charges are identical⁹.

We ourselves also refrain from making the distinction: we use ‘CB cards’ and ‘payment cards’ as catch-all terms for all three types. This said, at the time of our survey only 5 per cent were credit cards. The low popularity of credit cards is related to the strict regulation of consumer credit and to the existence of a substitute in the form of deferred debit cards.

Our focus on CB cards should not be taken to imply that French consumers hold no other cards. There are, for example, ‘MasterCard only’ and ‘Visa only’ cards – cards that are not co-branded with CB. However, at the time of our merchant survey they did not exist yet. There are also a limited number of Amex cards in circulation¹⁰. The precise number is unknown, as American Express does not provide information per country.

⁷ In return, banks do not have to pay interest on checking accounts.

⁸ Source: Cartes Bancaires. The corresponding figures for 2008, the year of our merchant survey, are: 6.2 billion, 1.2 million, and 58 million (retrieved from <http://www.cartes-bancaires.com>; last visit: 12/06/2015).

⁹ Merchant service charges can differ from one acquirer to the next – see lower in the main text – but any given acquirer will charge identical fees for all types of CB cards. Also, the deferred payment is an option proposed to cardholders by issuers; it does not affect the timing with which merchants’ bank accounts are credited.

¹⁰ Source: Cartes Bancaires, personal communication.

In our questionnaire, we separated Amex cards from CB cards by lumping them together with private label cards – a category that we do not analyse. The bulk of these private label cards are issued by retailers or by non-bank companies specialised in consumer credit. They are infrequently used as they are only accepted by affiliated stores. This will become clear in the next Section, where we also present usage statistics for most other instruments.

A final interesting feature of the French card market is that in the CB scheme each member bank is free to set its own fees for merchants and/or cardholders. As we document below, pricing strategies differ widely between banks, and in some cases even within banks. BNP Paribas, for example, has centralised pricing, but Crédit Agricole, the largest retail bank, is made up of local and regional banks with their own pricing policies.

4. Data description

This Section describes the data that we use to construct our variables in Section 5. In particular, we exploit one merchant survey and two consumer surveys.

4.1. Merchant survey

From March to May 2008, we conducted a national, representative survey of the French retail industry, with the exclusion of hypermarkets and the public sector. Hypermarkets combine a supermarket and a department store. The public sector comprises government administrations as well as stated-owned companies such as the national railway company (SNCF) and the national mail service (La Poste). The main reason for their exclusion was feasibility of the surveys, which were conducted by phone. The agency that conducted the survey (GfK/ISL) thought that it would be almost impossible to find a reliable contact person, as the diverse topics were likely to fall under the responsibility of different people. In addition, the public sector does not necessarily follow the same commercial logic as private merchants.

We used stratified random sampling to select the merchants, with a first stratum consisting of territorial regions and a second of sectors crossed with number of employees. For the regions we relied on the first level of the EU Nomenclature of Territorial Units for Statistics (NUTS1), which for France specifies nine regions. For the sectors we selected all eighteen sector codes assigned by the French National Institute for Statistics and Economic Studies (INSEE) that make up the retail industry *minus* the hypermarkets. Together, these sectors represented 70 per cent of all card-accepting retailers in 2008. Our final sample comprised 4,601 merchants.

The questionnaire asked about the merchant’s banking relationships, the acceptance of payment instruments (and related costs), as well as characteristics of the clientele and the merchant itself (sales revenue, number of transactions, etc.). We also asked merchants to select their sector from a predefined list of ten possibilities.¹¹ The main reason for not using the INSEE classification is that we wanted to limit the number of sectors, especially since some of the INSEE sectors come quite close to one another.

Table 1 documents the acceptance of the different payment instruments. Where CB cards are concerned, the average of 68 per cent hides substantial variation: acceptance ranges from a low of 6.3 per cent in ‘legal activities’, via 63 per cent in ‘health’, to 89.5 per cent in ‘restaurants/bars/hotels’. Where card fees are concerned, only 80.8 per cent of the card-accepting merchants answered our question about the structure of the fees. Moreover, of the merchants who did answer, only 45.3 per cent (or 1,152) knew, or were willing to disclose, the *level* of the fees – a problem that is also encountered by Jonker (2011, p. 15)¹².

Table 1: Acceptance of payment instruments, 2008

Payment instrument	Number of merchants	Per cent
Cash ¹³	4,480	97.4
Cheques	4,463	97.0
CB cards	3,143	68.3
Private label and/or Amex cards	1,262	29.6

Table 2 shows that French acquirers use no less than seven different types of pricing plans, containing an *ad valorem* fee (that is, a percentage of the value of the transaction), a fixed fee per transaction, a ‘subscription’ (a fixed annual fee), or combinations of the former. As can be seen, the plan with only an *ad valorem* fee is by far the most prevalent.

4.2. Consumer surveys

We also have at our disposal the results of two national, representative surveys amongst French individuals of eighteen years and older. The surveys were conducted in 2005 and 2011, and

¹¹ Namely: equipment and personal services, transport, restaurants/bars/hotels, food and beverages, leisure and culture, home furniture, legal activities, newspapers/tobacco/gambling, health, and other.

¹² We could have had a ‘truncated sample’-problem here, in that merchants who did not answer might be those who got a sweet deal. However, upon inspection characteristics such as sales revenue and number of transactions do not differ significantly between merchants who answered and those who did not. Calculations can be provided upon request.

¹³ In France, certain legal professions, such as public notaries, are allowed to refuse cash payments.

sample sizes were 1,447 and 1,106. Both surveys had two parts: a questionnaire and an eight-day shopping diary.¹⁴ In the diary, respondents were asked to record details of all purchases, such as transaction value, type of goods or services, type of sector, and payment instrument used. Respectively 1,386 and 1,047 participants effectively completed their diaries, providing us with info on 16,000+ and 10,000+ transactions¹⁵.

Table 2: Card pricing plans for merchants, 2008

Pricing plan	Number of merchants	Per cent
<i>Ad valorem</i> fee only	1,578	62.1
<i>Ad valorem</i> fee plus subscription	332	13.1
Subscription only	272	10.7
Fixed fee per transaction only	145	5.7
<i>Ad valorem</i> fee plus a fixed fee per transaction	122	4.8
<i>Ad valorem</i> fee plus fixed fee per transaction plus subscription	54	2.1
Fee per transaction plus subscription	38	1.5

The diary data indicate that the share of card payments increased significantly between 2005 and 2011: from 21 to 31 per cent. This trend is visible in all sectors, all regions, and for the entire range of transaction amounts. However, there is substantial variation in terms of levels. For one, cards are little used for low-value transactions but are dominant above €20. In 2011, the *carte bancaire* accounted for a mere 3 per cent of transactions below €5, compared with 65 per cent in the €50-€100 interval. When it comes to regions, with 35.9 per cent the *carte bancaire* is especially popular in the ‘région Ouest’ (the region that gathers departments¹⁶ from the North West), and less popular in the South West (19.8 per cent). Finally, on the sectoral level, CB cards are frequently used in ‘transport’ (66 per cent of transactions in 2011) and ‘home furniture’ (55 per cent), but less so in ‘food and beverages’ (24 per cent) or ‘newspapers/tobacco/gambling’ (16 per cent), where cash still dominates.

5. Methodology and construction of variables

¹⁴ For a description of the surveys and descriptive statistics, see Bouhdaoui and Bounie (2012) and Arango et al. (2013). See Bagnall et al. (2014) for additional information on the use of diaries in the payments literature.

¹⁵ This includes online transactions. However, online transactions accounted for only 0.5 per cent of the total in 2005 and for 2 per cent in 2011. We therefore do not treat them separately.

¹⁶ Excluding the overseas territories, France is divided into 96 “départements”. Departments are administrative divisions that correspond to the NUTS3 level. One level higher, on the NUTS2 level, the departments form 22 regions. NUTS1, for its part, only divides France into 9 regions.

In this Section we present our methodology and explain the construction of our variables. The dependent variable is a simple dichotomous variable for card acceptance (0/1) by the merchants in our sample, and we use a standard binary logit model. Our choice of explanatory variables has been guided by the ambition, given the state of the literature, to devise a better test of the existence of indirect network externalities, while controlling for other revenue- and cost-side influences. We also wanted to use hard contextual data rather than just perceptions.

Below we discuss our variables one by one. When relevant, we point out how they compare with those used by other authors.

5.1. Card usage, consumer payment preferences, and network externalities

As explained in the Introduction and in Section 2, consumers' card usage should positively influence merchant acceptance – for two reasons. A first is that many potential benefits of card payments for merchants (increased customer throughput, lower cash handling costs, etc.) – what Rochet and Tirole (2011) call ‘convenience benefits’ – grow with the number of card-paying customers. By analogy with the second reason, this could be called the ‘wanna take’ explanation: merchants accept cards because their utility/cost ratio is at least as good as that of other payment instruments.

The alternative, ‘must take’ explanation is that merchants who are *not* convinced of the convenience benefits of cards may nevertheless accept them – out of fear that they might lose business if they do not. Again there is a positive relationship with the popularity of cards among consumers: the more consumers prefer to pay by card, the higher the potential loss for the merchant.

To capture these effects we try two variables. In an attempt to improve upon the variables used by Carbó-Valverde et al. (number of cardholders per region), Jonker (average regional income), and Loke (merchants' perception of customers' card usage), we look, in both cases, at observed card usage. Our first variable is based on data provided by CB, namely card sales revenue per inhabitant, for the year 2008, in the department (NUTS3) where the merchant is located. This should be a better indicator than mere card ownership, but does remain quite aggregate as a measure.¹⁷ As highlighted in Section 4, card usage differs substantially between sectors and across transaction sizes.

¹⁷ Card ownership overstates the externality generated by cardholders if there are cards in circulation that are inactive or seldom used; see Van Hove (2000).

To incorporate these dimensions into our analysis, we constructed a second variable based on the much richer data from our consumer surveys. Indeed, from the shopping diaries we know the frequencies of use of all payment instruments per sector, per transaction amount, or per region, and this for the years 2005 and 2011 (see Section 4.2 for illustrations). We can obviously also *combine* these dimensions and, for example, compute the frequency with which a transaction of, say, 5 euro in the food sector in the ‘région parisienne’ is paid for in cash. We have exploited this to construct a merchant-level variable: we compute, for every merchant in our sample, the probability that an average-sized transaction in his store is paid for by card *if* consumers were free to choose; that is, if the merchant accepted CB cards.

Assigning such probabilities to merchants implied that we had to match data from our consumer and merchant surveys on three dimensions. For the region (NUTS1, at least initially) this posed no problem whatsoever. The sectors, for their part, were not fully identical: the merchant survey had one additional sector, namely ‘legal affairs’. To harmonise the sectors across surveys we incorporated ‘legal affairs’ into ‘other’. Finally, the matching of transaction amounts required some aggregation of the consumer data. Indeed, when we asked merchants to assess the average transaction amount paid in their store, we did not ask for precise amounts. Rather we worked with five intervals: ‘less than €5’, ‘from €5 to €20’, ‘from €20 to €50’, ‘from €50 to €100’, and ‘more than €100’. We thus had to convert the payment instrument frequencies of use, as generated by the shopping diaries, from frequencies per transaction amount to frequencies per transaction interval.

Once the above transformations were completed, we computed, for all merchants, the share of card payments – i.e. the number of card payments over the total number of payments – in their region and sector, and for the interval selected by the merchant as best representing his average basket¹⁸. The combination of five intervals of transaction amounts, nine sectors, and nine NUTS1 regions implies that the resulting variable – which we use in our base case – can take on 405 different values. However, our diary data allow us to further refine the spatial dimension to NUTS2 regions and even departments (NUTS3). This increases the number of distinct probabilities (to no less than 4,320 in the NUTS3 case), but does imply that we progressively lose observations (because the diary data do not cover all combinations on the merchant side).

¹⁸ 232 merchants refused to give this information, so we lose observations here.

Apart from the matching as such, there was also a timing problem: the consumer surveys were conducted in 2005 and 2011, and the merchant survey in 2008. We have solved this by taking, interval per interval, the average of the 2005 and 2011 shares of card payments, and assuming that the resulting shares represent French consumers' payment behaviour in 2008, the year of the merchant survey. We think that this is a reasonable assumption – particularly so because, by coincidence, 2008 happens to lie exactly in between 2005 and 2011¹⁹.

Prior to taking averages, we also performed another operation. For a merchant who is pondering card acceptance the crucial question is: 'What share of my transactions will enjoy the benefits brought about by card payments once I start accepting cards (the 'wanna take' argument), and/or 'What percentage of my sales revenue do I stand to lose if I don't accept cards?' (the 'must-take' argument). The answer to this question depends on French consumers' desire to pay by card. Crucially, observed card usage underestimates this desire because merchant acceptance puts a 'ceiling' on card usage. In other words, we would have an endogeneity problem.

We therefore eliminated from our calculations all transactions where consumers were forced to use a payment instrument other than the one they wanted to²⁰. Concretely, we had to drop 1,746 transactions (or 8%) of the 21,793 that were left after the elimination of the hypermarkets.²¹

¹⁹ Also, as documented by Bouhdaoui and Bounie (2012), in France changes in payment behaviour over 2005-2011 were gradual, not abrupt. (As a sensitivity analysis, we have repeated our estimations with the 2005 data only; see 6.2.) This said, a strict implementation of the proposed procedure would have resulted in a substantial loss of observations, in particular for the more disaggregated spatial dimensions. The reason is that not every combination of basket size + sector + region/department that appears in the merchant survey is covered in both consumer surveys. With NUTS3 departments, for example, we would have lost no less than 2,380 of the 4,601 observations (or 52%). In order to preserve as many observations as possible, we have therefore also used observations for which we only found a match in either the 2005 or the 2011 survey. As long as we work with NUTS1 regions, this affects a mere 118 observations of the 4,369 (or 3%). With NUTS2 and NUTS3 regions, the impact is progressively bigger: the observations for which we use a single-year value rather than an average increase to, respectively, 520 out of 4,299 (12%) and 1,454 out of 3,443 (42%).

²⁰ In the diaries, respondents were given the possibility to check a box that said (translated) "forced choice of payment instrument". One of the examples of such a situation that was given in the user guide for the 2011 survey was "you have paid by cheque even though you wanted to pay using your bank card but the shop refused the bank card". Another illustration was: "you wanted to pay by bank card but the amount is below the threshold at which the shop accepts card payments". So, provided that the respondents filled out the diary correctly, if we eliminate all transactions for which they indicated that the choice of payment instrument was forced (and, reassuringly, the patterns in the discarded transactions make sense), we in effect are left with transactions where consumers could use the payment instrument they wanted.

²¹ Concerning the potential endogeneity, let us also stress that we do *not* have on one side of our regressions the share of card payments (in a certain region and sector, and for a certain transaction range) and on the other side the share of card-accepting merchants. This would have been a classic case of simultaneity. Rather, our consumer preferences variable is based on the experience of multiple consumers at multiple merchants, whereas the dependent variable is acceptance (y/n) of an individual merchant. Given this difference in aggregation level, reverse causation would not seem to be an issue. Nevertheless, in a robustness check, we also ran a regression with consumer preferences for the year 2005 alone (rather than an average of 2005 and 2011), so that there is, on

Our probabilities are thus conditional: *when and where it was possible*, to what extent did consumers pay by card? In order to stress this, we have coined the resulting variable ‘consumer card preferences’.

As can be seen in Table 3, the revealed card preferences of French consumers vary literally from 0 to 100 per cent, with an average of 35.4 per cent. Section 4.2 already documented that card usage varies substantially per sector, region, and transaction size. It is thus not surprising that the variation is even higher when the three dimensions are combined. We also note that the mean of the variable is quite stable from one definition to another – around 35 per cent – except for the variable that excludes the transaction value dimension. Obviously, the dispersion is higher when we use three dimensions to compute the variable (the first three definitions) than when we only use two dimensions (the last three definitions).

Table 3: Descriptive statistics for the consumer preferences variable (with different definitions)

	Geographical dimension = NUTS1	Geographical dimension = NUTS2	Geographical dimension = NUTS3	Without geographical dimension	Without sectorial dimension (NUTS1)	Without transaction value dimension (NUTS1)
N	4,369	4,299	3,443	4,372	4,372	4,601
Mean	35.38	35.92	35.83	35.13	35.87	31.83
Standard deviation	22.44	26.21	33.60	18.10	15.60	14.94
min	0.00	0.00	0.00	0.00	0.25	6.47
max	100.00	100.00	100.00	75.76	62.61	65.04

As set out at the start of the subsection, our hypothesis concerning the consumer preferences variable is straightforward: we expect it to correlate positively with merchant card acceptance. Crucially, however, our approach cannot discriminate between the ‘wanna take’ and ‘must take’ explanations for this correlation ²². But, luckily, in order to demonstrate the existence of network externalities – our ultimate goal – we do not need to.

That network externalities are key in the ‘wanna-take’ scenario is self-evident: ‘wanna take’ is the very definition of (indirect) network externalities. But the externalities are also at work in the ‘must take’ explanation, albeit with a different (and more lengthy) ‘transmission’ from

purpose, also a difference in timing with the dependent variable (which relates to 2008). The results proved stable. As a final check, we also performed Durbin-Wu-Hausman tests (Davidson and MacKinnon, 1993) for all variants of the consumer preferences variable; see Section 6.

²² Neither can the extant literature, for that matter.

consumer card preferences to merchant card acceptance. From the point of view of non-card-accepting merchants, this transmission consists of the following steps: when consumers' desire to pay by card increases, so do the benefits of accepting cards for rival merchants; as a result, more of these competitors will start accepting cards; this, in turn, increases the danger of losing card-loving customers for merchants who do not accept cards; ultimately, more of the latter merchants might give in, and start accepting cards.

In short, indirect network externalities also play a crucial role in the 'must take' scenario – in the first step – but this time not for the merchants whose card acceptance decision we study, but for their rivals. Hence, if we can demonstrate that consumer preferences impact merchant card acceptance we have at the same time demonstrated the existence of indirect network externalities – regardless of whether merchants accepts cards for wanna-take or must-take reasons. In an attempt to separate the two explanations, we did add a variable to our regressions that measures the (perceived) degree of competition; see 5.3. Ideally we have liked to control for the proportion of rival merchants who accept cards, but we do not dispose of this information.

5.2. Financial costs

For merchants, financial costs are an obvious element in any adoption decision. This is no different for payment instruments (Carbó-Valverde et al., 2012). We therefore should control for both the variable and fixed costs associated with card acceptance. The variable costs consist mainly of the merchant discount fees; see below.²³ But accepting card payments also entails fixed cash outlays – for buying or renting a terminal, for example. Unfortunately, our merchant survey does not provide information on such costs. As explained in Section 5.3, we therefore use merchant size as a (rough) proxy.

²³ In France most payment terminals nowadays rely on the Internet to connect to payment scheme servers, and merchants typically pay a subscription for the service. Telecommunications costs can thus be considered fixed.

Table 4: Descriptive statistics for the independent variables

Variable	Definition	Source	Mean	Min	Max	N
Card usage						
Annual value of card payments	Value of card payments per inhabitant, per department, in 2008 (in euro)	CB	4,834	2,416	13,508	4,601
Consumer card preferences	Share of card payments per interval of transaction values, sector, and region (NUTS1)	Consumer survey	35.38	0	100	4,372
Financial costs: Harmonised discount fee	Set of dummy variables: 'low' 'intermediate' 'high'	MS				
			0.27	0	1	4,601
			0.19	0	1	4,601
			0.54	0	1	4,601
Degree of competition	Set of dummy variables for the <i>exclusive</i> answer to the question "How would you describe the degree of competition you face?" 'not competitive' 'weakly competitive' 'strongly competitive' 'do not know/refuse to answer'	MS				
			0.16	0	1	4,601
			0.31	0	1	4,601
			0.51	0	1	4,601
			0.02	0	1	4,601
Characteristics of customers						
Financial situation	Set of dummy variables for the <i>non-exclusive</i> answer to the question "If you had to describe the financial situation of your clients, would you say they are 'financially well-off' 'neither rich nor poor' 'poor'	MS				
			0.27	0	1	4,601
			0.67	0	1	4,601
			0.30	0	1	4,601
Age	Set of dummy variables for the <i>non-exclusive</i> answer to the question "If you had to describe the age of your clients, would you say they are 'less than 30 years' 'between 30 and 60 years' 'more than 60 years'	MS				
			0.41	0	1	4,601
			0.89	0	1	4,601
			0.51	0	1	4,601
Sex	Set of dummy variables for the <i>exclusive</i> answer to the question "If you had to describe the financial situation of your clients would you say they are 'mostly women' 'mostly men' 'mixed clientele' 'do not know'	MS				
			0.36	0	1	4,601
			0.17	0	1	4,601
			0.47	0	1	4,601
			0.004	0	1	4,601

Merchant size						
Annual sales revenue	Set of dummy variables for the <i>unique</i> answer to the question “What is your annual sales revenue?”	MS				
	‘less than €50,000’,		0.16	0	1	4,601
	‘from €50,000 to €200,000’,		0.28	0	1	4,601
	‘from €200,000 to €500,000’,		0.14	0	1	4,601
	‘more than €500,000’,		0.18	0	1	4,601
‘do not know/refuse to answer’	0.23	0	1	4,601		
Number of operations per day	Set of dummy variables for the <i>unique</i> answer to the question “On average, how many transactions do you realise per day?”	MS				
	‘less than 5’,		0.13	0	1	4,601
	‘from 5 to 20’,		0.35	0	1	4,601
	‘from 21 to 50’,		0.15	0	1	4,601
	‘from 51 to 100’,		0.07	0	1	4,601
	‘more than 100’,		0.13	0	1	4,601
‘do not know/refuse to answer’	0.18	0	1	4,601		
Card fraud	Annual value of fraudulent card payments over the total value of card payments, per department, in 2008	CB	0.0004	0.00004	0.001	4,601
Tax regime	Set of dummy variables for the <i>unique</i> answer to the question “What is your taxation regime?”	MS				
	‘micro-firm regime’		0.06	0	1	4,601
	‘simplified’		0.31	0	1	4,601
	‘normal’		0.40	0	1	4,601
	‘other’		0.09	0	1	4,601
‘do not know/refuse to answer’	0.14	0	1	4,601		
Length of bank relationship	Set of dummy variables for the <i>unique</i> answer to the question “Since when have you had an account with your bank?”	MS				
	‘1 to 3 years’,		0.28	0	1	4,601
	‘3 to 10 years’,		0.33	0	1	4,601
	‘10 to 20 years’,		0.23	0	1	4,601
	‘more than 20 years’,		0.14	0	1	4,601
‘do not know/refuse to answer’	0.02	0	1	4,601		
Bank network	Set of 14 dummy variables corresponding to the 13 most important French banks plus a miscellaneous category.	MS	-			4,601

Where the discount fees are concerned, Section 4.1 showed that French acquirers use a wide array of pricing plans. We thus needed to find a way to render the level of the fees comparable across merchants. A second complication is that not all merchants provided information. Moreover, we have, by definition, no fee data for merchants who do not accept cards, whereas if we want to explain (non-)acceptance we clearly need to have an idea of how much these merchants would have ended up paying had they decided to accept cards.

Our solution to these problems consists of three steps. In a first step we computed how much the 1,152 merchants for whom we have fee data ended up paying in card fees over the year – including annual subscriptions, if any. (We refer to Appendix A.3 of the working paper version for details.) To have a common measure across pricing plans, we divided these total fees by annual card sales revenue. The result can be seen as a harmonised merchant discount fee (HMDF), per euro of card sales revenue. We created three categories for this fee – ‘low’, ‘intermediate’, and ‘high’ – each corresponding to around a third of its distribution.²⁴ We decided to work with intervals so as to make our final estimates (see step 3) more stable.²⁵

In a second step we used an ordered logit model to explain, for the merchants for whom we have the information, the fee category in which they ended up. The explanatory variables are: annual total sales revenue, total number of transactions per day, identity of acquirer²⁶, length of bank relationship, bank, and region (on the NUTS1 level²⁷). As can be seen in Table 5, sales revenue, bank network, and region are the three main determinants, whereas the number of transactions per day is not statistically significant. These findings are in line with the observation, in Section 3, that pricing strategies can differ between and even within banks, as well as with the descriptive statistics provided in Table 2 (where we observe that *ad valorem* fees are the most prevalent in France).

²⁴ The ranges of the tertiles are as follows: ‘less than 0.747 eurocents’ for ‘low’ (36.5 per cent of the merchants), ‘between 0.00747 and 0.0075 eurocents’ for ‘intermediate’ (32.8 per cent) and ‘more than 0.0075 eurocents’ for ‘high’ (30.7 per cent). The minimum and maximum values are 0.0000857 and 0.96 eurocents. (The tertiles do not account for exactly 33.3 per cent each because the HMDFs are discrete and sometimes a great many merchants share the same fee.)

²⁵ Since we needed to make quite a few assumptions in order to be able to compute the HMDF and since the survey responses that we use in our calculations may well be imprecise, we thought it unwise to try to predict, in step 3, exact fees for merchants for whom we do not have the information. By predicting only a rough level, we reduce our dependence on both our assumptions and the quality of the answers.

²⁶ As explained in Section 3, in France pricing strategies differ widely between banks.

²⁷ We opted for the NUTS1 level rather than NUTS3 (departments) so as to be sure to have a sufficiently high number of merchants per territorial division. As explained in Section 4.1, the geographical stratum of the merchant survey was on the NUTS1 level. For certain departments we have less than ten merchants.

Table 5: Estimation of the discount fee (ordered logit model)

Probability to climb the scale from the category "low" to "intermediate and to "high"	coef.	se
Number of transactions per day ("less than 5" as reference):		
from 5 to 20	-0.12	(0.24)
from 21 to 50	-0.12	(0.26)
from 51 to 100	-0.039	(0.29)
more than 100	0.27	(0.27)
do not know / refuse to answer	0.036	(0.31)
Total annual sales revenue ("less than 50 K€" as reference):		
from 50 K€ to 200 K€	-0.78***	(0.20)
from 200 K€ to 500 K€	-1.38***	(0.22)
more than 500 K€	-2.04***	(0.22)
Length of bank relationship ("less than 1 year" as reference):		
from 1 to 3 years	0.13	(0.23)
from 3 to 5 years	0.32	(0.24)
from 5 to 10 years	-0.0045	(0.23)
from 10 to 15 years	0.11	(0.25)
from 15 to 20 years	0.50*	(0.26)
more than 20 years	0.29	(0.25)
do not know / refuse to answer	-1.31	(1.29)
Bank network ²⁸ :		
A	-0.45**	(0.23)
B	-0.17	(0.25)
C	-0.20	(0.53)
D	-0.16	(0.29)
E	-0.32*	(0.19)
F	-0.68***	(0.26)
G	-0.096	(0.24)
H	-0.93***	(0.41)
I	-1.11**	(0.46)
J	0.15	(0.54)
K	-0.53**	(0.27)
L	0.28	(1.45)
M	-0.50**	(0.25)
Region (1 as reference):		
2	-0.42*	(0.26)
3	-0.60***	(0.23)
4	0.46	(0.30)
5	-0.22	(0.24)
6	-0.64***	(0.21)
7	-0.081	(0.22)
8	-0.58***	(0.22)
9	-0.13	(0.20)
cut 1	-2.27***	(0.37)
cut 2	-0.73**	(0.36)
N	1,132	
Pseudo R ²	0.069	
AIC	2,385.4	
BIC	2,576.6	
Log LK	-1,154.7	
*: p<0.10, **: p<0.05, ***: p<0.01		

In the third and final step, we used the probability form of our logit model to predict the probabilities of belonging to each of the tertiles for the 3,499 merchants for whom we do *not* have fee information. Merchant per merchant we then picked the tertile with the highest

²⁸ Identities are not disclosed for reasons of confidentiality.

probability as our prediction of their (category of) discount fee. In the end, we know for all merchants in our sample – card acceptors for whom we have fee data, card acceptors for whom we lack fee data, and non-acceptors – the categories in which they, respectively, really are, probably are, and would probably end up if they accepted cards. Incidentally, 54.4 per cent of the merchants are in the ‘high’ category, vs. 18.8 for ‘intermediate’ and 26.8 for ‘low’.

5.3. *Other variables*

As documented in Section 2, previous empirical studies have shown that the *degree of competition* also affects merchants’ decision to accept cards. The intuition is based on Rochet and Tirole (2002) who find, in a two-sided market model, that merchants who face competition are more likely to accept cards in order to attract customers from competitors who do not, or may feel obliged to accept cards so as not to lose customers. To capture this competitive effect, we asked merchants to self-assess the degree of competition in their market.²⁹ We use four categories to summarise their answers: ‘strongly competitive’, ‘weakly competitive’, ‘not competitive’, and “do not know”.³⁰

The *characteristics of a merchant’s clientele* could also, indirectly, influence his propensity to accept cards. Consumer studies such as Bagnall et al. (2014) find that card usage increases with income and age. Hence, a merchant who, say, has many high-income clients might want to accommodate their desire to pay by card. We use three different variables to capture such effects. For both age and financial situation, we have created three non-exclusive binary variables³¹; see Table 4. For the sex composition of the clientele we use four dummy variables: ‘mostly women’, ‘mostly men’, ‘mixed clientele’, and “do not know”.

As announced in sub-section 5.2, we hypothesise that fixed costs are less of a hurdle for ‘bigger’ merchants. We therefore use two measures of *merchant size* as (very rough) proxies of fixed costs: annual total sales revenue (in five classes) and daily number of transactions across all payment instruments (six items); see Table 4 for details. These variables might also pick up the degree of ‘sophistication’ of a merchant.

²⁹ For a discussion of the pros and cons of this type of measure, see Jonker (2011, p. 14).

³⁰ We have also tried the ratio, per department, between the number of CB-affiliated merchants and the total number. However, this variable proved insignificant. Compared to the first, the alternative variable is at the same time less fine-grained (it is not on the level of individual merchants) and narrower (competition between merchants involves more than just card acceptance). This probably goes same way to explain its insignificance.

³¹ Because the answer categories were non-exclusive, a merchant can, for example, receive a 1 for both ‘less than 30 years’ and ‘between 30 and 60 years’, and a 0 for ‘more than 60 years’.

Also on the costs side, card fraud may discourage acceptance as it affects merchants' bottom line. We therefore introduce the card fraud rate per department (provided by CB), which is calculated as the value of fraudulent card payments over the total value of card payments. As can be seen in Table 4, the fraud rate varies from 0.004 to 0.1 per cent, so there is quite some variation across departments. We have also tried the card fraud rate per sector.

Finally, we also control for the tax regime of the merchant, the reason being that of the three main taxation regimes for businesses in France, the "régime micro-entreprise" is substantially more evasion prone. The regime is reserved for very small businesses as well as liberal professions with sales revenue below certain thresholds. Unlike for the 'real' regimes, taxation is based on self-reported revenue (to which the tax authorities then apply a fixed rate of abatement). The idea behind our tax regime variable – a nominal variable that can take five values – is thus that merchants who fall under the micro-firm regime (6 per cent of the sample) have more room for tax evasion and will, if they engage in such activities, prefer not to accept cards in order to hide their real sales volume.

6. Estimation results

In this section, we first analyse the overall quality of our models and subsequently discuss the results. In Table 6, we present seven specifications, all with consumer preferences measured at the NUTS1 level. In models 1 to 6, we gradually introduce our variables of interest so as to detect possible multicollinearity issues. The final specification, model 7, includes all variables. The results are stable across specifications, in terms of both significance and signs of the coefficients (and this despite the loss, due to missing values, of 232 observations in models 3 and 7). This is in itself an indication of the absence of multicollinearity. Moreover, the values for the (Spearman) correlation coefficients are low.³²

In what follows, we therefore concentrate, where Table 6 is concerned, on the full specification of model 7. Unsurprisingly, this specification has the best fit, with a pseudo R^2 of 0.4 (MacFadden definition). It is also the most informative as indicated by the Akaike and Bayesian information criteria. Moreover, 83.5 per cent of the predictions are correct.³³

³² Due to the high number of variables, we do not report the correlation matrix. It is available upon request.

³³ With a cut-off value of 0.5. Also, the standardised residuals appear to be normally distributed and the exclusion of the 18 observations with a Pregibon influence statistic higher than 0.2 did not alter the outcomes.

Table 6: Estimations of the probability of card acceptance, NUTS1 consumer preferences

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	coef.	coef.	coef.	coef.	coef.	coef.	coef.
Card usage							
annual value of card payments per inhabitant in the department		0.08 (0.02)					0.05 (0.03)
consumer preferences (NUTS1)			0.012*** (0.0027)				0.013*** (0.0027)
Harmonised merchant discount fee ("low" as reference):							
intermediate					-0.49*** (0.16)		-0.55*** (0.16)
high					-0.69*** (0.16)		-0.76*** (0.17)
Degree of competition ("not competitive" as reference):							
weakly competitive				0.20 (0.12)			0.29** (0.13)
strongly competitive				0.47*** (0.12)			0.55*** (0.12)
do not know				0.89*** (0.33)			0.91** (0.41)
Financial situation of customers:							
financially well-off	0.15 (0.10)	0.15 (0.11)	0.16 (0.11)	0.17 (0.11)	0.15 (0.11)	0.15 (0.11)	0.17 (0.11)
neither rich nor poor	-0.069 (0.10)	-0.065 (0.10)	-0.041 (0.11)	-0.075 (0.10)	-0.088 (0.10)	-0.069 (0.10)	-0.077 (0.11)
poor	-0.27*** (0.100)	-0.27*** (0.100)	-0.23** (0.10)	-0.29*** (0.10)	-0.25** (0.100)	-0.27*** (0.100)	-0.23** (0.11)
Age of customers:							
less than 30 years old	-0.035 (0.092)	-0.036 (0.092)	-0.053 (0.095)	-0.034 (0.092)	-0.039 (0.092)	-0.035 (0.092)	-0.056 (0.096)
between 30 and 60 years old	0.87*** (0.14)	0.87*** (0.14)	0.93*** (0.14)	0.89*** (0.14)	0.88*** (0.14)	0.87*** (0.14)	0.96*** (0.14)
more than 60 years old	0.062 (0.091)	0.063 (0.091)	0.045 (0.095)	0.065 (0.092)	0.065 (0.091)	0.062 (0.091)	0.051 (0.096)
Sex of customers ("mixed clientele" as reference):							
mostly women	0.29*** (0.10)	0.29*** (0.10)	0.26** (0.10)	0.27*** (0.10)	0.28*** (0.10)	0.29*** (0.10)	0.24** (0.10)
mostly men	0.17 (0.13)	0.17 (0.13)	0.20 (0.14)	0.17 (0.13)	0.15 (0.13)	0.17 (0.13)	0.16 (0.14)
do not know / refuse to answer	1.89** (0.75)	1.89** (0.75)	1.96** (0.77)	1.81** (0.75)	1.86** (0.74)	1.89** (0.75)	1.88** (0.75)
Annual sales revenue ("less than 50K €" as reference):							
from 50K € to 20K €	0.91*** (0.12)	0.91*** (0.12)	0.88*** (0.12)	0.90*** (0.12)	0.78*** (0.13)	0.91*** (0.12)	0.73*** (0.13)

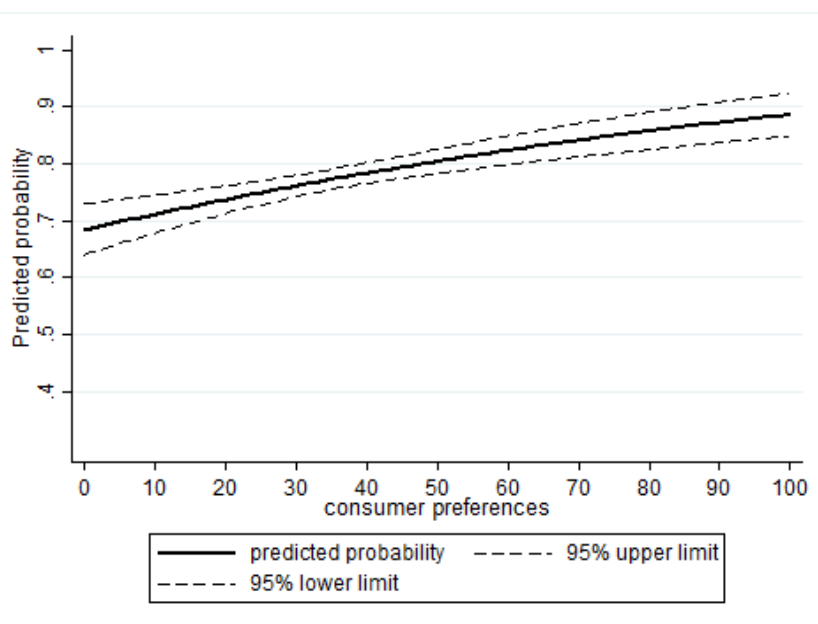
from 200K € to 500K €	1.89*** (0.16)	1.89*** (0.16)	1.86*** (0.17)	1.87*** (0.16)	1.53*** (0.19)	1.89*** (0.16)	1.43*** (0.19)
more than 500K €	2.92*** (0.19)	2.92*** (0.19)	2.95*** (0.20)	2.89*** (0.19)	2.38*** (0.23)	2.92*** (0.19)	2.32*** (0.24)
do not know / refuse	1.33*** (0.14)	1.33*** (0.14)	1.27*** (0.14)	1.32*** (0.14)	1.36*** (0.14)	1.33*** (0.14)	1.29*** (0.14)
Number of transactions per day ("less than 5" as reference):							
from 5 to 20	1.13*** (0.13)	1.13*** (0.13)	1.16*** (0.14)	1.11*** (0.13)	1.10*** (0.13)	1.13*** (0.13)	1.11*** (0.14)
from 21 to 50	1.54*** (0.17)	1.54*** (0.17)	1.65*** (0.18)	1.55*** (0.17)	1.52*** (0.17)	1.54*** (0.17)	1.65*** (0.18)
from 51 to 100	1.69*** (0.22)	1.69*** (0.22)	1.89*** (0.24)	1.69*** (0.23)	1.69*** (0.23)	1.69*** (0.22)	1.90*** (0.24)
more than 100	1.28*** (0.20)	1.29*** (0.20)	1.45*** (0.21)	1.26*** (0.21)	1.34*** (0.21)	1.28*** (0.20)	1.50*** (0.22)
do not know / refuse to answer	0.68*** (0.16)	0.68*** (0.16)	0.71*** (0.16)	0.63*** (0.16)	0.68*** (0.16)	0.68*** (0.16)	0.69*** (0.17)
Card fraud						0.35 (115.5)	-64.7 (178.4)
Tax regime ("micro-firm regime" as reference):							
simplified	0.74*** (0.17)	0.74*** (0.17)	0.79*** (0.17)	0.72*** (0.17)	0.73*** (0.17)	0.74*** (0.17)	0.77*** (0.18)
normal	1.05*** (0.17)	1.05*** (0.17)	1.07*** (0.18)	1.02*** (0.17)	1.05*** (0.17)	1.05*** (0.17)	1.05*** (0.18)
other regime	0.059 (0.21)	0.061 (0.21)	0.20 (0.22)	0.060 (0.21)	0.052 (0.21)	0.059 (0.21)	0.18 (0.22)
do not know / refuse to answer	0.95*** (0.20)	0.95*** (0.20)	1.05*** (0.21)	0.94*** (0.20)	0.95*** (0.20)	0.95*** (0.20)	1.04*** (0.21)
Intercept	-2.49*** (0.33)	-2.53*** (0.34)	-3.04*** (0.35)	-2.69*** (0.34)	-1.71*** (0.37)	-2.49*** (0.33)	-2.42*** (0.42)
Observations	4,601	4,601	4,369	4,601	4,601	4,601	4,369
Pseudo R ²	0.37	0.37	0.39	0.38	0.38	0.37	0.40
AIC	3,696.6	3,698.4	3,425.0	3,681.1	3,681.7	3,698.6	3,398.2
BIC	4,011.8	4,020.1	3,744.2	4,015.7	4,009.8	4,020.3	3,762.0
Log likelihood	-1,799.3	-1,799.2	-1,662.5	-1,788.6	-1,789.9	-1,799.3	-1,642.1
*: p<0.10, **: p<0.05, ***: p<0.01							
The sector of the merchant (10 categories), the length of the bank relationship (5 categories) and the bank network (14 categories) are also introduced but not reported for reasons of convenience. Detailed results can be obtained upon request.							

Table 7: Estimations of card acceptance with different measures of consumer preferences

	Geographical dimension = NUTS1 (Table 6)	Geographical dimension = NUTS2	Geographical dimension = NUTS3	Without geographical dimension	Without sectorial dimension	Without transaction value dimension
	Model A	Model B	Model C	Model D	Model E	Model F
	coef. (s.e.)	coef. (s.e.)	coef. (s.e.)	coef. (s.e.)	coef. (s.e.)	coef. (s.e.)
Card usage						
annual card payments per inhabitant in the department	0.0000048 (0.000028)	0.0000040 (0.000028)	0.0000071 (0.000030)	0.0000010 (0.000028)	-0.0000019 (0.000028)	0.0000093 (0.000027)
consumer preferences	0.012*** (0.0027)	0.0069*** (0.0021)	0.0058*** (0.0017)	0.028*** (0.0044)	0.020*** (0.0036)	0.00081 (0.0085)
Harmonised merchant discount fee ("low" as reference):						
intermediate	-0.55*** (0.16)	-0.51*** (0.17)	-0.49** (0.19)	-0.52*** (0.16)	-0.52*** (0.16)	-0.50*** (0.16)
high	-0.76*** (0.17)	-0.68*** (0.17)	-0.75*** (0.20)	-0.74*** (0.17)	-0.75*** (0.17)	-0.71*** (0.16)
Degree of competition ("not competitive" as reference):						
weakly competitive	0.29** (0.13)	0.31** (0.13)	0.19 (0.15)	0.27** (0.13)	0.28** (0.13)	0.22* (0.12)
strongly competitive	0.55*** (0.12)	0.55*** (0.12)	0.41*** (0.14)	0.55*** (0.12)	0.56*** (0.12)	0.47*** (0.12)
do not know / refuse to answer	0.91** (0.41)	0.94** (0.41)	0.83* (0.46)	0.92** (0.42)	0.94** (0.41)	0.90*** (0.33)
Financial situation of customers:						
financially well-off	0.17 (0.11)	0.19* (0.11)	0.024 (0.13)	0.15 (0.11)	0.14 (0.11)	0.16 (0.11)
neither rich nor poor	-0.077 (0.11)	-0.066 (0.11)	-0.10 (0.12)	-0.094 (0.11)	-0.088 (0.11)	-0.091 (0.10)
poor	-0.23** (0.11)	-0.22** (0.11)	-0.18 (0.12)	-0.21* (0.11)	-0.21* (0.11)	-0.26*** (0.10)
Age of customers:						
less than 30 years old	-0.056 (0.096)	-0.064 (0.097)	0.027 (0.11)	-0.076 (0.096)	-0.094 (0.096)	-0.040 (0.092)
between 30 and 60 years old	0.96*** (0.14)	0.94*** (0.15)	1.06*** (0.17)	0.94*** (0.15)	0.93*** (0.15)	0.89*** (0.14)
more than 60 years old	0.051 (0.096)	0.041 (0.097)	-0.027 (0.11)	0.051 (0.096)	0.062 (0.096)	0.069 (0.092)
Sex of customers ("mixed clientele" as reference):						
mostly women	0.24** (0.10)	0.25** (0.11)	0.22* (0.12)	0.23** (0.10)	0.24** (0.10)	0.27*** (0.10)
mostly men	0.16 (0.14)	0.17 (0.14)	0.13 (0.17)	0.16 (0.14)	0.13 (0.14)	0.14 (0.13)

do not know / refuse to answer	1.88** (0.75)	1.91** (0.76)	1.81** (0.81)	1.93*** (0.75)	1.95*** (0.75)	1.79** (0.74)
Annual sales revenue ("less than 50K €" as reference):						
from 50K € to 200K €	0.73*** (0.13)	0.77*** (0.14)	0.73*** (0.15)	0.72*** (0.13)	0.72*** (0.13)	0.77*** (0.13)
from 200K € to 500K €	1.43*** (0.19)	1.49*** (0.20)	1.47*** (0.22)	1.42*** (0.19)	1.39*** (0.19)	1.49*** (0.19)
more than 500K €	2.32*** (0.24)	2.40*** (0.24)	2.58*** (0.29)	2.29*** (0.24)	2.28*** (0.24)	2.34*** (0.23)
do not know / refuse to answer	1.29*** (0.14)	1.28*** (0.14)	1.32*** (0.16)	1.27*** (0.14)	1.26*** (0.14)	1.35*** (0.14)
Number of transactions per day ("less than 5" as reference):						
from 5 to 20	1.11*** (0.14)	1.10*** (0.14)	1.13*** (0.17)	1.12*** (0.14)	1.12*** (0.14)	1.08*** (0.14)
from 21 to 50	1.65*** (0.18)	1.63*** (0.18)	1.69*** (0.21)	1.67*** (0.18)	1.68*** (0.18)	1.53*** (0.17)
from 51 to 100	1.90*** (0.24)	1.89*** (0.24)	1.96*** (0.28)	1.97*** (0.24)	1.98*** (0.24)	1.69*** (0.23)
more than 100	1.50*** (0.22)	1.45*** (0.22)	1.39*** (0.24)	1.60*** (0.22)	1.59*** (0.22)	1.32*** (0.21)
do not know	0.69*** (0.17)	0.69*** (0.17)	0.65*** (0.19)	0.74*** (0.17)	0.76*** (0.17)	0.64*** (0.16)
Card fraud	-64.7 (178.4)	-35.8 (178.9)	-42.6 (189.9)	7.86 (177.8)	-24.8 (177.7)	-10.3 (171.2)
Tax regime ("micro-firm regime" as reference):						
simplified	0.77*** (0.18)	0.79*** (0.18)	0.77*** (0.19)	0.79*** (0.18)	0.78*** (0.18)	0.71*** (0.17)
normal	1.05*** (0.18)	1.06*** (0.18)	1.00*** (0.20)	1.04*** (0.18)	1.05*** (0.18)	1.02*** (0.17)
other regime	0.18 (0.22)	0.19 (0.22)	0.079 (0.24)	0.17 (0.22)	0.18 (0.22)	0.053 (0.21)
do not know / refuse to answer	1.04*** (0.21)	1.10*** (0.21)	1.06*** (0.23)	1.04*** (0.21)	1.04*** (0.21)	0.94*** (0.20)
Intercept	-2.42*** (0.42)	-2.31*** (0.42)	-1.97*** (0.48)	-2.95*** (0.43)	-2.67*** (0.42)	-1.97*** (0.47)
Observations	4,369	4,299	3,443	4,372	4,372	4,601
Pseudo R ²	0.40	0.40	0.40	0.40	0.40	0.38
AIC	3,398.2	3,342.6	2,666.9	3,388.3	3,396.4	3,671.8
BIC	3,762.0	3,705.5	3,017.2	3,752.1	3,760.3	4,038.5
Log likelihood	-1,642.1	-1,614.3	-1,276.5	-1,637.1	-1,641.2	-1,778.9
*: p<0.10, **: p<0.05, ***: p<0.01						
The sector of the merchant (10 categories), the length of the bank relationship (5 categories) and the bank network (14 categories) are also introduced but not reported - for reasons of convenience. Detailed results can be obtained upon request.						

Figure 1: Consumer preferences and probability of card acceptance



To start with the impact of card usage, our first proxy, namely the annual value of card payments per inhabitant in the department, proves to be insignificant; see model 7 in Table 6. We also tested a variant, namely its average over the period 2000-2008.³⁴ Again we found no evidence of a significant correlation. By contrast, our second proxy, consumer preferences, is highly statistically significant and positive. This said, the magnitude of the impact is low: an increase of 10 percentage points in consumer card preferences leads to an increase in the probability of merchant card acceptance of 2 per cent; see Figure 1.

This result is robust to changes in the geographical dimension of the variable; see Table 7. We test three variants: NUTS2, NUTS3 (the most detailed), as well as a consumer preferences variable without any geographical dimension. The coefficients are always significant at the 1 per cent level.³⁵ In short, our second (and preferred) card usage variable consistently exerts a positive influence on the probability of card acceptance. This demonstrates the value-added of the variable.

³⁴ We also tried the volume (rather than the value) of card payments in the department, and this for both the year 2008 and the period 2000-2008. Neither variable turned out to affect card acceptance.

³⁵ As already signalled in footnote 16, we have also repeated our regressions with consumer preferences based on 2005 data only. The coefficients remained significant, except in the NUTS3 regression, a regression with only 2,772 observations. (As explained in 5.1, we lose observations when we refine the spatial dimension. Not exploiting the 2011 consumer survey entails even higher losses.)

Conceptually, as argued in Section 2, the consumer preferences variable is an improvement over Loke (2007), in that it does not rely on a subjective evaluation by merchants. Empirically, we find that the sector and (average) transaction size dimensions of the variable are essential. Indeed, our first card usage variable has a geographical dimension but does not yield significant results. Exploring this further, the additional models E and F in Table 7 show that transaction size is *the* crucial component. Indeed, the coefficient of ‘consumer preferences’ becomes insignificant when we drop the transaction size dimension, whereas it remains significant, at the 1 per cent level, without the sectorial dimension³⁶. This result is in line with a well-known empirical and theoretical finding in the consumer payments literature: transaction size is a prominent driver of consumer payment choice (Bouhdaoui and Bounie, 2012; Hayashi and Klee, 2003; Whitesell, 2009).

To sum up, our results show that consumer preferences matters, and thus, as explained in section 5.1, that network externalities matter. However, our approach cannot discriminate between the two explanations for the positive link between consumer card preferences and merchant acceptance – and thus leaves an interesting challenge for future research.

Moving down our list of explanatory variables, we find that the (predicted) merchant discount fee has a strong impact. The odds for a merchant with an ‘intermediate’ or ‘high’ fee are, respectively, 0.6 and 0.5 times lower than for a merchant with a ‘low’ fee. Closer inspection confirmed the clear distinction between merchants in the ‘low’ category and the others, as well as the absence of a statistically significant difference between merchants with ‘intermediate’ and ‘high’ fees.

The degree of competition matters too. Merchants who perceive competition in their market as ‘very low’ are less likely to accept cards. The odds that a merchant with a ‘high’ perceived level of competition accepts cards are 1.7 times higher than for a merchant with a ‘very low’ level. However, whereas Jonker (2011, p. 23) finds that “merchants who face intense competition do not differ significantly from merchants who face moderate competition”, we do find such a difference: the gap between the ‘low’ and the ‘high’ categories amounts to 0.4 and is identical to the gap between the ‘very low’ and the ‘low’ categories (0.4)³⁷.

³⁶ In a robustness check, we added the average transaction size of the merchant (categorical variable) to the regression. This did not affect our results.

³⁷ Note that an interaction term between degree of competition and consumer preferences proved insignificant.

The three variables that characterise a merchant's clientele – sex, financial situation, and age – also play a role, which indirectly confirms the results of studies based on consumer survey data. Compared to the base category “mixed clientele”, the odds for a merchant with a mainly female clientele to accept cards are 1.3 times higher than those for a merchant with a mixed clientele. Conversely, a mainly male clientele has no statistically significant impact. Merchants who sell goods and services to ‘poor’ customers have a lower probability to accept cards, namely 0.8 times less.³⁸ This result echoes Jonker et al. (2012), who find that the higher the income, the more likely consumers are to use debit cards rather than cash, and especially the results of Jonker (2011) mentioned in Section 2. Finally, merchants with a clientele aged between 30 and 60 accepts cards have the highest odds ratio (2.6). This result is in line with Bagnall and Flood (2011) for Australia, Arango et al. (2012) for Canada, and Jonker et al. (2012) for the Netherlands, who detect a greater proportion of cash payments for younger and/or older age groups.

Merchant size – proxied by sales revenue and daily number of transactions – also exerts a strong influence on card acceptance. Compared to the lowest category (less than 50,000 euro), the odds-ratios of the next three levels are strictly increasing and each odds-ratio is at least two times higher than the previous (at 2.1, 4.2, and 10.1). In the same vein, compared to merchants with less than 5 transactions per day, merchants who realise a higher volume have a far greater probability to accept cards. In line with McAndrews and Wang (2012) and Jonker (2011), our results might point towards the role of fixed costs in the merchant card acceptance decision, as scale allows merchants to better recover their investments in payment terminals, etc. But alternative explanations cannot be excluded.

Somewhat surprisingly, our card fraud variable proved to be insignificant. This is also true for two alternatives that we tried: the fraud rate per department over 2000-2008 and the 2008 fraud rate per sector. But then none of these variables take into account the incidence of fraud with competing payment instruments. Building a relative measure was impossible because in France there are no centralised statistics on, for example, cheque fraud.

³⁸ We also tried a variant with the five original income categories (rather than the three that we created by grouping the first and final two together). This did not change the results.

Finally, the taxation regime of the merchant, which is meant to proxy the room for tax evasion³⁹, does have a significant impact on the probability of card acceptance: we find that the micro-firm regime exerts a negative effect. The odds ratio that a merchant with a ‘normal’ taxation regime accepts cards are 2.9 times higher than for a merchant with a micro-firm regime.

7. Conclusion

The present paper aimed to study the determinants of merchant card acceptance with a special focus on the network externalities generated by cardholders. An improved understanding of these externalities is of interest to several stakeholders, but especially to antitrust authorities, which may need to determine to what extent merchants are locked in (Rysman, 2009).

In terms of data, we matched two large-scale shopping diary surveys among French consumers with a nation-wide merchant survey. As far as we know, this is a first in the payments literature. Specifically, we computed, merchant per merchant, the probability that their average basket is paid for by card in similar settings (that is, in their sector and region), provided that consumers are given the option to do so. We see this probability as a revealed card payment preference of French consumers. We also propose a novel way to impute the (expected) merchant discount fee for, on the one hand, merchants who do not accept cards and, on the other hand, merchants who do but who were not able (or did not want) to provide information on their costs of card acceptance.

Using a binary logit model, we find that, besides costs, the competitive environment matters too: higher (perceived) competitive pressure increases the probability that a merchant will accept cards. We also find that merchants who are subject to a taxation regime that is more prone to tax evasion are less likely to accept cards. Finally, where the key question of the paper is concerned, we find that characteristics of the clientele – sex, age, and financial situation – prove to play a role and, especially, that merchants in regions, sectors, and especially transaction ranges where French consumers’ desire to pay by card is more pronounced are significantly more likely to accept the ‘carte bancaire’. This result is robust to refinements in the geographical dimension of the consumer preferences variable.

To sum up, while French merchants who fall under the micro-firm taxation regime clearly (also) have other considerations in mind, we find strong support for the hypothesis that merchants

³⁹ One could argue that the taxation regime is also related to the size of the merchant. However, our correlation matrix did not reveal a strong correlation with either sales revenue or daily number of transactions.

tend to take into account consumer payment preferences when deciding which payment instruments to accept. At the same time, this is also evidence of the existence of indirect network externalities on the merchant side of the payment card market. While we cannot discriminate between the two alternative explanations for the positive relationship between consumer card usage and merchant card acceptance, network externalities are a key element in both scenarios.

Acknowledgments

We thank the Editor, two anonymous referees, Nicole Jonker, Sibel Aydogan, Yassine Bouhdaoui, Cédric Sarasin and Ludovic Francesconi for helpful comments on earlier versions of this paper.

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