Demand for Payment Instruments
How would you like to pay?

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Abstract

Consumers and merchants seek efficient payment instruments for completing their transactions. This paper analyses the incentives lying behind the demand for payment instruments and the sources of transaction costs. Consumers and merchants will use the instrument that generally reduces demand-side – i.e. consumer and merchant – transaction costs, compared to other available instruments. Yet, intriguing differences occur in the usage of certain instruments between Australia, Canada, New Zealand, Norway, the United Kingdom and the United States. The analysis in this paper suggests that it is instruments' attractiveness to merchants that is a dominant determinant of these differences.

1.   Introduction

A plethora of transactions between consumers and merchants involve the former transferring to the latter funds for goods and services provided. Payment instruments are the devices that aid such transfers, in this way playing a fundamental role in an economy. From the instruments available for retail transactions, the two parties together agree on the instrument that allows the low-cost completion of this part of their transaction. This paper investigates the determinants of these costs in order to construct a model for understanding payment instrument demand. It then analyses the process used by consumers and merchants to choose an instrument.

In a process that began with the development of the Diners Club payment card in the United States in 1949, the range of instruments available to consumers and merchants has increased significantly in the developed world. Yet, there is considerable variation in the use of certain recently-developed instruments by consumers and merchants in a sample of six countries of this world. As well as analysing the rationale for payment instrument use, this paper studies the reasons for the differences in instrument demand in six countries, Australia, Canada, New Zealand, Norway, the United Kingdom (the "UK") and the United States (the "US"). As part of its investigation of payment instrument demand, it seeks to answer the question, why do merchants and consumers in some countries make greater use of particular instruments than those in others?

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With the development of two-sided market theory and regulatory interest in credit cards, the literature relevant to payment instruments has increased substantially in recent years. It is summarised in section 2 of this paper. Section 3 presents a model of the attributes of payment instruments that are important to consumers and merchants. Section 4 extends the model by analysing the process used by consumers and merchants to choose a payment instrument. Section 5 analyses the importance of network effects for payment instrument demand. Section 6 compares merchant acceptance of a payment instrument with consumer demand. Section 7 concludes.

This paper focuses on three recently-developed payment instruments, credit cards, debit cards and stored-value cards, which are all usable for transactions at a merchant's point of sale ("POS").[1] The key reason for this focus is availability of information. For payment instruments suitable for retail transactions in the sample countries, data showing pricing and usage together are generally available only for credit cards and debit cards. This paper assesses the causes of differences in the use of these instruments by investigating instrument usage in the English-speaking developed countries of, Australia, Canada, New Zealand, the UK and the US. Norway is also analysed in this paper because of its particularly well used debit card instrument, BankAxept. Table 1 provides some key facts for the sample countries. While comparable data isn't available for stored-value cards, this payment instrument is included in order to assess why their large-scale adoption has yet to occur. The attributes of these three instruments are compared to a traditional payment instrument still in common use, cash. Analyses of the usage of this instrument are limited, however, because data showing its usage only as a payment instrument are generally unavailable.[2]

Recently-developed payment instruments rely on contracts for the purpose of transferring funds, which makes the enforceability of contracts relevant to the adoption of payment instruments. For this reason, information about the general, country-wide protection of property rights is included for the period in which information is available from the Heritage Foundation's Index of Economic Freedom.

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[1] Credit cards and some debit cards are also useful for transactions completed away from the POS, which are termed, remote payments.

[2] Some measures of cash use may exist (such as the amount of cash in circulation), but these will capture its use as a store of value as well as a payment instrument. The work of Amromin and Chakravorti (2009), discussed in section 2, confirms the significance of this distinction.

Table 1. Key Facts for the Sample Countries

Country	Population (million)	GDP Per Capita (US$, PPP)	Index Rating for Property Rights (out of 100)		Currency
	2009	**2009**	**2011**	**1995**	**2011**
Australia	21.9	$38,911	90	90	Australian dollar
Canada	33.7	$38,025	90	90	Canadian dollar
New Zealand	4.3	$26.708	95	90[1]	New Zealand dollar
Norway	4.8	$52,561	90	90[1]	Norsk krone
United Kingdom	61.8	$34,619	85	90	Pound sterling
United States	307.4	$46,381	85	90	United States dollar

Sources: Heritage Foundation (2011), Author
(1) Figures for 1996, data for 1995 being unavailable for these countries

Compared to data for the 183 countries surveyed in the 2011 Index of Economic Freedom, the countries in the sample are sizeable, wealthy and have had a strong general level of protection of property rights in recent times. The least populous of the sample countries, New Zealand, is the 62nd smallest of the countries surveyed in the index. The average GDP per capita is US$13,847 (PPP). The ratings for protection of property rights compare to an average Property Rights rating of 43.6 in 2011. All of the countries sampled for this paper operate their own currencies.
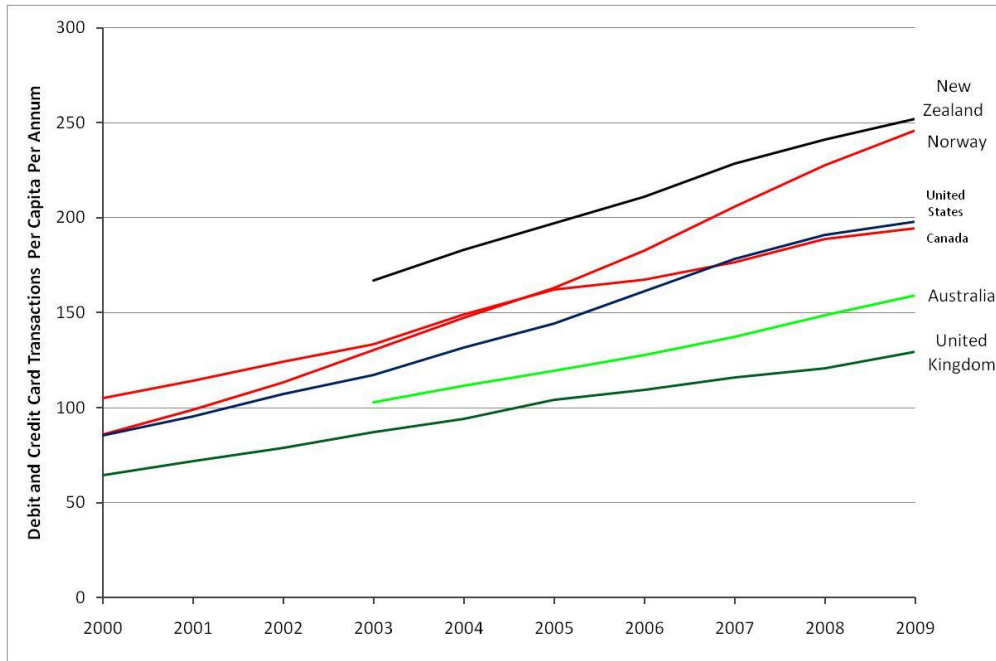
Evidence of adoption

Figure 1 shows the relative use of debit and credit cards in the sample countries.[3,4] It measures use by the number of transactions per capita per

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[3] Germany was also considered for inclusion in this graph and, more generally in this paper. Data from CPSS (2011), however, indicate the country had fewer than 30 debit and credit card transactions per capita during 2009. The author has not succeeded in explaining the reasons lying behind Germany's low card usage.

annum completed for purchases.[5] The data are from official sources described in subsection 8.1. Payments made with both card types are shown together because of the prevalence in Norway of bank overdrafts, which are an alternative to credit cards as a source of consumer credit and are accessible using debit cards.

Figure 1. Transactions Per Capita Per Annum for Debit and Credit Card Purchases

This graph shows, for example, that New Zealand had 167 transactions per capita in 2003, well at the top on the sample countries. By 2009, this had increased to 252 transactions, which still put New Zealand at the top, although Norway had almost caught up. For the other countries, the graph shows significant and sustained differences in the usage of debit and credit cards with limited convergence between the sample countries.

2.   Literature review

Payment instruments are a common example of a two-sided market because they involve interactions between two groups, merchants and consumers, who use a facility provided by a third party. Rochet and Tirole (2003) describe the fundamental role of platforms in two-sided markets as reducing transaction

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[4]   One country with higher use of debit and credit cards than those shown in the graph is Iceland. Transaction data from the Icelandic central bank, Sedlabanki Islands (2010), indicate that the country had, on average, 319 debit and credit card transactions per capita during 2009.

[5]   That is, data in the graph do not include transactions at automatic teller machines.

costs by helping users on each side of a platform interact. Competition between platforms will occur over methods of lowering transactions costs, helping to make participation in the platform attractive to both of the two groups of users. Rochet and Tirole call this, bringing both sides onboard. As defined by Dahlman (1979), transaction costs are costs of exchange between two or more parties. He classifies them into one of three groups: search and information costs, bargaining and decision costs, and policing and enforcement costs. Depending on circumstances, each source of cost would potentially play a role in decisions between payment instruments.

Consistent with Dahlman's definition of transaction costs, there appear to be a variety of causes of transaction costs relevant to choices of payment instruments, in addition to the financial costs of using an instrument. Bolt, Humphrey and Uittenbogaarda (2008) compare the adoption of new payment instruments between 1990 and 2004 in Norway, which has a system of explicitly charging consumers for the costs of different transactions, and the Netherlands, which has no similar pricing system. In the Norwegian system, consumers could reduce the fees they faced by choosing to use cheaper payment instruments, while consumers face no difference in fees when using cheaper instruments in the Netherlands. Bolt et al find that both countries have rapidly adopted electronic instruments in spite of their different approaches to consumer pricing. They attribute this to lower (although non-priced) transactions costs associated with electronic payment systems. They find, however, that Norway's system of explicit pricing has accelerated the shift to electronic payment systems by approximately 20 percent, relative to that shift in the Netherlands.[6] The finding that explicit pricing only accelerated the rate of this shift by approximately one fifth can be interpreted to show that other factors are also important, indicating that payment instruments are in fact differentiated products. The decision framework proposed by Rosen (1974) is used to analyse choices between such products. According to it, a differentiated product has a vector of implicit or "hedonic" prices that reflects the specific amounts of characteristics associated with it. Users will choose the best product in accordance with their assessment of these prices and their valuation of the attributes as a whole.

Recently-developed payment instruments

In developments described by Stearns (2007), Diners Club started the mass-marketing of a payment card that could be used at the POS of many different merchants in 1949. Diners Club received the substantial portion of its revenue from the payment by merchants of transaction fees, known as merchant service fees ("MSFs"), rather than from fees paid by cardholders. These MSFs were calculated as a proportion of a transaction's value. Such charges

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[6] They measure adoption in terms of average, annual number of transactions per person.

are labelled, proportional fees. During the 1950s, other companies, including American Express, joined Diners Club in issuing what became known as, Travel and Entertainment or T&E cards. In 1966, a Californian bank, Bank of America, began licensing to other banks its payment card, BankAmericard. This licensing structure eventually developed into the Visa credit card. The major alternative credit card, MasterCard, was formed through a similar process of cooperation between banks. All of these new cards operated by receiving the majority of their revenue from the payment of proportional MSFs. Around the world, credit and T&E cards were introduced with similar structures to those developed in the United States.

The sample countries' experiences of the development of debit cards have been more haphazard. Wilkinson (2011) reviews those experiences with the majority of countries' initial pilots of debit card networks occurring following Visa's development of an electronic debit card terminal for merchants in the US in 1979.[7] This development allowed payments to occur at the POS using cards suitable for automatic teller machine ("ATM") transactions. From 1985 through to the mid-1990s, all of the sample countries experienced changes that have led to the debit card systems that exist today. These changes are summarised in Table 4. That Table also summarises interesting differences that exist in the payment of transaction fees by merchants (MSFs) and cardholders between countries' major networks. Wilkinson (2011) includes an analysis of the development of scheme-based debit cards (those issued under schemes such as Visa or MasterCard) in all of the sample countries.

The development of stored-value cards has been even more problematic than that of debit cards. They use a rechargeable card to complete payment, often without contact between a consumer's card and a merchant's terminal (in this way, such instruments are often called, contactless).[8] Van Hove (2006) describes the problematic development of such cards in Europe, confirming that none of the networks introduced by banks in the mid-1990s have experienced significant success. He acknowledges that opportunities for these cards involving public transport appear to hold promise, with successful cards based on transport applications introduced in Hong Kong, Singapore and London. Van Hove does, however, remain cautious about these opportunities, arguing that the networks in Hong Kong and Singapore did not attract

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[7] According to Wilkinson (2011), citing the work of Hayashi, Sullivan and Weiner (2003, p. 13), the very first trial of a debit card instrument allowing payment at the POS occurred in the US in 1976.

[8] In its glossary of payments system terms, the Committee on Payment and Settlement Systems (2003) defines a stored-value card as, "a prepaid card in which the record of funds can be increased as well as decreased." Because of its greater lucidity, this paper relies on this term, although others, such as by Van Hove, use terms such as electronic purse, e-money and contactless to describe similar instruments,.

merchants to accept these instruments significantly faster than did the less successful European networks.[9]

Consumer costs of adoption, habit and learning

Schreft (2006) warns that the analysis of payment instrument choice is difficult because consumers' decisions are complex. Consistent with this, the literature points to the barrier posed by significant irreversible costs to the adoption of new payment instruments by consumers. Yang and Ching (2009) use a structured consumer lifecycle model to estimate the cost to Italian consumers from adopting (starting to use) ATM cards to obtain cash. They show the cost of adoption is non-trivial and arises because of factors such as non-pecuniary learning costs incurred at the time of adoption. They also argue the benefits of adoption are variable because younger people can expect to benefit by using a new technology for a longer period, explaining the link between a consumer's age and their adoption decisions. Similarly, Ackerberg and Gowrisankaran (2006) find consumer irreversible costs of adoption are a substantial impediment to the adoption of ACH direct entry payments by banks and consumers in the United States when they analyse data on ACH adoption decisions between 1995 and 1997. In contrast to consumers' costs, they find the costs of adoption for banks are low and do not explain much of why ACH hasn't been more widely adopted.

The irreversible costs consumers incur when adopting new instruments help explain the literature on the importance of consumer habit. For example, Guariglia and Loke (2004) show the importance of consumer habit (which they measure by the lagged use of instruments) to the adoption of non-cash payment instruments when they study instrument use, by volume and value, in 15 developed, EU and G10 countries between 1990 and 1998. (The results of this paper are further discussed later in this section in relation to measuring adoption by the value or volume of transactions made using a payment instrument.)

Consumers' irreversible costs of adoption are likely to influence the way dispersion of new payment instruments occurs. For example, Ching (2010) investigates the diffusion of generic drugs that copy a name brand drug after the expiry of its patent, noting that customers are heterogeneous and some are more price sensitive than others. Rather than fixed costs of adoption, he shows that consumer uncertainty that includes pessimistic priors about the quality of generic drugs creates a process whereby patients learn from others about generic drugs, the more price sensitive a patient the more quickly he or she tries the generic drug. While product uncertainty and price sensitivity are different to the fixed costs of adoption, it seems likely that user heterogeneity

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[9] Merchants are not yet able to accept payment from consumers using London's successful Oyster Card.

contributes to a similar learning process for consumer adoption of payment instruments. The literature does support the existence of such a learning process with payment instruments. Van Hove (2006) highlights the role of public transport in stored-value card applications by showing it can underpin usage of stored-value instruments. He quotes (p. 392) Eric Tai, Chief Executive Officer of the Hong Kong stored-value system, Oyster, who said in 2005: "[w]e have a killer application – transportation, which customers have to use on a regular basis." This quote is argued to show consumer learning because, if a consumer already holds an instrument for a specific purpose, they are more likely to subsequently try to use it as a general payment instrument, particularly if they see those around them using it. Such a learning process will contribute to a gradual dispersion of new payment instruments among consumers, raising the importance of network effects, which are discussed below.

Substitution between payment instruments

A significant amount of research shows substitution occurs between the instruments analysed in this paper. Amromin and Chakravorti (2009) show that debit card use reduces demand for low denomination notes and coins by analysing the change in transactional demand for cash resulting from greater usage of debit cards in 13 countries from 1988 to 2003.[10] They suggest that this is because these denominations are most useful for completing transactions at the POS, while high denomination notes are used for non-transactional purposes, such as being a store of value.

Zinman (2009) investigates the use of debit and credit cards and argues there is strong substitution between the two when he models payment card use in 4,000 US households between 1995 and 2004. He finds 38% of debit card use occurs as consumers choose debit to minimise the cost of transactions because choosing credit would raise such costs for consumers who already revolve debt, face a binding credit limit constraint or lack a credit card. For those consumers not facing credit charges, Zinman suggests (p. 365) paying by debit card offers greater time savings because of no requirement to regularly repay balances.[11] Zinman also cites evidence suggesting credit and debit cards are becoming stronger substitutes over time. Rysman (2006) also investigates credit and debit card usage by analysing US data between 1998 and 2001. He finds that consumers mainly use a single payment instrument, although many will hold other cards. Although he doesn't offer a conclusive answer as to why this happens, Rysman does investigate factors behind consumers' choices

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[10] They segment low denomination from high denomination bank notes by referring to what is generally available from ATMs.

[11] While this cost might be thought of as being independent of the size of a credit card bill, they will not completely be so since repaying a larger regular bill may be more difficult for a consumer than a smaller bill.

of favoured network. He finds that customers favour the network most widely accepted.

Van Hove (2004) considers the advantages of European stored-value instruments, acknowledging that substitution can occur between them and debit cards. He argues that stored-value networks may offer instruments that operate with significantly lower costs for merchants than debit cards because stored-value instruments do not require real-time connection with a central computer. However, he refers (pp. 31-32) to a lack of success for these systems in countries where debit cards are suitable for low value transactions and points out (p. 32) that a 2001 Internet survey conducted in Europe found that a "resounding" 84% of respondents answered the question, "Would you rather see that the credit/debit card were easier to use on small values?", affirmatively.

Payment instrument attributes

Two papers analyse the causes of transaction costs for users of payment instruments for consumers. Borzekowski, Kiser and Ahmed (2008) analyse a 2004 survey of debit card use by Michigan consumers and note the importance of six factors to the decision of whether to use cash, a cheque, a debit card or credit card to complete a transaction:

- time (a preference for fast transaction processing at, for example, the checkout counter)

- convenience

- money (a pecuniary motive such as avoiding interest payments or fees, using the float, or seeking airline miles or cash rewards points)

- restraint (a desire to limit overspending)

- tracking (ability to track and record purchases) and

- acceptance (acceptance of the payment method by retailers).

In her summary of research on consumers' payment instrument choice, Schreft (2006) mentions another attribute likely to be important to consumers, their ability to use one instrument, credit cards, to smooth their consumption over time. This important point indicates another important attribute for a payment instrument, the degree to which it affects consumers' liquidity constraint.

Arango and Taylor (2008) consider payment instrument decisions from a merchant's perspective using a 2006 survey of Canadian merchants. They find that merchants' preferences are shaped by both costs and the relative intensity of payment instrument use by merchants' customers. They also discuss merchants' concerns about reliability of an instrument and the risk of loss from crime. In spite of merchant preferences, however, Arango and

Taylor analyse payment instrument market shares relative to merchant perceptions of cost, reliability and risk of crime. They argue that the analysis demonstrates merchants have little control over their customers' payment instrument decisions beyond the merchant's decision to accept an instrument. This conclusion suggests that a merchant's decision to accept a particular instrument plays a fundamental role in payment instrument usage decisions.

The literature indicates that an important relationship exists between consumers' and merchants' preferred instruments. That is, behaviour of merchants in relation to an instrument can affect the attributes of that instrument for consumers. Strong evidence of this comes from the rules that govern the use of payment instruments by merchants. This paper focuses on two:

- the No-Surcharge Rule, which prevent merchants from charging customers for the use of a particular payment instrument (also known as the no-discrimination rule) and

- the Honour-All-Cards Rule, which, in the US or Australia, require merchants that accept a network's credit card to also accept that network's debit card, if the latter exists in that country (also known as the handle-all-cards rule).[12]

Several papers argue that each rule is welfare enhancing. Wright (2003) argues that removal of the No-Surcharge Rule allows monopolistic merchants to charge differential prices for credit card users. This reduces the benefits the cardholder obtains from surcharged transactions resulting in the "under-subscription" of the card network, especially when cardholders face a fixed cost when joining a network. Monnet & Roberds (2007) consider a mathematical model of a payment network and highlight the importance of a No-Surcharge Rule to participation in the network and therefore to entry of new payment instruments. By reducing agents' incentive to deal in cash, the rule increases participation and the viability of a payment network.

Bolt, Jonker & van Renselaar (2009) show that, when surcharging is allowed, it doesn't become pervasive, although the surcharging that does occur does raise total costs. They empirically analyse the number of Danish merchants who react to acquirers charging them flat fees for processing debit card transactions by surcharging customers. They find that 22% of Dutch merchants surcharge and those who do surcharge don't do so for transactions greater than, on average, 10 EUR. Bolt et al also calculate that merchants who surcharged debit card transactions charged 23 euro cents on average,

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[12]   An alternative definition, which isn't used in this paper, but which is more common for credit cards in Europe, is that the Honour-All-Cards Rule requires merchants who accept a scheme's card to always accept that card no matter who the issuer.

compared with an average MSF of 4-5 euro cents. Evans and Schmalensee (2005b, p. 93) propose two reasons why, when able to do so, many merchants choose not to surcharge: there are transaction costs of imposing different prices based on payment methods; and consumers may patronize other stores that do not surcharge.

Rochet and Tirole (2008) show how the Honour-All-Cards Rule has a socially beneficial rebalancing effect between the interchange fees charged by two platforms (such as debit and credit cards) facing different levels of competition. They point to support for their model coming from the observation that Visa and MasterCard reduced their debit interchange fees and increased their credit interchange fees following the removal of the Honour-All-Cards Rule in the US in 2003.

Network effects

The importance of network effects to retail payment systems is well established in the literature. Liebowitz and Margolis (1994) suggest an appropriate definition of network effect, the circumstances in which the net value of an action is affected by the number of agents taking equivalent actions.[13] A particular network effect relevant to retail payment systems is the chicken and egg problem. This simultaneity problem is described in the context of retail payment systems by Evans and Schmalensee (2005a). The problem is: who came first, merchants willing to accept an instrument or consumers wishing to use it? The idea is important. As well as suggesting prices have only a limited influence on debit card adoption in Norway and the Netherlands, Bolt et al (2008) show what is more important is terminal availability. They find that a 10% rise in the availability of terminals in Norway relative to the Netherlands increases the relative usage by 5.3% while a 10% rise in the relative price of debit card transactions decreases relative usage by just 2.2%. Accordingly, it appears sensible to consider the incentives of merchants when considering how network effects play out.

Measuring usage by volume or value

There are two key ways of measuring the use of recently developed payment instruments: the volume or value of transactions completed using an instrument. For several reasons, this paper measures the adoption of an instrument by focusing on the volume of transactions completed. Guariglia and Loke (2004) provide evidence showing the relative merits of each measure using data from 14 developed, EU and G10 countries between 1990 and 1998. They find both transaction volume and value are affected by past payment habits and the extent of payment instrument infrastructure (measured by the

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[13] Given the potential existence of a dynamic process of learning similar to that described by Ching (2008), Liebowitz and Margolis' definition seems very relevant.

number of merchant terminals for accepting debit card transactions), but they find subtle distinctions in the influences on the two variables. Two subtleties are explored that indicate that comparison of volumes may yield greater insights into the use of recently-developed payment instruments

Guariglia and Loke find that the interest rate is positively related to the value, but not the volume, of non-cash transactions. They suggest this happens because an increase in the interest rate raises the opportunity cost of holding a larger amount of cash. Although they are silent on the effect of income on the two variables, there are reasons for thinking that income will have a greater effect on value of a country's non-cash transactions, than on their volume. Kravis and Lipsey (1982) are among researchers observing a link between price levels and a country's wealth. More costly goods will mean greater exchanges of value in each transaction. Consistent with this idea, Snellman, Vesala and Humphrey (2001) analyse substitution of non-cash payment instruments for cash in 10 European countries and estimate that income (GDP per capita) has a positive effect on the value of cash holdings per capita. This makes it likely that the value of transactions completed by non-cash payment instruments is also positively correlated with income. Furthermore, the two countries with the largest amount of debit and credit card use per capita measured by volume shown in Figure 1, New Zealand and Norway, are also the poorest and richest, respectively, as measured by the GDP Per Capita statistics shown in Table 1.

3. Desired attributes of payment instruments

Consumers and merchants will prefer to use payment instruments that minimise the costs they face in transactions with each other. The plethora of their transactions combines with the heterogeneity of both groups to mean many payment instruments will exist in equilibrium. Why does a particular instrument get used? Assessment of that starts with an investigation of the instrument attributes that are generally preferred by consumers and merchants. Borzekowski et al (2008) and Arango and Taylor (2008) indicate the attributes of utility for consumers and merchants, respectively. Table 2 synthesises important attributes of instruments for both consumers and merchants to analyse how attributes affect demand and interact. For the purposes of comparison, however, Table 2 includes one payment instruments that merchants must accept, cash.

Table 2 is populated with the author's subjective ratings for the different attributes of each instrument for domestic transactions.[14] With one group of exceptions discussed below the Table, the ratings themselves are not central to

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[14] Of the instruments analysed, only credit cards and scheme-based debit cards, being based on Visa, MasterCard or similar scheme, are generally used for transactions in other countries other than the one they were issued in.

this paper.[15] Indeed, the ratings themselves may vary for each and every transaction. The purpose of the Table is to provide a model for understanding what consumers and merchants prefer about the instruments they use. The Table shows a snapshot, taken at the present time, of whether an instrument has a low, medium or high amount (L, M or H) of a particular attribute, relative to other payment instruments. These attributes are not mutually exclusive and ratings will naturally change over time.

While factors that raise transaction costs for both merchants and consumers are assessed, no attempt is made to aggregate these to a combined cost index. Instead, revealed preference is relied upon (which instrument gets used) to inform which instruments are accepted by merchants and preferred by consumers because they reduce demand-side transaction costs. The decision not to aggregate these costs for the two groups makes descriptions involving the minimisation of (demand-side) transaction costs unhelpful - minimising suggests that demand-side transaction costs are minimised for both consumers and merchants for every transaction. Instead, this paper argues that the instrument used generally reduces transaction costs for consumers and merchants because, if it did not do so, merchants would not choose to accept it at the same time that consumers chose to proffer it.

The consumer preferences given by Borzekowski et al (2008) form the basis for Table 2. In place of their attribute of acceptance by merchants, merchants' desired attributes are used, as indicated by Arango and Taylor (2008). Of merchants' attributes, however, intensity of use is ignored because it arguably reflects consumer demand for instruments. Some attributes will be relevant to both consumers and merchants and Table 2 specifies where an attribute relates to just one or both of those parties. For the sake of simplicity, Borzekowski et al's attributes, restraint and tracking, are assigned to the attribute of convenience. The Table also includes a measure of the liquidity constraint associated with a payment instrument, the importance of which was indicated by Schreft (2006) when she described the complex, inter-temporal decisions that occur when consumers decide to use a particular payment instrument. Additionally, attributes are phrased to make a low rating more preferable (for example, the attribute, inconvenience, is used rather than the attribute, convenience). Finally, the Table assumes merchants and consumers already hold one bank account into which they receive their wages or revenues.

The literature described in section 2 emphasises the importance of consumers' existing payment habits to their current behaviour. This has not been incorporated into the Table, however, since, with the current exception of stored-value cards, it focuses on commonly-used payment instruments. The

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[15] Subsection 8.2 in the appendix contains reasons, however, for the author's choices of ratings.

importance of habit receives greater focus during the analysis of competition over attributes in section 3. Another factor not reflected in the table is that consumers will experience additional inconvenience from an instrument if using it requires them to maintain an account separate to the one that absorbs their earnings. The two instruments of this paper that commonly require secondary accounts include credit cards and stored-value cards. The inconvenience that comes from maintaining a second account is consistent with the observation of Zinman (2009) that paying by debit card offers greater time savings for consumers because of no requirement to regularly repay balances.

The attribute of inconvenience is separated to measure the inconvenience of using an instrument for POS payments and for remote payments because particular instruments may be unsuited to one of these two types of payments. The need for users to incur account fees to access a payment instrument and the need in all of the countries studied for merchants to buy or rent terminals means financial costs (including pecuniary benefits) for merchants and consumers are separated into fixed costs of obtaining access to a payment instrument and the marginal costs paid each time an instrument is used (per-transaction fees). The inconvenience and the liquidity constraint imposed by an instrument are considered for merchants as well as for consumers. At this stage, merchants are assumed not to surcharge or discount transactions paid for with particular instruments, an assumption relaxed when competition over instrument attributes is considered in section 4.

Table 2. Table of Attributes of Commonly Used Payment Instruments[1]

Attribute	Party	Relevant Details	Cash	Credit Card	Debit Card	Stored-Value Card
Time	Both		L	M	M	L
Concerns About Reliability	Both		L	L	M	M
Risk of Crime	Both		H	L/M	L	L
Inconvenience[2]	Consumer	Point of Sale	M	L/M	L/M	L
		Remote	M	L/M	M	M
	Merchant		L	L	L	L
Financial Cost[3]	Consumer	Fixed Cost	L	H	L/M	H
		Marginal Cost	L	L	L/M	L
	Merchant	Fixed Cost	L	L	M/H	M/H
		Marginal Cost	L	H	L/M	M
Liquidity Constraint	Consumer		H	L	M	M/H
	Merchant		L	L	L	L

(1) L, M and H equal a low, medium and high significance of the attribute.
(2) Includes implied interest cost
(3) Includes reward points (a negative financial cost).

Description of attributes

Subsection 8.2 in the appendix explains the choices for the ratings in Table 2. One group of ratings, however, deserves special attention, the ratings given for the inconvenience to consumers for POS and remote transactions, and the

rating for merchants, of conducting transactions in cash. A medium rating is given for the inconvenience consumers face when dealing in cash because consumers in two of the sample countries, New Zealand and Norway, used debit cards extensively, in spite of being charged per-transaction fees from the outset. Although cash is often seen as unsuitable for remote payments,[16] this is argued to be more a result of its associated risk of crime, rather than in its inconvenience. For this reason, it is given the same 'M' rating as for POS transactions.

Cash transactions require merchants to make arrangements to deposit money at the merchant's bank. This sort of inconvenience is argued to have a relatively low marginal (opportunity) cost, but a higher average variable cost. That is, any one transaction doesn't create much additional cost for the merchant, but the greater the number of such transactions the more significant the additional cost.[17]

4.   Competition over attributes

As discussed in section 2, Rosen (1974) suggests that a differentiated product may be thought of as having a vector of implicit or hedonic prices, one for each characteristic. Users will assess all these characteristics in deciding which product is best. This diverse set of characteristics of payment instruments combines with the great variety of transactions between merchants and consumers to mean that many payment instruments will exist in equilibrium. This section analysis further the process by which consumers and merchants settle on an instrument for the completion of their transactions.

In section 2, literature was reviewed showing that consumers face significant sunk costs when they adopt new payment instruments. This is consistent with literature showing the persistence of habitual payment instrument use. Both the sunk costs of adoption and the importance of habit may be related to the analytical complexities for consumers forming hedonic price estimates for each available instrument. The analytical complexities of using unfamiliar instruments might also explain the analysis of Rysman (2006) that consumers' favoured networks were often those most accepted by merchants. This leads to a key observation, consumers will be unable to make using particular instruments habitual unless those instruments are accepted by merchants. Arango and Taylor (2008) find that "aside from the initial decision to accept a payment method, merchants have little influence over the payment

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[16]   Placing cash in an envelope and posting it represents one way of using cash for remote transactions.

[17]   Other instrument attributes may also have high average variable cost relative to marginal costs, for example, the risk of crime associated with an instrument. For the sake of brevity, however, these other attributes are not analysed in this way.

decisions made by consumers".[18] They support this statement with analysis of the market shares of different retail payment instruments. The observed shares bear little relation to the attributes of direct utility for merchants. However, the statement understates the importance of merchants: while consumers will have a preferred instrument (based on their valuations of its characteristics), a merchant's customers will only be able to use it if it is accepted by the merchant.

Merchants will likely find some instruments better serve the nature of their business than others. If they refuse to accept a payment instrument proffered by their customers and those customers don't have a convenient alternative to hand, they risk causing their customers significant disutility. Not wishing to cause disutility would mean merchants internalise benefits for consumers to some degree. Any such disutility will primarily occur as search costs consumers incur finding an alternative payment instrument to complete a transaction or finding a product to purchase elsewhere. Consumers might shop elsewhere for goods or not buy the goods. A further consideration for merchants will be whether customers wishing to pay with an instrument are likely to purchase more than a merchant's average customer. For these reasons, some merchants will accept payment instruments that might appear to be unprofitable.[19]

However, merchants may have more options than just whether to accept a certain payment instrument. In some countries, merchants can also surcharge transactions made using certain instruments. Alternatively, merchants may influence their customers' choice of instrument, or steer instrument choice, in other ways. One example of steering is the practice of refusing to accept transactions made with an instrument of less than a certain value. Merchant surcharging is considered first.

Merchant surcharging

Evans and Schmalensee (2005b, p. 93) suggest merchants are reluctant to surcharge transactions made with instruments not preferred because doing this raises significant transaction costs. They say transaction costs associated with surcharging come from two major sources:

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[18] Arango and Taylor studied merchants' retail payment system decisions in Canada, where the No-Surcharge Rule remains in force for Visa and MasterCard credit cards, although not for Interac debit card payments. Merchants are assumed to be unable to surcharge customers for, or otherwise steer them from, using a particular payment instrument, before this assumption is relaxed later in this section.

[19] For example, some merchants accept three-party credit and charge cards, such as American Express and Diners Club, in spite of their charging significantly higher MSFs than other payment instruments.

- Costs associated with the merchant effectively maintaining a separate price for some customers

- Costs associated with the merchants' customers deciding to shop elsewhere or deciding not to purchase a good.

These transaction costs may explain why many merchants choose not to surcharge when free to do so. For example, Bolt et al (2009) find that the 22% of Dutch merchants who surcharge don't do so for transactions greater than, on average, 10 Euros. A customer who wishes to use a debit card for transactions greater than this size may be less likely to have an alternative to hand. If so, a surcharge will cause them greater disutility. For smaller transactions, however, customers are more likely to have sufficient cash on hand to complete the transaction.

Two considerations may explain why some merchants surcharge in spite of the transaction costs:

- A merchant may be able to increase its profits by encouraging its customers to use its preferred payment instrument

- As indicated by Wright (2003), a local merchant monopolist might steer customers by setting surcharges excessively to extract rent from inframarginal cardholders.

Merchants who surcharge aren't necessarily monopolists. Surcharging may encourage a merchant's customers to use another instrument, while extracting enough rent from those customers unwilling to do so to compensate for the transaction costs they incur. For example, Bolt et al calculate that merchants who surcharged debit card transactions charged 23 euro cents on average, compared with an average MSF of 4-5 euro cents.

If the merchant is in a competitive environment as is the norm, encouraging some customers to use its preferred instrument, while extracting rent from those consumers that don't, may allow it to lower its prices, generally. The lack of stores that choose to surcharge, however, suggests transaction costs associated with surcharging commonly make this strategy unprofitable.

Should a merchant surcharge a payment instrument, the inconvenience consumers experience from using that instrument will likely increase significantly, relative to an un-surcharged instrument.[20] Yet, even if a consumer doesn't use a surcharged instrument, he or she still bears search costs associated with finding an alternative instrument or an alternative source

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[20] Although this paper focuses on the inconvenience of using a surcharged instrument, an alternative representation would be analyse it as an increase in the consumer's financial costs of using that instrument.

as well as search costs relating to uncertainty about a merchant's prices. Surcharging raises transaction costs overall when compared with not surcharging.

The No-Surcharge Rule is thus consistent with generally reducing transaction costs. If a No-Surcharge Rule is not imposed, merchants that decide to surcharge must decide surcharging is profitable because they recoup the additional transaction costs they face from consumers. Evidence given by Wilkinson (2011) shows merchant surcharges commonly exceed the size of MSFs, suggesting that merchants look to recoup the additional costs they face when surcharging. Such recoupment might occur because surcharging allows merchants to take advantage of different price elasticities of demand for consumers generally wishing to pay with a particular instrument. Additionally, surcharging will raise transaction costs for consumers who search for an un-surcharged instrument with which to complete their transaction or become uncertain about merchants' prices. Accordingly, the imposition of a No-Surcharge Rule prevents merchants from imposing transaction costs on consumers, generally reduces demand-side transaction costs and will likely be welfare-enhancing.

Other steering methods

As well as influencing consumers' choice of payment instrument by refusing to accept an instrument or by surcharging or discounting transactions made with one, a merchant may employ other methods to influence the payment instrument used. A relatively common one is that merchants refuse to accept a payment instrument for transactions below a certain amount. Additionally, a merchant may wish to accept one type of a scheme's instruments (such as a Visa or MasterCard credit card), but not another type (such as a Visa or MasterCard debit card). Some payment networks, however, involve rules that prevent merchants from taking this type of action, indicating that it may raise transaction costs for consumers, impeding an instrument's use. In particular, evidence was discussed in section 2 showing that the Honour-All-Cards Rule likely reduces consumer uncertainty, thereby reducing demand-side transaction costs.

5. Payment instrument demand and network effects

The discussion in section 3 assumed that payment instruments were already commonly used. If new payment instruments are considered, one key factor relating to demand for such new instruments raise the importance of network effects.[21] The factor is the non-pecuniary sunk costs of adoption associated

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[21] Consistent with the work of Liebowitz and Margolis (1994) discussed in section 2, the term network effect is used to refer to the effect on the net value of an action of the number of agents taking equivalent actions.

with learning that are incurred by consumers trying new payment instruments, described in the literature summarised in section 2. In section 4, these costs were related to the importance of consumer habit. They will also mean that consumers observe the habits of those around them, before deciding that the expected benefit of adopting a new instrument is worth the sunk cost incurred. Such a process will have parallels to Ching's (2008) dynamic learning process for the diffusion of generic drugs, which was also discussed in section 2. Such a process would explain the smooth curves showing the gradually increasing adoption of payment instruments observed in Figure 1. It also implies that, if consumers already hold an instrument for another purpose, such as for accessing their bank accounts through ATMs or public transport, they will find it easier to try using a payment instrument should they see those around them using it.

A factor complicating the nature of network effects, however, is that payment instruments commonly involve two distinct groups of users, consumers and merchants. Consumers' expectations, and therefore desire to use a payment instrument, depend on merchants' acceptance of that instrument while merchants' expectations, and therefore acceptance of an instrument, depend on consumers' desire to use an instrument. This creates what is commonly called the chicken and egg problem: why will consumers wish to use an instrument unless it's accepted by merchants and why will merchants wish to accept it, unless consumers wish to use it? Network effects' importance, is highlighted by the difficulties experienced in all of the sample countries creating a successful stored-value card system during the 1990s. Wilkinson (2011) explains that none of the pilots of the Mondex stored-value instrument introduced in all of the sample countries led to large-scale deployments. The paper provides further analysis of the importance of network effects by comparing merchant acceptance of payment instruments and their use by consumers in the next section.

6. Comparing merchant acceptance with consumer habit

This section analyses the introduction and adoption of payment instruments. The analysis indicates that, while the instrument that gets used will generally reduce demand-side transaction costs, that instrument will likely be the one that is acceptable to merchants, rather than being the most technologically advanced instrument.

6.1 The introduction of new payment instruments

Table 3 sets out the MSFs of selected new retail payment instruments, compared to the MSFs of what are judged to be the major competing instrument(s). The new instruments shown are, with one exception, selected as instruments that did not require merchants to incur significant additional fixed financial costs, such as through the purchase or rental of card terminals,

before they were able to accept the instrument.[22,23] The introduction of credit cards are not to shown in the table for the sake of simplicity.[24] An instrument provided for use with no MSF does not charge the merchant a fee, per-transaction; a fixed MSF refers to a per-transaction fee that does not change with a transaction's value while a proportional fee is proportional to value.

The exception made is to the assumption described above is the stored-value system, Snapper, introduced in New Zealand. It is included because its development demonstrates why a merchant might accept an instrument, in spite of the need to invest in a special terminal to do so. Snapper is included because it can be accepted by many different merchants and its use is underpinned by a public transport application. These features make it unlike other stored-value instruments in the sample countries, such as the Mondex stored-value instrument and London's Oyster card. The literature discussed in section 2 suggests that Snapper's advantage's help it overcome relevant network effects.

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[22] This is, in effect, a simplifying assumption. As argued in relation to Table 2, the fixed financial costs faced by merchants will make their desire to use a retail payment instrument dependent on their expectations of how much that instrument will be used. In order to disregard such expectations, analysis focuses on payment instruments where merchants do not face additional fixed financial costs.

[23] Table 3 does not include new payment instruments introduced in Norway or the UK because insufficient evidence on the introduction of instruments meeting the table's criteria was found by Wilkinson (2011).

[24] Wilkinson (2011) shows that credit card transactions incur proportional MSFs without exception in the sample countries, making such data inappropriate for assessing effects of differences in instruments' MSFs.

Table 3. MSFs of Selected Newly-Introduced and Competing Payment Instruments for POS Transactions

Country	New Inst.	First Year	MSF of New Inst.[1]	Major Competing Inst.	MSF of Competing Inst.[1]
Australia	Scheme-based debit card	1982	Prop.	Cash (credit card)	None (prop.)
Canada	Scheme-based debit card	2008	Fixed	Interac debit card	Fixed
New Zealand	Scheme-based debit card	2006	None	EFTPOS debit card	None
	Stored-value card[2]	2008	Prop.	EFTPOS debit card	None
United States	Scheme-based debit card	Mid-1990s[3]	Prop.	Cash (credit card)	None (prop.)

(1) Prop. refers to MSFs that are proportional to transaction value. None refers to MSFs that do not change with a transaction value and none specifies that no MSFs are charged.
(2) Contrary to the assumption discussed above, merchants do incur some additional fixed financial costs to accept Snapper stored-value card transactions, in the form of an additional terminal. The relevance of Snapper is discussed further below.
(3) Wilkinson (2011) shows that, although scheme-based debit cards were first developed during the 1970s, it wasn't until this time that they were significantly promoted by the Visa and MasterCard credit card schemes.

Snapper is included in this Table to show that an instrument needs to offer additional benefits over competing instruments, in order to be accepted by merchants. The analysis in Table 2 showed that merchants can benefit from the faster transaction speed of Snapper, compared to what is judged to be the major competing instrument, the EFTPOS debit card.

Table 3 deals with all successfully introduced payment instruments identified by Wilkinson that, with the exception of Snapper, don't require

merchants to incur fixed costs before accepting them. That is, no successfully introduced instruments without such costs were identified that did not compare favourably for merchants with the incumbent instrument. In order to test the pricing for merchants of instruments that do require fixed costs to be incurred before they can be accepted (such as from a need for terminals), the usage of debit cards is analysed.

6.2 Debit card pricing for merchants

Consumers in the sample countries were using much the same payment instruments when debit cards were introduced (that is, cash supplemented by cheques, credit cards and, in Norway, a cheque-like bank account transfer called a giro). Following the development of the POS terminal, debit cards represented a major improvement over existing payment instruments because they allowed consumers to directly access the accounts that held their earnings.[25,26] Table 4 analyse relevant prices, being the per-transaction fees charged to consumers and merchants, and differences between countries in the adoption of debit cards. The year in which major systems were introduced is also included.

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[25] Although credit cards were developed before debit cards, their use generally requires consumers to open an account generally additional to the one that absorbs their earnings.

[26] Wilkinson (2011) reports that merchants in all of the sample countries are generally required to purchase or rent POS terminals in order to accept payments by debit card.

Table 4, Pricing and Usage of Major Debit Card Systems

Country	Names of Major Networks	Initial Year	Nature of Per-transaction Fees of Major Networks Faced By:[1]		Average Trans. Volume Per Capita, 2009[2]
			Merchants	**Consumers**	
Australia	EFTPOS	1985[3]	Fixed	Some fixed	90
Canada	Interac	1994[3]	Fixed	Some fixed	115
New Zealand	EFTPOS	1989[5]	None	Some fixed	192
Norway	Bank-Axept	1991[6]	None significant	Fixed	205[7]
United Kingdom	Visa Debit, Maestro and Solo	1986-88[8]	Fixed	None	97
United States	MasterCard and Visa	Mid-1990s[9]	Proportional	Commonly none	125

(1) Column refers to the current per-transaction fees for POS transactions made using major systems. None means no per-transaction fees are charged. Fixed refers to per-transaction fees that do not change with the size of the transaction. Some fixed refers to fees that, depending on a consumer's account, are generally either zero or fixed. Proportional refers to fees that are proportional to the transaction's value.

(2) Figures include debit card transactions completed over all networks, rather than just major ones

(3) Year from which contracts allowing network interconnection negotiated

(4) Year Interac debit card network rolled out nationally

(5) Year agreement reached between banks creating ETSL EFTPOS network

(6) Year agreement reached between banks creating BankAxept

(7) Figure does not include transactions made with Norwegian cards in countries outside Norway, nor transactions on non-BankAxept debit cards

(8) Years in which banks introduced own debit card instruments, Visa and Switch

(9) Approximate date Visa and MasterCard started promoting offline debit cards.

Table 4 clearly shows that, in the two countries with the most well-used debit card systems, New Zealand and Norway, merchants are not charged significant MSFs by the major debit card network. The table shows little, if any, relationship between the year of a system's introduction and the extent of its adoption. Merchants' per-transaction fees are important to the adoption of debit cards because, once merchants have incurred the fixed cost of a debit card terminal, they will likely accept transactions of any amount. In the two countries where merchants aren't charged significant transaction fees, consumers show a preference to use their debit cards in spite of facing fixed per-transaction fees. When merchants are charged significant per-transaction fees for debit cards, as happens in the other four countries in the sample, they are less willing to accept smaller debit card transactions. This is because their customers will arguably have a an instrument to hand that is cheaper for them to accept, namely cash. Consistent with the analysis in subsection 6.1, it is the acceptance of instruments by merchants that appears key to the development of retail payment systems.

The focus of Table 4 on just one payment instrument. the debit card, makes it difficult to draw additional conclusions. Norway's higher use of debit cards than New Zealand's will be influenced by the greater use of bank account overdrafts (accessible using just a debit card), rather than credit cards, as a source of short-term consumer credit. However, no evidence has been found to assess the use of credit cards against bank account overdrafts in any sample countries.

7.   Conclusion

This paper has investigated the demand for payment instruments and found that instruments will be used by consumers and merchants to lower the transaction costs each faces. Payment instruments are differentiated products, with a variety of attributes that affect their demand. The heterogeneity of merchants and consumers and the plethora transactions between them means that many payment instruments will exist in equilibrium. In a process generally involving a consumer proffering an instrument that may or may not be accepted by a merchant, the two parties agree on an instrument to be used to complete their transaction. The instrument used will generally reduce demand-side transaction costs, compared to other available instruments.

Merchants may be able to surcharge, or otherwise steer their customers into using, certain instruments. However, such actions are likely to raise transaction costs and rules preventing them from occurring may enhance welfare.

Consumers commonly incur non-pecuniary sunk costs associated with learning when adopting new instruments. Such costs impede uptake and thereby increase network effects. Some uptake induces a dynamic learning

process amongst consumers. Under this process, consumers observe the instruments that those around them are using before deciding to incur sunk costs when adopting new instruments, themselves. Such a process explains the steady but gradual increase in the adoption of new payment instruments. It also means that consumers already holding an instrument (say to access ATMs or public transport) are more likely to try using it to complete payments, making an underpinning reason to hold an instrument an important element in its success. Even if consumers hold an instrument, however, they'll be unable to use it unless it's already accepted by a merchant.

Analysis of the charges imposed on merchants for using newly introduced instruments, relative to competing instruments, and for using debit cards demonstrates that merchant acceptance responds to charges and it is this response that is fundamental to payment instrument use. This analysis also demonstrates that the extent of acceptance is the dominant determinant of differences, internationally, in the use of payment instruments. While the conclusion that merchant acceptance precedes customer habit may look superficially obvious, it should be considered alongside the consumer network effects of payment instrument use described above. However, the conclusion does suggest that, even if enough consumers are willing to use them, instruments based on technological improvements will have problems overcoming network effects if they do not confer sufficient benefits on merchants.

Wilkinson (2011) suggests reasons for the varied approaches to pricing for payment instruments. Since these involve aspects to the supply of payment instruments, however, they are beyond the scope of this paper.

8. Appendix

8.1 Usage statistics

The statistics on payment instrument use shown in Figure 1 are entirely from official sources.[27] Transaction and population statistics for Canada, the United Kingdom and the United States are from two Redbook publications of the Committee on Payment and Settlement Systems (2006, 2011). For Australia, transaction statistics are from the Reserve Bank of Australia (2010a), while population statistics are from the Australian Bureau of Statistics (2010). The Reserve Bank of Australia (2010b) outlines inconsistencies in data collection that make statistics for the period prior to 2003 unsuitable for comparison. For New Zealand, transaction and population statistics are from Statistics New Zealand (2010a, 2010b), with the former only available since November 2002.

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[27] That is, statistics are checked to ensure they include neither transactions conducted at automatic teller machines nor transactions conducted at merchants' points-of sale that only have a cash-out component.

Finally, population and transaction statistics for Norway are from the 2007 Norges Bank Annual Report on Payment Systems (Norges Bank, 2008), because that data was available in spreadsheet format. Statistics for 2008 and 2009 are from the 2009 Norges Bank Annual Report on Payment Systems (Norges Bank, 2010). Minor inconsistencies in statistics mean several observations from this latter report are used, in place of those from the 2007 Annual Report.

An important data issue for payment instruments is that there are generally two ways of measuring transaction volume in a country: the volume of issued transactions, being the number of transactions on cards issued in a country, and the volume of acquired transactions, being the number of transactions on merchant terminals in a country. The two will be separated by cross-country travel. For all of the sample countries, statistics for the volume of issued transactions are what is available from official sources, except for New Zealand and the US, where they are for acquired transactions. Issued transaction statistics for Norway and the United Kingdom track closely to acquired transaction statistics taken from Norges Bank (2008, 2010) and UK Cards Association (2009) (statistics for years, 2003-2008). For the total of debit and credit card transactions, acquired transactions are not more than 5.1% different from issued transactions, averaging 3.6% less for Norway and averaging 1.1% less for the United Kingdom.

8.2   Explanation of ratings of attributes

The ratings given in Table 2 for transaction time assume that it takes less time to process transactions made using cash or stored value cards than it does other payment instruments because those other instruments generally require the customer to use a PIN or signature for identification.[28] Since cash and credit cards have been used as payment instruments for longer, merchants and consumers are assumed to commonly have fewer concerns about their reliability. Debit card and stored-value card instruments are more reliant on recently developed technology and are assumed to be perceived to be less reliable.[29]

Crime associated with payment instruments might come from fraudulent use by other consumers (including from theft) or fraudulent use by merchants or merchants' agents. Because it is anonymous and largely untraceable, cash has the highest risk of being stolen. Reliance on signatures for customer identification means a greater risk of crime associated with credit cards than

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[28]   Although credit or debit cards are given the same attribute rating for time, Zinman (2009) suggests paying by debit card is less time consuming for many consumers because it does not require balances to be regularly repaid.

[29]   Concerns about reliability are distinct from concerns about the risk of crime, which are discussed below.

with debit cards, which are commonly PIN-protected. Stored-value cards require neither PINs nor signatures for customer identification implying they may be associated with a greater risk of crime. However, because of this, consumers are more likely to limit the funds available using their stored-value cards compared to other payment instruments. Furthermore, since transactions made using stored-value cards are more traceable than cash, they may be associated with substantially lower risk of crime. For example, the introduction of the stored-value card, Snapper, on buses in New Zealand resulted in the dismissal of nine drivers that had been stealing bus fares under the previous cash-based ticketing system (Williamson, 2009, July 9). For these two reasons, stored-value cards are assigned a low rating for their associated risk of crime.

Separate subjective measures of inconvenience are provided for both POS transactions and remote payments, the latter being those that are completed at locations away from the POS. The rating given to the inconvenience of cash for POS and remote payments was discussed in section 3. Most other instruments have an M rating for consumer inconvenience for POS payments.[30] However, stored-value cards are argued to have a lower inconvenience because they do not require signature or PIN for user identification. Credit cards are argued to be suitable for remote payments, while debit card and stored-value card are less suited to remote payments, because they generally require the use of a terminal for the completion of payments.[31]

In terms of its inconvenience for merchants, the use of cash was also discussed in section 3. The three other instruments are given a low rating for their inconvenience to merchants because each instrument will generally result in the merchant receiving funds from transactions without significant additional difficulty.

In terms of financial costs, consumers will generally face fixed costs from the maintenance of an account at a financial institution. As discussed, consumers are assumed to maintain one account for receiving their incomes. Payment instrument accounts secondary to that are considered additional fixed costs for those instruments. Of the payment instruments considered, credit cards and stored-value cards will commonly require customers to maintain a second account, in addition to the one used to receive wages, although some

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[30] Although credit cards are given an M inconvenience rating, credit cards allow payment to be deferred, which means more interest can be earned on account balances. While this might be thought to mean a decrease in the inconvenience of credit card payments, attributes for inconvenience are not modified to reflect it because interest income will be negligible for the great majority of payments.

[31] Although ratings are not changed to reflect it, debit cards are issued under the schemes of Visa or MasterCard in all of the sample countries and these cards can be used for remote payments (as well as internationally).

debit cards require an additional annual or semi-annual fee from consumers. Consumers do not generally face a marginal financial cost for most payment instruments, although, in some jurisdictions, they incur fees for debit card use. Consumers may in fact face negative financial costs for using credit cards if award points they receive when using such cards are included. Such points only appear to make a small difference to prices, however.

Because this paper considers commonly used instruments, merchants are assumed to have one bank account for their operations and thereby don't incur additional fixed costs from account-keeping. Wilkinson (2011) shows, however, that merchants in each of the sample countries generally need to buy or rent terminals to accept debit cards and the evidence gathered on stored-value cards shows they generally require a different terminal to accept these, also. Merchants are often charged per-transaction fees when accepting transactions, known as MSFs. Although proportional in nature, the highest rating is assigned to credit cards because such cards generally incur the highest MSFs of commonly used payment instruments. If there are MSFs for cash payments, these will be insignificant when a number of transactions are conducted using cash. MSFs will be low to medium for account-to-account payment instruments, such as cheque, debit card and computer-based instruments, but higher for stored-value cards. Because these require a separate account to be maintained, but are less able to charge users for it (since users will then be much less likely to use it), a payment network will have little choice, but to charge a higher MSF for a stored-value instrument.

Credit cards provide consumers with a source of short term credit and therefore offer the least constraint on liquidity of the instruments considered.[32],[33] Because they commonly link to a consumer's bank account, the other instruments provide more liquidity than cash or stored value cards. All the instruments considered quickly provide merchants with funds, with the exception of cheques, which may take some days to clear into a merchant's bank account.

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[32] In Norway, banks commonly provide accounts with short-term overdrafts accessible using a debit card. However, this appears less common in the other countries considered.

[33] Some commentators argue that debit cards are used because they represent a commitment device for individuals to constrain their spending. However, Zinman (2009) makes no reference to this reason for debit card use in his analysis of debit card/credit card decisions for consumers and it isn't included in this analysis.

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