

PRICE INCENTIVES AND CONSUMER PAYMENT PATTERNS

John Simon, Kylie Smith and Tim West

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Payments Policy Department

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Abstract

In this paper we estimate the effect of particular price incentives on consumer payment patterns using transaction-level data. We find that participation in a loyalty program and access to an interest-free period tend to increase credit card use at the expense of alternative payment methods, such as debit cards and cash. Specifically, we find that a loyalty program increases the probability of credit card use by 21 percentage points and access to the interest-free period increases the probability by 15 percentage points. Interestingly, the pattern of substitution from cash and debit cards is different in each of these cases. A loyalty program reduces the probability of cash use by 10 percentage points and has little effect on debit card use, while access to the interest free period has little effect on cash use but reduces the probability of debit card use by 19 percentage points. We find these effects to be economically significant and large enough that they can help explain observed aggregate payments patterns. An implication is that the Reserve Bank reforms of the Australian payments system are likely to have influenced observed payment patterns.

JEL Classification Numbers: D12, C35, G20

Keywords: consumer choice; retail payment systems; price incentives; loyalty programs

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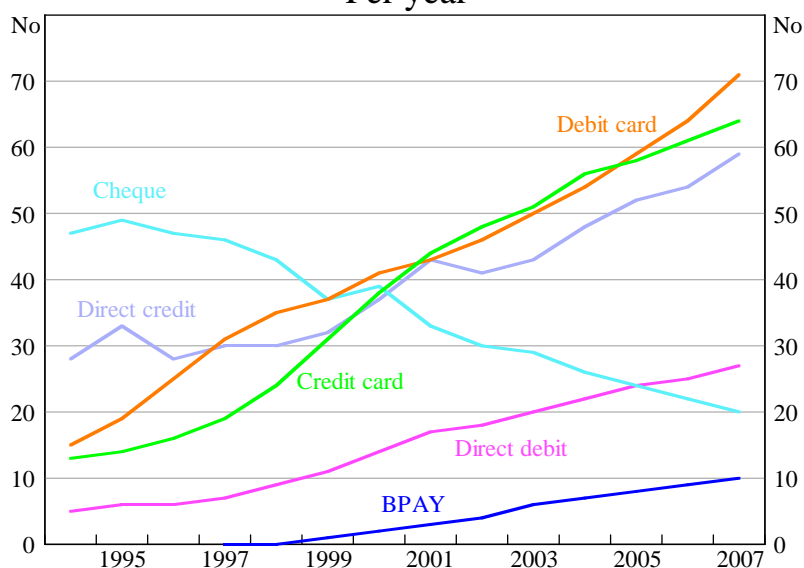
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1. Introduction

Over the past decade, payment patterns in Australia have changed substantially. In line with most other countries, electronic means of payment, such as credit cards and debit cards, have grown strongly, while the number of personal cheques written per person has declined significantly (Figure 1). Among electronic payment methods, however, there have been some interesting trends and trend reversals. For example, credit cards enjoyed remarkable rates of growth in the late 1990s, subsequently overtaking debit cards as the most popular form of non-cash payment. Subsequently, their rate of growth has tailed off and, more recently, there has been a switch back towards debit cards as the most popular form of non-cash payment.

Figure 1: Number of Non-cash Payments per Capita
Per year



Note: Debit and credit card data prior to 2002 have been adjusted for a break in the series due to an expansion of the Retail Payments Statistics in 2002

Sources: ABS; APCA; BPAY; RBA

What then explains these trends? While factors such as convenience, increased merchant acceptance, and consumer attitudes, particularly towards financial management, may have an important part to play, price incentives are also clearly implicated. The period of strongest growth in credit cards coincided with the introduction of loyalty programs in Australia whereby consumers would receive incentives of around one per cent of the purchase value to use a credit card. Similarly, the recent slowdown in credit card use has coincided with regulatory reforms in Australia that have had the effect of reducing loyalty program incentives and raising other costs associated with use of a credit card, including the introduction of surcharging for credit card purchases by some merchants.

These changes in payment method use over a period of substantial reform provide *prima facie* evidence that a relationship exists between price incentives and the use of particular payment methods. The aggregate data, however, are not sufficient to make more than tentative conclusions about this relationship. Data on individual payments behaviour offers the prospect of obtaining a more nuanced and accurate view of the influences on payment patterns.

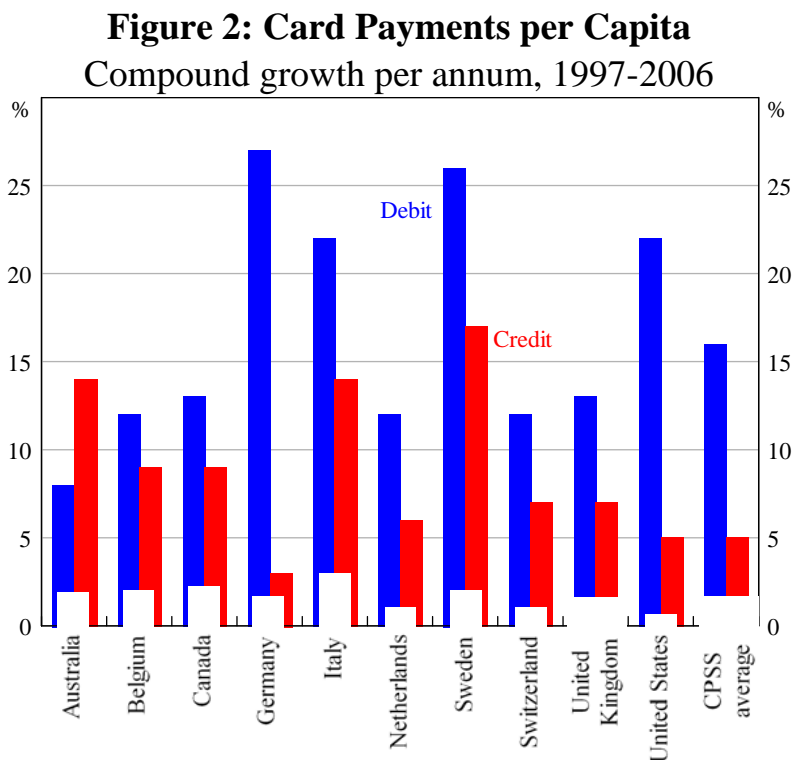
As part of its review of its card-payment reforms, the Reserve Bank of Australia collected detailed data on the transaction behaviour of a broadly representative sample of 662 Australians over a two-week period in 2007. These data provide the first comprehensive transaction-level study in Australia of payment methods used by individuals, including importantly, cash. In this paper, the data collected from the diary study are used to estimate econometric models of the holding of credit cards, and the use of credit cards, debit cards and cash. Similar to Bounie and François (2006), our dataset allows us to not only control for demographic influences, but also for transaction-related characteristics, such as merchant type and transaction value. Further, of particular interest to this study, our dataset allows us to identify price incentives for credit cards: whether the consumer participates in a loyalty program and whether the consumer typically obtains the benefit of the interest-free period.

We use these data to examine a number of aspects of consumer payments. In particular, we consider what effect loyalty programs have on the choice of payment instruments and look at the patterns of substitution between credit cards, debit

cards and cash as a result of those programs. We conduct similar analysis on the effect of access to an interest-free period.

2. The Australian Payments Landscape

The main payment instruments available to Australian consumers are similar to those in other industrialised countries.¹ One unusual feature of Australian payment patterns until quite recently, however, has been the strong growth in credit card use, relative to debit card use (Figure 2).



Note: Incorporates estimate of 2006 credit card use in Japan. 'CPSS average' refers to member countries of the Bank of International Settlements Committee on Payment and Settlement Systems.

Sources: ABS; APCA; BIS; RBA

One factor that may have contributed to this trend in Australia was the different pricing structure of the credit card and the domestic debit card (EFTPOS) systems; for many Australian consumers, the effective price of using a credit card to make

¹ Further details on these payment instruments and their uses can be found in Emery *et al* (2008).

payments was less than that of using EFTPOS.² For example, at the time of the Reserve Bank's initial investigation of credit and debit card systems in 2000, an EFTPOS transaction often incurred a cost of around \$0.50 once a certain number of fee-free transactions had been made each month. In contrast, for credit cards, loyalty program rewards were quite generous with average expenditure of around \$12 400 earning a \$100 shopping voucher in 2003.³ The average annual fee on a standard rewards card was \$61 in June 2002 and \$98 on a gold rewards card,⁴ and the average interest-free period was up to 47 days.

One important factor that determines the pricing structure in these two systems is interchange fees – the fees paid between the merchant's and cardholder's financial institutions each time a transaction is made. In Australia, the average interchange fee in the credit card system has tended to be substantially higher than the interchange fee in the EFTPOS system. Prior to the reforms, the average interchange fee in the MasterCard and Visa credit card schemes was around 0.95 per cent of the transaction value (paid to the issuer). Similar interchange fees also applied for the MasterCard and Visa debit card schemes. Practically unique to Australia, however, is the fact that the interchange fee in the EFTPOS system flows in the opposite direction – from the cardholder's financial institution to the merchant's financial institution – and was around \$0.20 per transaction prior to the reforms. Not surprisingly, this structure of fees provided very little incentive for issuers to promote or price the domestic debit card system attractively.

The Reserve Bank was concerned that the structure of prices, in particular the relative levels of interchange fees between credit and debit cards, was not contributing to an efficient payments system. Some particular concerns were that the relative prices to cardholders for card payments did not generally reflect relative costs and interchange fees were not subject to the normal forces of competition. In addition, price signals to cardholders were further being distorted by credit card schemes imposing rules that did not allow merchants to surcharge at the point of sale. Hence, based on its legislative mandate to promote efficiency and

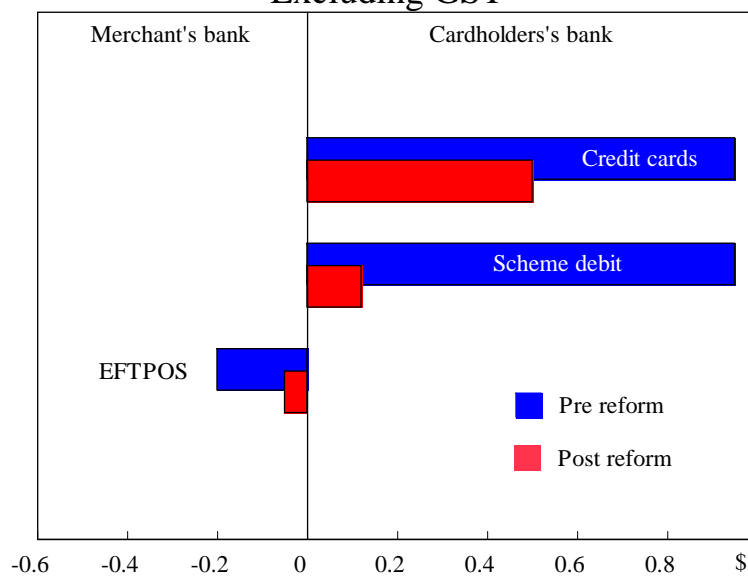
² Australian Competition and Consumer Commission and Reserve Bank of Australia (2000).

³ These are the earliest data available. Sources: Bank websites, ANZ Telstra Rewards Visa card, Commonwealth Bank MasterCard Awards card, National Australia Bank Visa Gold card, Westpac Altitude MasterCard.

⁴ Averages for credit cards with an interest-free period issued by major banks. Reserve Bank of Australia (2008b) provides additional detail.

competition in the payments system, the Reserve Bank's Payments System Board introduced a number of reforms to debit and credit card arrangements. These included setting interchange fee benchmarks for the credit card, debit card and EFTPOS systems, and removing scheme rules that prevented merchants from surcharging.⁵ Figure 3 shows the extent to which the reforms have had the effect of both lowering interchange fees in the respective systems, as well as narrowing the difference in fees between the systems.

Figure 3: Interchange Fees on a \$100 Payment
Excluding GST



Note: The post-reform data show the benchmark for each system.

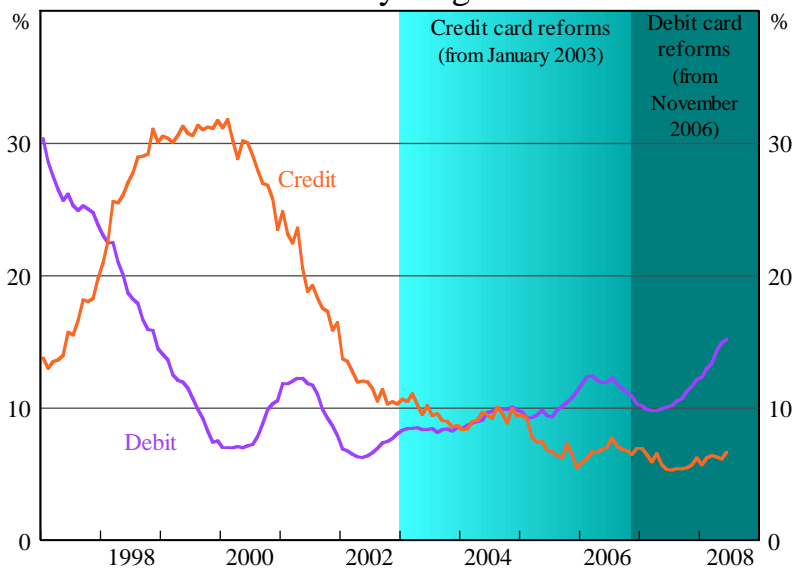
Source: RBA

These reforms have contributed to changes in effective prices facing card users. For credit cards, the reforms have had a number of effects, including: a reduction in the value of loyalty program rewards; higher annual fees, especially for cards with a reward program attached; and a gradual increase in the prevalence of surcharging at the point of sale. For the EFTPOS system, the opposite has occurred, with most financial institutions now offering unlimited fee-free transactions for a small fixed monthly account keeping fee.

⁵ See Reserve Bank of Australia (2008a) for a detailed discussion of the reforms.

Figure 4 shows growth in credit and debit card payments during this period of significant payment system change. Although clearly some slowing in credit card payment growth was inevitable from the rapid pace experienced over the late 1990s, what is interesting is that there appears to have been a shift in the relative growth in the two card payment instruments. And, this shift appears to have coincided with the shift in relative prices resulting from the reforms.⁶ However, further investigation of transaction-level data will enable us to better quantify the magnitude of any such price incentive effects.

Figure 4: Number of Card Payments
Year-on-year growth



Source: RBA

3. Consumer Payments Literature

The academic literature on consumers' use of payment methods remains relatively limited compared to the literature devoted to other microeconomic topics, although this field of payments research has grown considerably in recent times. Earlier literature in this area focussed on the influence of demographic variables and

⁶ This seems even more likely if we consider that (other things equal) consumer attitudes towards various payment instruments are unlikely to change substantially over time. For example, preferences for debit cards as a means of self restraint may only change with the broader macroeconomic business cycle.

payment instrument attributes on consumers' choice of payment instrument. See Stavins (2001) and Klee (2006), for example. More recent papers, such as Borzekowski, Kiser and Ahmed (2008), Ching and Hayashi (2008) and Zinman (2008), build upon this earlier literature to incorporate price-related variables into econometric modelling, given the relevance of these factors when considering payments system competition policy. Humphrey, Kim and Vale (2001) use aggregate transaction and price data for Norway to estimate own-price, cross-price and substitution elasticities for cash, debit cards and cheques. They conclude that consumers are quite sensitive to explicit pricing for payment services and also find that debit cards are quite a strong substitute for cheques.

The approach taken in this paper is similar to the approach in Borzekowski *et al* (2008) which estimates a series of probit models of debit card holding and use. That paper used 2004 data from a special component of the Michigan Surveys of Consumers. A nationally representative sample of around 1 500 households were asked about their use of PIN and signature debit cards, and open-ended questions to elicit information on the underlying reasons households choose to use debit cards (for example, security and convenience attributes). In addition to demographic variables, data on fees some banks charge cardholders for PIN debit transactions were also incorporated into probit models of debit card use. The results of these models indicate that the imposition of fees for PIN debit transactions encourages households to use signature debit cards instead of PIN debit cards but reduces the overall likelihood of households using debit cards. In fact, the paper finds that a transaction fee of less than 2 per cent of the average transaction amount is associated with a 12 per cent reduction in the likelihood of using a debit card. The authors note that the price response to merchant surcharging is likely to be larger than this, given that transaction fees are generally not disclosed to the consumer at the point of sale.

Ching and Hayashi (2008) estimate a series of multinomial logit models to analyse the effects of demographic variables (including individuals' adoption of technology), payment method attributes (including convenience and security) and loyalty program rewards on consumers' choice of payment methods at the point of sale. The paper uses data from the 2005/06 Study of Consumer Payment Preferences conducted by the American Bankers Association and Dove Consulting. Around 3 000 consumers completed the questionnaire, mainly via the

internet. While not a nationally representative survey, it provides a richer source of payments information (for example, data on consumers' credit card reward program participation) than can be obtained from sources such as the Survey of Consumer Finances. The questionnaire asked consumers about their most frequently used payment method across five merchant categories.

The paper runs a hypothetical experiment of abolishing loyalty program rewards and finds that only a small percentage of consumers would switch from electronic to paper-based payment methods while consumers would increase their use of debit cards and decrease the use of credit cards. The paper also finds that those consumers who normally incur an interest charge on their credit card balance are far less likely to make payments with a credit card. Zinman (2008) also estimates probit models of the use of payment instruments and finds that revolvers – those credit card holders who use the credit facility of a credit card and incur an interest charge – are at least 21 per cent more likely to use debit cards than transactors – those credit card holders who pay their bill in full each month – based on 1995 to 2004 data from the Survey of Consumer Finances. Zinman's results suggest that debit cards are a close substitute for credit cards, cash and cheques.

This paper builds on the existing literature that examines the influence of price-related variables on the use of payment instruments. It takes advantage of a unique transaction-level database that provides rich data not typically available in the questionnaire-style approach underpinning much of the existing literature. In this regard, our dataset is most similar to that used in Bounie and François (2006) which estimates a multinomial logit model of cash, cheque and payment card use incorporating demographic and transaction explanatory variables (for example, transaction amount and merchant type). Our paper extends this type of work by incorporating price-related variables such as loyalty program participation and consumers' transactor/revolver status. The dataset used in Bounie and François (2006) consisted of transaction-level data on 12 000 payments made by around 1 400 French adults over an eight-day period in 2005, captured through a payments diary. Consumers were asked to record the details of the payments they made, for example the amount, merchant type, type of good, any payment restrictions faced, and the channel (e.g. face-to-face internet, telephone) used. The paper discusses the importance of factors such as the transaction amount and merchant environment in determining the payment instrument used. For example,

the authors found a significant negative effect of the transaction amount on cash use. One of the key advantages of diary-based data over questionnaire data is that consumers may potentially provide more accurate responses if they are asked to record their behaviour at the time of payment. This approach also provides a wealth of data on transaction characteristics such as use of payment instruments by transaction value, merchant category and channel, as well as demographics.

4. Data and Summary Statistics

4.1 The Data

This paper uses transaction-level data obtained from a survey of consumers' use of payment methods commissioned by the Bank in 2007 as part of its Review of Payments System Reforms. The Bank employed a private research company, Roy Morgan Research, to design and conduct the survey, which involved individuals recording the details of every purchase and bill payment they made over a two-week period in a specially designed pocket-sized diary. For each payment, participants were asked to record information on the payment instrument, the value of the transaction, the merchant category, the channel (for example, point of sale, internet, telephone or mail) and mark a check-box if they were charged a fee by a merchant (or billing organisation) for using the particular payment instrument chosen (a 'surcharge').⁷

Roy Morgan Research selected a nationally representative sample of 1 000 individuals, aged over 18 years from its proprietary Single Source database to participate in the survey. These individuals were each sent an information package including the pocket-sized diary shortly after being recruited by Roy Morgan Research through telephone interviews. Participants were asked to complete the survey over a two-week period in early June 2007. Completed diaries were

⁷ Participants were also asked to record details in the diary of every cash withdrawal they made during the survey period, including the method used to withdraw the cash and the amount of cash obtained. In addition to completing the diary, participants were asked to complete a one-page questionnaire on their personal use of automated debits and surcharging experience at the end of the two-week period. 587 individuals returned this questionnaire.

received from 677 people. Fifteen individuals were excluded owing to inconsistencies in responses, resulting in a final sample of 662 individuals.⁸

Demographic information on each respondent was provided by Roy Morgan Research from its Single Source database. Some of the key demographic variables included information on the individual's age, gender, regional location, educational level, income, and credit card holding status (that is, whether they hold a credit card, and if they do, whether they usually pay their bill in full each month). Furthermore, information was available on whether or not the cardholder held at least one credit card with a loyalty program attached to it.

The diary captured data on the use of nine different payment instruments in 17 different merchant categories and generated a sample of almost 17 000 payments for a total value of around A\$850 000. In addition, the diary captured data on the use of four methods of obtaining cash and generated a sample of around 1 800 cash withdrawals for a total value of around A\$320 000. Table 1 presents a selection of sample statistics and Appendix A contains more detailed information on the fields contained in the diary survey.

⁸ While the sample was designed to be representative of the Australian adult population, the response rates were such that ultimately some demographic groups (for example, older people) were over-represented in the final sample. Accordingly, Roy Morgan Research applied weightings to ensure that the final data were more representative of the population as a whole.

| Table 1: Sample statistics | | | |
|--|---------|-----------------------------------|---------|
| Proportion of respondents, per cent | | | |
| Age (years) | | Education level | |
| 18-29 | 22 (10) | Under Grade 10 | 14 (15) |
| 30-44 | 28 (26) | Grade 10/11 | 17 (19) |
| 45-59 | 26 (32) | Grade 12 | 10 (8) |
| 60+ | 24 (32) | Technical qualification | 26 (25) |
| | | University degree | 33 (32) |
| Personal income (p.a.) | | Loyalty program | |
| <\$20 000 | 39 (40) | Loyalty program | 69 (69) |
| \$20 000-\$39 999 | 28 (27) | No loyalty program | 31 (31) |
| \$40 000-\$59 999 | 16 (15) | | |
| \$60 000-\$79 999 | 9 (8) | | |
| \$80 000-\$99 999 | 5 (5) | | |
| \$100 000-\$119 999 | 2 (2) | | |
| \$120 000+ | 2 (3) | | |
| Gender | | Location | |
| Male | 49 (42) | Capital city | 62 (57) |
| Female | 51 (58) | Regional | 38 (43) |
| Credit card holding | | Transactor/revolver status | |
| Credit card | 50 (61) | Transactor | 66 (67) |
| No credit card | 50 (39) | Revolver | 34 (33) |

Note: Roy Morgan Research applied weightings for age, gender, location and credit card holding status. The unweighted ratios for these variables are in brackets.

Source: Roy Morgan Research

4.2 Summary Statistics

This section provides an overview of the data. We focus on a more rigorous evaluation of the effect of these characteristics in the econometric work in the next section.

One of the key findings from the diary survey was that despite strong growth in the use of non-cash payment methods in recent years, cash is still by far the most commonly used payment instrument in Australia, accounting for around 70 per cent of the number of consumer payments and 38 per cent of their value (Table 2).

Table 2: Payment Methods
Per cent of number and value ^(a)

| | Share of number | Share of value |
|-----------------------------------|-----------------|----------------|
| Cash | 70 | 38 |
| EFTPOS | 11 | 14 |
| MasterCard/Visa debit card | 4 | 6 |
| MasterCard/Visa credit card | 9 | 17 |
| American Express/Diners Club card | 1 | 2 |
| Petrol/store card | * | * |
| Cheque | 1 | 9 |
| BPAY | 2 | 9 |
| Other ^(b) | 1 | 3 |

Notes: (a) Amounts less than 0.5 per cent are marked with an asterisk.

(b) 'Other' payment methods include instruments such as money orders and Cabcharge payments.

Source: Roy Morgan Research

4.2.1 Influence of transaction characteristics

The diary results suggest that consumers' choice of payment instrument is closely related to the transaction amount. Cash is by far the most commonly used payment instrument for low-value transactions, accounting for nearly all transactions under \$10 and three-quarters of transactions between \$11 and \$25 (Table 3). Conversely, cheques and BPAY are used relatively more for higher-value consumer payments, together accounting for 29 per cent of the payments above \$500. Cards are used extensively across all but very low transaction values. For transactions between \$25 and \$200, debit and credit/charge cards account for 45 per cent of transactions.

Consumers' choice of payment instrument also appears to be related to the merchant environment. Cash is used extensively in many merchant categories, for example in take-away food stores and pubs, but less so for travel and insurance purchases (Table 3). Likewise, the share of payments made by debit cards is largest at petrol stations and supermarkets and credit/charge cards' share of payments is largest for travel and insurance payments.

Table 3: Payment Method Use
Share of the number of payments (per cent)

| | Cash | Debit card | Credit/charge card | Other methods |
|-----------------------------------|------|------------|--------------------|---------------|
| Transaction value (\$) | | | | |
| 0-10 | 95 | 3 | 1 | 0 |
| 11-25 | 74 | 16 | 8 | 2 |
| 26-50 | 56 | 23 | 17 | 5 |
| 51-75 | 39 | 29 | 24 | 8 |
| 76-100 | 37 | 28 | 21 | 14 |
| 101-150 | 34 | 29 | 22 | 14 |
| 151-200 | 31 | 28 | 24 | 17 |
| 201-500 | 31 | 21 | 21 | 26 |
| 500+ | 19 | 18 | 30 | 33 |
| Merchant category | | | | |
| Take-away food | 94 | 5 | 1 | 0 |
| Pub/bar | 90 | 6 | 3 | 0 |
| Small food store | 89 | 7 | 4 | 0 |
| Sporting/entertainment | 86 | 6 | 5 | 2 |
| Transport | 83 | 7 | 6 | 3 |
| Restaurant | 78 | 9 | 12 | 0 |
| Other | 69 | 9 | 7 | 15 |
| Education/childcare | 67 | 13 | 5 | 15 |
| Liquor store | 65 | 19 | 15 | 0 |
| Retailer | 64 | 19 | 15 | 3 |
| Supermarket | 62 | 25 | 12 | 0 |
| Health/medical care | 57 | 19 | 20 | 5 |
| Professional service | 52 | 13 | 17 | 18 |
| Petrol | 48 | 32 | 17 | 4 |
| Housing/utilities | 39 | 12 | 13 | 35 |
| Holiday/travel | 27 | 20 | 42 | 11 |
| Insurance | 26 | 13 | 23 | 38 |
| Age (years) | | | | |
| 18-29 | 69 | 19 | 8 | 4 |
| 30-44 | 65 | 19 | 11 | 5 |
| 45-59 | 70 | 14 | 11 | 5 |
| 60+ | 79 | 8 | 9 | 4 |
| Personal income (p.a.) | | | | |
| <\$20 000 | 76 | 13 | 8 | 4 |
| \$20 000-\$39 999 | 70 | 18 | 7 | 6 |
| \$40 000-\$59 999 | 64 | 18 | 13 | 5 |
| \$60 000-\$79 999 | 65 | 16 | 15 | 4 |
| \$80 000-\$99 999 | 67 | 12 | 18 | 3 |
| \$100 000-\$119 999 | 69 | 6 | 21 | 4 |
| \$120 000+ | 65 | 10 | 19 | 6 |
| Transactor/revolver status | | | | |
| Transactor | 64 | 10 | 22 | 4 |
| Revolver | 62 | 19 | 12 | 7 |
| No credit card | 79 | 17 | - | 4 |
| Credit card holders | | | | |
| Loyalty program | 61 | 12 | 23 | 4 |
| No loyalty program | 66 | 16 | 11 | 7 |

Note: Payment methods' shares sum across categories. In some cases the sum does not equal 100 due to rounding.

Source: Roy Morgan Research

These differences across merchant categories may reflect a number of factors. For example, consumers' desire for quick transaction times for certain purchases like take-away food may lead to high use of cash in these situations. Use of debit cards in petrol stations and supermarkets may reflect the availability of EFTPOS cash-out facilities. Differences across merchant categories may also reflect different average transaction values and restrictions such as which instruments or channels are available to consumers. For example, the share of payments made by cash is much lower for travel and insurance purchases and this may reflect a 'channel' effect as consumers commonly deal with these types of businesses via the internet.

4.2.2 Influence of demographics

One demographic factor that appears to play some role in determining consumers' use of payment instruments is age. Cash is used extensively across all age groups, however, older individuals appear to use cash more than younger people (Table 3). People over 60 years of age use cash for almost 80 per cent of their payments, compared to around 65 per cent for those aged between 30 and 44 years.

The use of debit cards (relative to other instruments) is highest in the younger age groups and declines with age. Conversely, the use of credit cards is relatively low for the youngest age group reflecting the fact that younger people are not as likely to hold credit cards. Around one-third of respondents aged 18-29 years in our sample held a credit card; this compares to around half for the adult population.

The use of cards also appears to be influenced by an individual's personal income. Credit/charge cards are used relatively more at higher income levels, while debit card use is highest for middle income bands. Those with a personal income of more than \$100 000 used credit/charge cards for around 20 per cent of their total payments, more than twice the share of those earning under \$40 000. However, it is difficult to separate the influence of higher credit card holding among high-income individuals from higher use of credit cards as income increases. In Section 5 we examine the effect of income on credit card use, conditional on holding a credit card.

4.2.3 Influence of price incentives

In addition to the influence of transaction and demographic characteristics described above, credit card holders' use of payment instruments also appears to be influenced by components of the relative price of payment instruments. In particular, credit card holders' revolver/transactor status appears to be important.

According to the diary survey, transactors use credit cards relatively more frequently than revolvers – for around 22 per cent of their transactions compared to 12 per cent for revolvers, and 35 per cent of the value of spending compared to 22 per cent for revolvers. Conversely, revolvers are more likely to use debit cards than transactors (Table 3). In part, this pattern is likely to reflect the fact that for revolvers an additional purchase on their credit card accrues an interest charge immediately, increasing the relative price of credit cards compared to other payment methods.

Loyalty programs are another important price mechanism that is likely to influence consumers' use of payment instruments. According to data from Roy Morgan's Single Source database, almost 70 per cent of Australian credit/charge card holders aged over 18 years have a loyalty program attached to at least one of their credit cards. Loyalty program participation appears to be more common for transactors, with three-quarters of transactors participating in loyalty programs compared to 59 per cent of revolvers. On average, credit card holders with loyalty programs use their credit cards around twice as much as those who do not participate in a loyalty program (Table 3).

4.2.4 Merchant surcharging

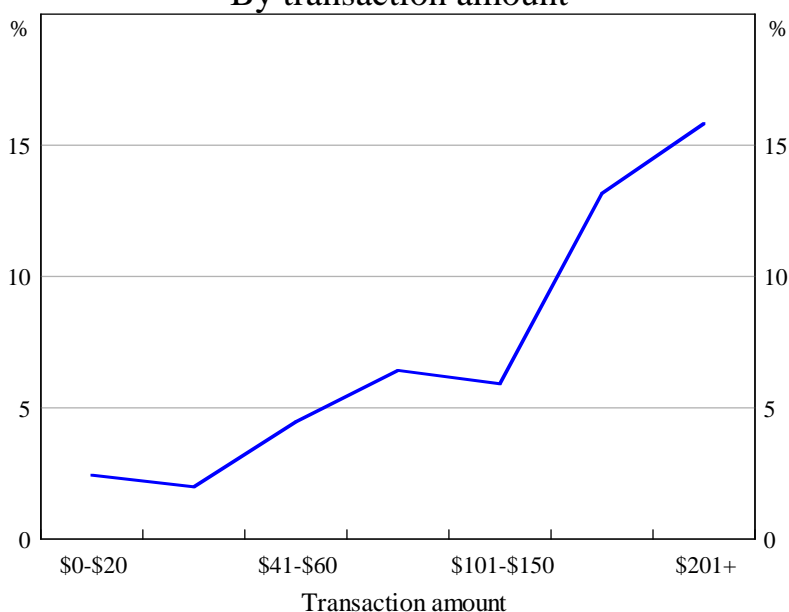
Participants in the diary study were asked to record each transaction they made where they paid a surcharge. Instances where the merchant applied a surcharge for a particular payment method but where the consumer chose to use an alternative payment method are not observed. More generally, obtaining this kind of information on the range of choices and limitations the consumers faced when making their decisions is difficult because often it is not readily available to the consumer at the point of sale and it can add a significant reporting burden, reducing the likelihood that consumers will participate in the survey. Given this

limitation of the data, it is not possible to incorporate the surcharging variable into the econometric models used below. In addition, Roy Morgan Research noted that some respondents may have incorrectly understood the instructions on surcharging, as a number of respondents reported being surcharged for the use of cash. The sample size for the number of credit card transactions attracting a surcharge is also small, limiting its usefulness.

Notwithstanding these limitations, there are a number of interesting findings that can be made using the data available. Cardholders reported paying a surcharge for around 5 per cent of credit card transactions. Of those respondents who filled in the automated debits and surcharging questionnaire, and reported facing a credit card surcharge at least once over the two-week period, 44 per cent reported that it affected their choice of payment instrument ‘very much’ or ‘somewhat’, while 52 per cent thought it affected their choice ‘very little’ or ‘not at all’.

Credit card holders appear to be more likely to pay a surcharge the higher the transaction amount, with a noticeable increase in the share of transactions attracting a surcharge for amounts above \$150 (Figure 5). Only around 1-2 per cent of department store and supermarket credit card transactions were reported as attracting a surcharge compared to around 29 per cent of holiday/travel credit card purchases and 18 per cent of sporting/entertainment purchases. This difference across merchant categories could reflect the influence of the payment channel. For example, it was reported that 16 per cent of credit card payments made over the internet attracted a surcharge – a reasonably high proportion of holiday/travel credit card purchases are made on the internet – compared to four per cent of those made in-person. In addition, people who participate in a loyalty program paid surcharges for credit card transactions at about twice the rate of people without a loyalty program (5.7 per cent versus 2.9 per cent of credit card payments made). Given these interesting statistics, we hope to make greater use of these surcharging data in later work.

Figure 5: Proportion of Credit Card Purchases Attracting Surcharges
By transaction amount



Source: Roy Morgan Research

5. Estimating Consumer Payment Patterns for Australia

In this section we present the results of an econometric model for the holding and use of various payment instruments: credit cards; debit cards; and cash.⁹ As discussed in Section 4, there are three sets of factors that may be important determinants of whether a consumer uses a particular payment instrument: demographic factors; transaction characteristics; and our variables of interest – loyalty program participation and the interest-free period.¹⁰ We are especially interested in how these price incentives affect the probability of using different payment instruments. Our dataset, compared with those used in most previous

⁹ Credit cards include MasterCard and Visa credit cards and American Express and Diners Club charge cards. Debit cards include cards from the domestic EFTPOS system and the MasterCard and Visa debit schemes.

¹⁰ Loyalty program participation and interest-free period are dummy variables. Loyalty program participation is defined as: 1 if consumer does *not* have a loyalty program and 0 otherwise. The interest-free period is defined as: 1 if the consumer does *not* have an interest-free period (is a revolver) and 0 otherwise (is a transactor).

studies, is especially useful for this purpose because it records *actual* payment instrument use, as opposed to *assumed* most frequent use.

5.1 Modelling Framework

5.1.1 Credit card holding

In Australia, for the vast majority of everyday transactions, consumers will generally be able to pay with a credit card, debit card or cash. However, while cash and debit cards are held by almost all consumers, many do not have a credit card.¹¹ Hence, we first examine the main factors determining the probability of a consumer holding a credit card.

For our dependent variable, we only know the outcome of whether the consumer holds the credit card or not, rather than the utility derived from holding the credit card. Therefore, a latent variable approach is used. The dependent variable, $CChold$, is defined as 1 if the consumer holds a credit card and 0 otherwise and $CChold^*$ is the latent variable:

$$CChold_j^* = \beta_0 + \sum_{k=1}^N \beta_k X_{jk} + \mu_i \quad (1)$$

$$CChold_j = \mathbb{1}[CChold_j^* > 0]$$

where j is the individual consumer and there is a set of N independent demographic variables, X , for each consumer. We use a probit model to estimate the probability of holding a credit card:

$$P(CChold_j = 1 | \{X_{jk}\}_{k=1}^N) = \Phi\left(\beta_0 + \sum_{k=1}^N \beta_k X_{jk}\right) \quad (2)$$

where $\Phi(\bullet)$ is the standard normal cumulative distribution function.

¹¹ In Australia, an EFTPOS card is typically issued with the opening of a transaction account; hence, most individuals carry a debit card. According to Roy Morgan Research (2006), around 91 per cent of individuals hold a debit card of some sort, compared to 53 per cent who hold a credit or charge card.

Aside from demographic variables, we also initially considered the value of total weekly transactions as an explanatory variable for the probability of holding a credit card. We might expect that a consumer with relatively high expenditure to be more likely to hold a credit card. As the bivariate analysis showed, credit cards are used for all but very low-value transactions, and a consumer that makes either high-value or a high number of transactions may prefer to have a choice of card payment instruments rather than carrying cash. However, it may be equally likely that holding a credit card affects the weekly spending of consumers, either increasing it because they have the ability to borrow for an interest-free period and may make purchases earlier than otherwise, or decreasing it because they are paying interest on credit card debt and so have to reduce consumption. This potential reverse causation means that the value of total weekly transactions is likely to be endogenous, and its inclusion in Equation (2) would bias our estimates.

We attempted to control for this potential endogeneity using an instrumental variables approach. Unfortunately, our dataset does not contain a wide range of variables that both explain the total value of weekly transactions and are independent of factors affecting the decision to hold a credit card. The instrumental variables method did not produce sensible results because the potential instrumental variables were only weakly correlated with the value of total weekly transactions. In this case, our preferred approach is to exclude the endogenous explanatory variable and estimate the probit model for credit card holding using only demographic explanatory variables.¹²

5.1.2 Loyalty program credit card holding

Given our focus on price incentives in this paper, we are also interested in determining the characteristics of credit card holders that have a loyalty program attached to one of their cards. Therefore, for our sample of credit card holders, we estimate the following model:

$$P(LPhold_j = 1 | \{X_{jk}\}_{k=1}^N) = \Phi\left(\delta_0 + \sum_{k=1}^N \delta_k X_{jk}\right) \quad (3)$$

¹² Borzekowski *et al* (2008) and Klee (2006) also estimate payment instrument holding on a set of demographic variables alone.

where $LPhold$ is defined as 1 if the consumer holds a loyalty program credit card and 0 otherwise. As with credit card holding, we estimate a model that only includes demographic variables. Again, we considered whether the value of weekly *credit card* transactions might influence the probability of holding a loyalty program credit card. However, the value of weekly credit card transactions is potentially endogenous and we could not find suitable instruments.

5.1.3 Credit card, debit card and cash use

Once we establish the type of consumers holding a credit card, as well as credit card holders that have a loyalty program, we turn to the main focus of our paper: whether there is a relationship between price incentives on credit cards and broader consumer payment instrument use. To do this we follow Borzekowski *et al* (2008) and use our transaction-level data to estimate separate probit models for the use of credit cards, debit cards and cash.¹³ Hence, for each payment instrument, the probability of use is modelled as:

$$P(Use_i = 1 | \{X_{ik}\}_{k=1}^N, \{T_{im}\}_{m=1}^M, LP_i, I_i) = \Phi\left(\alpha_0 + \sum_{k=1}^N \alpha_k X_{ik} + \sum_{m=1}^M \phi_m T_{im} + \gamma LP_i + \mathcal{I}I_i\right) \quad (4)$$

where: the dependent variable, Use , takes the value of 1 if the consumer used the payment instrument for a particular transaction – either credit card, debit card or cash – and 0 otherwise; i denotes an individual transaction; there is a set of M transaction related variables, T ; LP indicates whether the consumer participated in a loyalty program or not; and I indicates whether the consumer regularly pays off their monthly credit card bill or not (that is, they are a transactor or a revolver).

We base these use regressions only on those individuals who hold a credit card. This approach is consistent with that applied in previous studies; as Ching and Hayashi (2008) note, the focus is on the differences in payment choice between

¹³ Because this problem can also be treated as one where the consumer has a number of alternative payment options that are mutually exclusive and exhaustive, we could also use a multinomial logit model, similar to Bounie and François (2006). Our preliminary results from a multinomial logit model suggested similar effects in both sign and magnitude to those found for the less complex probit models.

those who participate in a loyalty program and those who do not, rather than between credit card and non credit card holders.¹⁴

5.2 Influences on the Probability of Credit Card Holding

The results from our model of credit card holding are presented in Table 4. The coefficients in the second column allow us to gauge only the direction of the variable's effect. Hence, in the last column we also report the marginal effect on the implied probabilities of a change of the independent variable, evaluated at the base case.¹⁵ Our model includes only dummy variables because most of our survey data were collected on a categorical basis. For these variables, the partial effect measures the estimated change in the probability of interest following a discrete change in the dummy from 0 to 1.

As shown in Table 4, we find that income has a large effect on the probability of holding a credit card, but it is only significant for lower income categories. We find that relative to a base income of \$40 000 - \$59 999, a consumer with an annual income of between \$20 000 - \$39 999 is 17 percentage points less likely to hold a credit card. This negative effect is even larger for those on an income of less than \$20 000, at around 34 percentage points. The finding that low income earners are less likely to hold a credit card is not surprising; however, what is interesting, is that there is no statistically significant difference between incomes of \$40 000 and higher. Thus the effect at lower income levels could reflect supply-side factors, for example the need to satisfy a certain eligibility criteria to obtain a credit card.

¹⁴ Also see Borzekowski *et al* (2008), Bounie and François (2006), and Zinman (2008). This focus on the sub-sample of credit card holders is one reason we do not model the two stages of credit card holding and credit card use in the Heckman selection framework. Kohler and Rossiter (2005) provide more detail on other reasons for preferring a two-part model over a selection model.

¹⁵ As most of our explanatory variables are multiple-category dummy variables, it is more appropriate to evaluate the marginal effects at the base case, or 'reference' person, rather than at sample means. Our base case for each dummy variable category was generally chosen as the category with the highest proportion of the sample. An exception to this in the holding regression was personal income for which we chose a base case of \$40 000 to \$59 999 to reflect the average income of a person with/currently completing a university degree.

Table 4: Credit Card Holding

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|-------------------------------------|-------------|-------------------------------|------------------------|
| Income (<\$20 000) | -0.90*** | \$40 000 - \$59 999 | -34.2 |
| Income (\$20 000 - \$39 999) | -0.46** | \$40 000 - \$59 999 | -16.7 |
| Income (\$60 000 - \$79 999) | 0.15 | \$40 000 - \$59 999 | 4.5 |
| Income (\$80 000 - \$99 999) | 0.23 | \$40 000 - \$59 999 | 6.8 |
| Income (\$100 000 - \$119 999) | -0.29 | \$40 000 - \$59 999 | -10.2 |
| Income (\$120 000+) | 0.80 | \$40 000 - \$59 999 | 18.5 |
| Hold scheme debit card | -0.37*** | Do not hold scheme debit card | -13.2 |
| Hold cheque book | 0.41*** | Do not hold cheque book | 11.5 |
| QLD | 0.34** | NSW | 9.8 |
| VIC | 0.10 | NSW | 3.1 |
| TAS | 0.13 | NSW | 3.9 |
| SA/NT | -0.22 | NSW | -7.7 |
| WA | 0.18 | NSW | 5.6 |
| Regional Location | -0.34*** | Capital city location | -11.9 |
| Education (< Year 10) | -0.36** | University | -12.9 |
| Education (Year 10/11) | -0.11 | University | -3.8 |
| Education (Year 12) | -0.52** | University | -19.0 |
| Education (Technical qualification) | 0.07 | University | 2.2 |
| Constant | 0.64*** | | |

Number of observations = 579

Prob > Chi2 = 0.0000

Pseudo R² = 0.16

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects calculated at the base case.

Another supply-side effect could be captured by the regional variable, which has a significant and negative effect. There may be a smaller proportion of merchants in regional areas who accept credit cards, therefore making it less desirable to hold a credit card. There also appears to be some variation in credit card holding between the various states and territories, though there is no immediately apparent reason why this might be the case.

The level of education of the consumer is significant. Consumers with less education are less likely to hold a credit card than those with a university qualification. This is consistent with Borzekowski *et al's* (2008) finding that higher

levels of education tend to increase the probability of debit card holding. What this tends to suggest is that additional education may increase the probability of holding payment instruments aside from the more traditional methods, such as cash.¹⁶

Finally, it is perhaps not surprising to find that a consumer who holds a scheme debit card is around 13 percentage points less likely to hold a credit card than a consumer without a scheme debit card. For these consumers, the attractiveness of holding a ‘scheme’ card over an EFTPOS card is most likely to be the ability to make payments that are not face-to-face, such as on-line payments, rather than necessarily having access to an interest-free period. Also, financial institutions tend to market credit card and scheme debit cards as substitute payment instruments. In contrast, we find that if the consumer holds a cheque book then they are around 12 percentage points more likely to hold a credit card. While these two payment instruments are used for quite different types of payments, one similar feature is that they may assist with consumer’s personal accounting, because both automatically provide a detailed record of expenditure.

5.3 Influences on the Probability of Loyalty Program Credit Card Holding

Having established the characteristics of consumers who hold a credit card, an additional interest may be to ascertain the characteristics of those consumers who also hold a credit card with a loyalty program. The results from our model of access to loyalty programs are presented in Table 5.

¹⁶ In their sample, only around 52 per cent of households held a debit card.

Table 5: Loyalty Program Credit Card Holding
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|--------------------------------|-------------|-----------------------|------------------------|
| Income (<\$20 000) | -0.66** | \$40 000 - \$59 999 | -25.7 |
| Income (\$20 000 - \$39 999) | -0.10 | \$40 000 - \$59 999 | -4.0 |
| Income (\$60 000 - \$79 999) | 0.29 | \$40 000 - \$59 999 | 10.7 |
| Income (\$80 000 - \$99 999) | 0.93** | \$40 000 - \$59 999 | 28.2 |
| Income (\$100 000 - \$119 999) | 0.51 | \$40 000 - \$59 999 | 17.7 |
| Income (\$120 000+) | 0.78* | \$40 000 - \$59 999 | 25.1 |
| Regional Location | 0.33** | Capital city location | 12.1 |
| Part-time work | 0.43* | Full-time work | 15.3 |
| Looking for work | 0.69 | Full-time work | 22.7 |
| Not looking for work | 0.22 | Full-time work | 8.2 |
| Retired | 0.45** | Full-time work | 15.9 |
| Constant | 0.25 | | |

Number of observations = 307

Prob > Chi2 = 0.0041

Pseudo R² = 0.07

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects calculated at the base case.

While the results above suggested that consumers with lower levels of income are less likely to hold a credit card, we find that those that do hold a credit card are less likely to hold one with a loyalty program attached. This suggests that these lower income consumers may be more likely to hold a credit card with lower annual fees and possibly lower interest rates, particularly if they are uncertain whether they will always be able to pay off their monthly credit card bill. We also find some evidence that higher income consumers are more likely to hold a credit card with a loyalty program than the reference group with incomes of between \$40 000 to \$59 999. Higher income consumers may be more certain of their financial situation and ability to pay off their credit card balance; hence, a rewards program, as opposed to lower annual fees and interest rates, may be a more attractive credit card product. Additional privileges that are attached to some loyalty program cards, such as concierge services for platinum card holders, may also be more attractive to higher income consumers.

Interestingly, we find that part-time workers and retirees are more likely to hold a loyalty program credit card than those that work full-time, other things equal. This seems somewhat counter-intuitive, though this variable may be also capturing effects of other debt holding that are not included in the model.¹⁷ For example, full-time workers in our credit card sample tend to be slightly younger than part-time workers and, not surprisingly, younger than retirees. With an average age of 40-45 years, full-time workers are likely to have other forms of debt, such as a mortgage and may prefer a lower-rate credit card without a reward program to avoid high interest charges given that they are perhaps more likely to be liquidity constrained.

Despite being less likely to hold a credit card in general, we also find that if a consumer who lives in a regional area holds a credit card, they are more likely to hold a credit card with a loyalty program attached. Perhaps loyalty programs that allow points to be redeemed for airline flights are particularly valuable to consumers who live in regional areas.

5.4 Influences on the Probability of Credit Card Use

We use the same set of demographic variables, as well as transaction-related and price incentive variables, to determine the main factors affecting payment instrument use. Table 6 presents a summary of the results for the probability of credit card use.¹⁸ Some explanatory variables have been excluded for presentation purposes; the full results table for credit card use is contained in Appendix B.

5.4.1 Demographic factors

Previous research has shown that demographic factors have an important effect on the probability of payment method use (Borzekowski *et al* 2008; Bounie & François 2006; Emery *et al* 2008; Klee 2006). In Section 5.2 we found that

¹⁷ Age was not found to be statistically significant and we do not have any variables on the level or existence of other debt available in our survey.

¹⁸ Again, our base case categories have generally been determined as the category with the highest proportion of the sample for each set of dummy variables. The exception in the use regressions is transaction value. In this case we took the category corresponding to the average transaction value (for those that hold a credit card); the highest proportion is skewed towards a low-value transactions.

personal income can explain the probability of a consumer holding a credit card. However, once a consumer holds a credit card, income does not appear to have a statistically significant effect on the probability that the consumer will use their credit card for a given transaction. This is not entirely inconsistent with other studies; for example, Bounie and François (2006) do not find an intuitive income effect in their results for payment instrument use.

In contrast, gender does not have a statistically significant effect on credit card holding, but it does play a role in determining the probability of credit card use, with males 11 percentage points more likely to use a credit card for a given transaction than females. We also find that there is some variation in credit card use across states/territories.

If the consumer also holds a scheme debit card, we find that the probability that the consumer will use a credit card for a given transaction is 14 percentage points lower, than if they did not hold a scheme debit card. This result provides some evidence that these cards may be substitutes for certain types of transactions, particularly on-line transactions, as noted above in the analysis of the credit card holding regression. In contrast, despite cheque book holding having a significant effect on credit card holding, it does not significantly affect the probability of using a credit card. This is consistent with the likelihood that these two types of payment instruments are used for quite different types of payments.

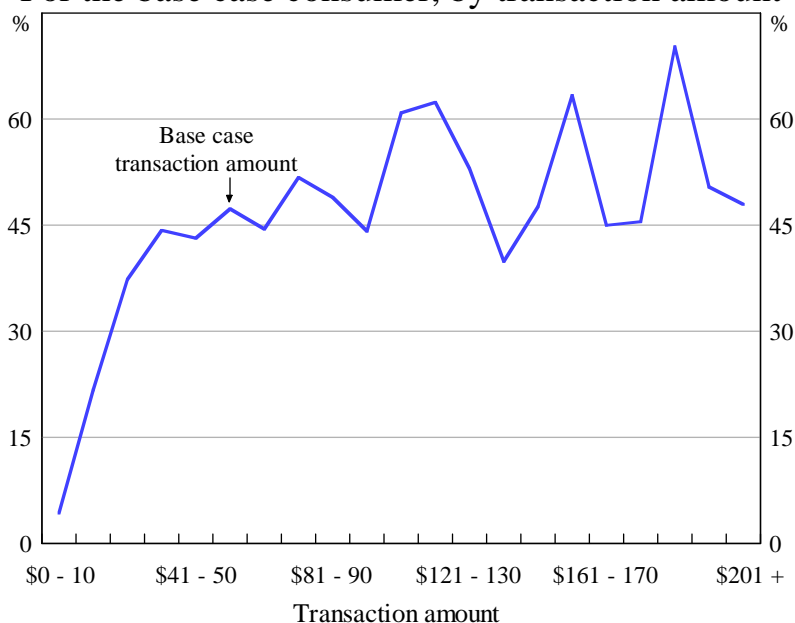
5.4.2 Transaction characteristics

Our estimated model in Table 6 also controls for a range of transaction-related factors that could affect the probability of credit card use. Low-value transaction amounts are significantly less likely to be associated with a credit card being used for payment, controlling for all other factors. For example, relative to a reference transaction of \$51-\$60, a consumer is 43 percentage points less likely to make a transaction with their credit card if the value is under \$10. For these low transaction values it is more convenient in terms of tender time to pay with other payment instruments, particularly cash. Further, while this result controls for loyalty program participation, for transaction values of this small size, the benefit of rewards would be quite small because they are accumulated as a proportion of transaction value. For example, a \$10 transaction would only accumulate around 6

cents in terms of a shopping voucher.¹⁹ Figure 6 shows, for a base case consumer, that as the transaction amount increases, the predicted probability of using a credit card tends to increase.

Figure 6: Predicted Probability of Credit Card Use

For the base case consumer, by transaction amount



Note: The characteristics of the base case consumer are: is female; lives in NSW; participates in a loyalty program; is a transactor; does not hold a scheme debit card; and made the transaction at a retailer.

Source: RBA

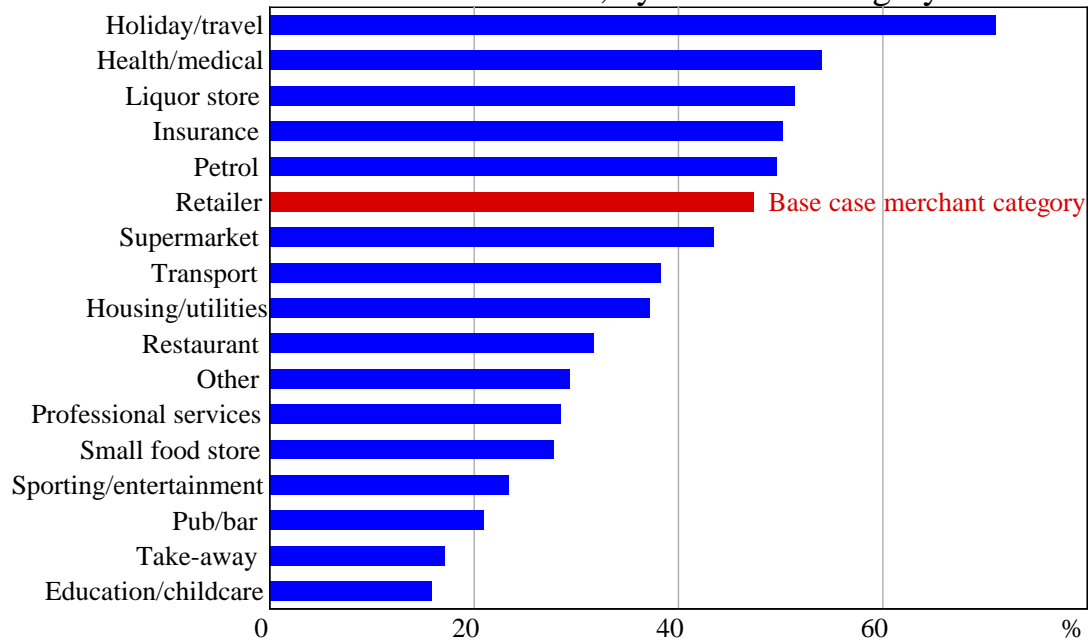
We also find that the type of merchant has a significant effect on the probability of the consumer using a credit card. Figure 7 shows the predicted probability of a base case consumer using a credit card at various merchant types. Our results suggest that relative to a purchase at a retail store such as a department store, consumers are more likely to make a purchase on a credit card when booking a holiday or travel and paying for health/medical purchases. The effect of holiday purchases may partly capture the likelihood that these payments are made on-line; a factor that is not included in these regressions because of potential collinearity with the merchant category variables. In Australia, because on-line EFTPOS is not available, credit cards have tended to dominate the on-line payments market. In contrast, there are a range of merchants for which the consumer is less likely to

¹⁹ See Reserve Bank of Australia (2007) for further details of reward program benefits to cardholders.

make a credit card purchase relative to a purchase at a retail store; the largest effects were found for pub/bars and take-away stores. These results potentially reflect the slow tender time of a credit card transaction; as the consumer needs to sign for the transaction made on credit card, they may feel they are ‘holding up’ queues in these generally busy merchants. Alternatively, the merchant may not actually accept credit cards for similar reasons. As the availability of PIN becomes more widespread for credit card use in Australia, the probability of credit card use at these types of merchants may increase.

Figure 7: Predicted Probability of Credit Card Use

For the base case consumer, by merchant category



Note: The characteristics of the base case consumer are: is female; lives in NSW; participates in a loyalty program; is a transactor; does not hold a scheme debit card; and made a transaction between \$51 and \$60.

Source: RBA

Table 6: Credit Card Use
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|---------------------------|-------------|-------------------------------|------------------------|
| No Loyalty Program | -0.57*** | Loyalty Program | -21.0 |
| Revolver | -0.39*** | Transactor | -14.9 |
| Male | 0.29*** | Female | 11.3 |
| Hold scheme debit card | -0.36*** | Do not hold scheme debit card | -14.0 |
| Transaction (\$0-\$10) | -1.65*** | Transaction (\$51-\$60) | -43.0 |
| Transaction (\$11-\$20) | -0.71*** | Transaction (\$51-\$60) | -25.6 |
| Transaction (\$21-\$30) | -0.26*** | Transaction (\$51-\$60) | -10.0 |
| Transaction (\$31-\$40) | -0.08 | Transaction (\$51-\$60) | -3.0 |
| Transaction (\$41-\$50) | -0.10 | Transaction (\$51-\$60) | -4.1 |
| Transaction (\$61-\$70) | -0.07 | Transaction (\$51-\$60) | -2.8 |
| Transaction (\$71-\$80) | 0.11 | Transaction (\$51-\$60) | 4.5 |
| Transaction (\$81-\$90) | 0.04 | Transaction (\$51-\$60) | 1.6 |
| Transaction (\$91-\$100) | -0.08 | Transaction (\$51-\$60) | -3.1 |
| Transaction (\$101-\$110) | 0.34** | Transaction (\$51-\$60) | 13.6 |
| Transaction (\$111-\$120) | 0.38** | Transaction (\$51-\$60) | 15.1 |
| Transaction (\$121-\$130) | 0.14 | Transaction (\$51-\$60) | 5.7 |
| Transaction (\$151-\$160) | 0.41** | Transaction (\$51-\$60) | 16.1 |
| Transaction (\$161-\$170) | -0.06 | Transaction (\$51-\$60) | -2.3 |
| Transaction (\$171-\$180) | -0.05 | Transaction (\$51-\$60) | -1.8 |
| Transaction (\$181-\$190) | 0.60* | Transaction (\$51-\$60) | 22.9 |
| Transaction (\$191-\$200) | 0.08 | Transaction (\$51-\$60) | 3.1 |
| Transaction (\$201+) | 0.02 | Transaction (\$51-\$60) | 0.6 |
| Holiday/travel | 0.62*** | Retailer | 23.7 |
| Health/medical | 0.17* | Retailer | 6.7 |
| Petrol | 0.06 | Retailer | 2.3 |
| Supermarket | -0.10 | Retailer | -4.0 |
| Restaurant | -0.41*** | Retailer | -15.7 |
| Professional services | -0.50*** | Retailer | -18.9 |
| Small food store | -0.52*** | Retailer | -19.6 |
| Sports/entertainment | -0.66*** | Retailer | -24.0 |
| Pub/bar | -0.74*** | Retailer | -26.4 |
| Take-away | -0.88*** | Retailer | -30.2 |
| Constant | -0.07 | | |

Number of observations = 8663

Prob > Chi2 = 0.0000

Pseudo R² = 0.27

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects evaluated at the base case.

5.4.3 Price incentives

As foreshadowed by both the aggregate time-series data and the bivariate analysis of our survey data, price incentives on credit cards play a significant role in credit card use. Our model shows a strong relationship between participation in a loyalty program and the probability of credit card use. The results indicate that the probability of a credit card holder using a credit card to make a payment is 21 percentage points lower for a ‘base case’ cardholder that does *not* participate in a loyalty program, than a cardholder that does have a loyalty program. The effect is reasonably large given the predicted probability of our base case person using a credit card is 47 per cent.²⁰

The results also suggest that access to an interest-free period on a consumer’s card and the probability of credit card use are related.²¹ The results suggest that the probability of a credit card holder using a credit card decreases by 15 percentage points if the ‘base case’ cardholder does *not* usually receive the benefit of the interest-free period. This effect is slightly smaller than that found for loyalty programs. This is not surprising given that reward points are a much more transparent price incentive to consumers at the point of sale. The results in the next section also suggest that there is a qualitative difference between loyalty programs and interest free periods that show up in the substitution patterns implied by the results for debit cards and cash.

5.5 Credit Card Price Incentives and the Use of Debit Cards and Cash

Tables 7 and 8 present a summary of the probit regression results for the use of debit cards and cash (the full results tables are provided in Appendix B). While the tables include the set of significant demographic and transaction-related variables,

²⁰ The observed probability of using a credit card in our sample is lower, at around 19 per cent. This is likely related to the fact that there are a large number of low value transactions made with cash. While this might suggest that our chosen base case for the transaction value gives us a large marginal effect, we find that for transaction values above \$20, the size of the marginal effect is insensitive to the choice of base case for the transaction value.

²¹ Due to data limitations, there may be some transactors in the sample whose card does not have an interest-free period. This problem is likely to be relatively small, however, as at the aggregate-level only 6 per cent of personal credit card accounts do not have an interest-free period, and revolvers are probably more likely than transactors to choose to hold these cards since they do not usually receive the benefit of any interest-free period.

we focus our discussion on the effects of the credit card price incentives on these other payment instruments.

A broad comparison of Tables 6 to 8 suggests that participation in a loyalty program or access to an interest-free period increases credit card use at the expense of using debit cards and cash. For debit cards we find that the interest-free period has a significant effect on use but loyalty program participation does not. A consumer is 19 percentage points more likely to use their debit card if they do not usually pay off their credit card in full and therefore does not have access to an interest-free period; this finding is consistent in sign, but larger in magnitude than the effect found in Zinman (2008).²²

For the cash regression we find virtually the opposite effect of credit card price incentives to those found in the debit card regression.²³ Access to a credit card interest-free period does not have a statistically significant effect on the probability of cash use. If the consumer does not have a loyalty program, however, we find that they are 10 percentage points more likely to use cash for a particular transaction than another payment method.

Having found some evidence of substitution between debit cards, credit cards and cash, we want to examine why the degree of substitution differs across price incentives and payment instruments. Consider first the effect of the interest-free period on the use of the three payment instruments. Based on interest costs alone, the price of using a credit card with an interest-free period is lower than that of using a debit card, which, in turn, is lower than a credit card where interest (at relatively high credit-card rates) is payable on a purchase. It is therefore logical that a cardholder paying interest might use a debit card rather than a credit card.²⁴

²² Zinman (2008) estimates a marginal effect of around 17 percentage points for 2004 data; however, his preferred results are from the pooled 1995-2004 sample for which the effect is around 10 percentage points.

²³ This different finding for the debit card and cash regressions is not driven by multicollinearity between the revolver and loyalty program variables. The coefficients for these variables remain largely unchanged if we only include one of these variables in the regression.

²⁴ Ching and Hayashi (2008) find that this substitution of debit for credit may not occur at all merchant types. For example, access to an interest-free period was not found to have a significant effect on the choice of payment instrument at department and discount stores. They suggest (p 21): ‘This may be because ... consumers may feel natural to use a credit card

Of more interest is why there is little substitution towards cash when the cardholder does not have an interest-free period. Perhaps for those transactions a consumer already prefers to perform on a credit card, debit cards are a closer substitute than cash. Some support for this interpretation comes from the information in Section 4 on the use of cash; it is most commonly used for small transactions, such as take-away meals, while cards are used for larger transactions where speed of the transaction is less important.

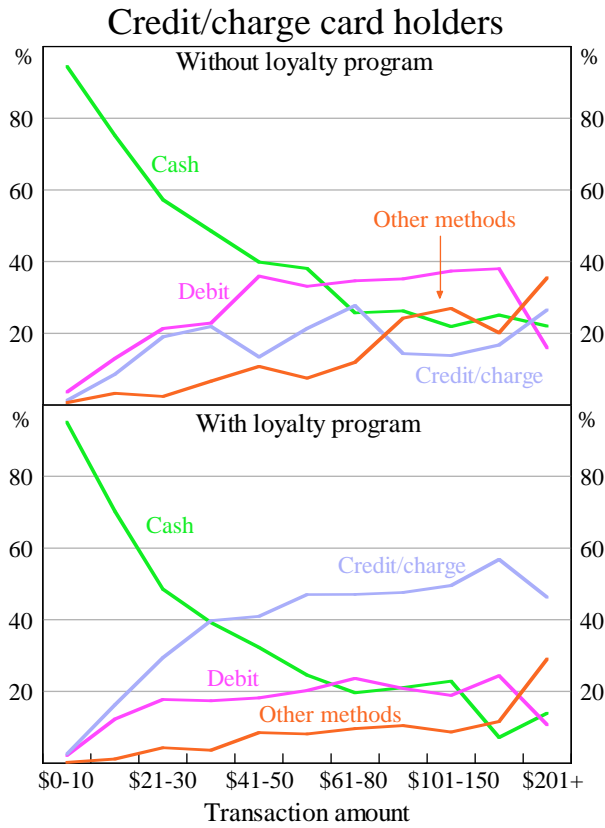
The results for the loyalty program variable are somewhat more difficult to reconcile. Indeed, the finding that participation in a loyalty program has no significant effect on debit card use is somewhat at odds with US studies. For example, Ching and Hayashi (2008 and 2006) and Sprenger and Stavins (2008), find that if the consumer has a loyalty program this increases the probability of credit card use and decreases the probability of *both* debit card and cash use. The results do, however, show substitution from cash to credit cards if the cardholder has a loyalty program. This can also be seen quite clearly in the raw diary study data on the use of payment instruments across transaction values. For credit card holders without a loyalty program, cash is the most frequently used payment method for transaction values up to around \$60, whereas for cardholders with a loyalty program, cash is only dominant for transactions up to around \$30 (Figure 8). At higher transaction values the presence of a loyalty program also appears to increase use of credit cards.

Together, the results for the price incentive variables suggest that while credit cards and cash might be relatively close substitutes for low-value transactions, cash is considered a less suitable payment instrument for higher-value transactions typically performed on cards. Debit cards, on the other hand, appear to be a reasonable substitute for these higher-value transactions if there is some cost to using a credit card. However, loyalty program benefits by themselves do not appear to be sufficient to encourage substitution between debit and credit cards. This result suggests that consumers may have strong preferences about the type of purchases made on debit cards and credit cards that are already controlled for in the regression. For example, whether the purchase is made in a supermarket has a

to borrow from their future incomes when purchasing items that are relatively more expensive.’

statistically significant effect on debit card use, which, as discussed in Section 4, may reflect factors such as the availability of EFPTOS cash-out at these merchants. Such factors apparently outweigh the benefit of earning reward points if the same purchase is made on a credit card.

Figure 8: Share of Payments (Number)



Source: Roy Morgan Research

Table 7: Debit Card Use
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|---------------------------|-------------|-------------------------|------------------------|
| No Loyalty Program | 0.14 | Loyalty Program | 4.1 |
| Revolver | 0.57*** | Transactor | 19.2 |
| Age (18 - 29 years) | 0.18 | Age (45-59 years) | 5.4 |
| Age (30 - 44 years) | 0.06 | Age (45-59 years) | 1.6 |
| Age (60+ years) | -0.25* | Age (45-59 years) | -6.1 |
| Transaction (\$0-\$10) | -1.26*** | Transaction (\$51-\$60) | -17.7 |
| Transaction (\$11-\$20) | -0.52*** | Transaction (\$51-\$60) | -11.1 |
| Transaction (\$21-\$30) | -0.28*** | Transaction (\$51-\$60) | -6.7 |
| Transaction (\$31-\$40) | -0.23** | Transaction (\$51-\$60) | -5.7 |
| Transaction (\$41-\$50) | 0.02 | Transaction (\$51-\$60) | 0.5 |
| Transaction (\$61-\$70) | 0.12 | Transaction (\$51-\$60) | 3.4 |
| Transaction (\$71-\$80) | -0.02 | Transaction (\$51-\$60) | -0.6 |
| Transaction (\$81-\$90) | 0.14 | Transaction (\$51-\$60) | 3.9 |
| Transaction (\$101-\$110) | -0.11 | Transaction (\$51-\$60) | -2.8 |
| Transaction (\$111-\$120) | -0.09 | Transaction (\$51-\$60) | -2.4 |
| Transaction (\$121-\$130) | -0.12 | Transaction (\$51-\$60) | -3.0 |
| Transaction (\$151-\$160) | -0.25 | Transaction (\$51-\$60) | -6.0 |
| Transaction (\$161-\$170) | 0.15 | Transaction (\$51-\$60) | 4.4 |
| Transaction (\$171-\$180) | 0.20 | Transaction (\$51-\$60) | 5.8 |
| Transaction (\$191-\$200) | 0.19 | Transaction (\$51-\$60) | 5.7 |
| Transaction (\$201+) | -0.19 | Transaction (\$51-\$60) | -4.7 |
| Holiday/travel | -0.30 | Retailer | -7.1 |
| Health/medical | -0.12 | Retailer | -3.1 |
| Supermarket | 0.26*** | Retailer | 7.8 |
| Restaurant | -0.60*** | Retailer | -12.3 |
| Professional services | -0.39** | Retailer | -8.9 |
| Small food store | -0.29** | Retailer | -6.8 |
| Pub/bar | -0.97*** | Retailer | -16.0 |
| Take-away | -0.50*** | Retailer | -10.8 |
| Transport | -0.43*** | Retailer | -9.6 |
| Insurance | -0.50* | Retailer | -10.8 |
| Housing/utilities | -0.76*** | Retailer | -14.2 |
| Constant | -0.86*** | | |

Number of observations = 8663

Prob > Chi2 = 0.0000

Pseudo R² = 0.22

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects evaluated at base case.

Table 8: Cash Use
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|---------------------------|-------------|-------------------------------|------------------------|
| No Loyalty Program | 0.29*** | Loyalty Program | 10.4 |
| Revolver | -0.06 | Transactor | -1.9 |
| Hold scheme debit card | -0.16* | Do not hold scheme debit card | -5.1 |
| Age (18 - 29 years) | -0.32** | Age (45-59 years) | -9.3 |
| Age (30 - 44 years) | -0.13 | Age (45-59 years) | -4.1 |
| Age (60+ years) | 0.21** | Age (45-59 years) | 7.2 |
| Transaction (\$0-\$10) | 1.98*** | Transaction (\$51-\$60) | 64.5 |
| Transaction (\$11-\$20) | 1.04*** | Transaction (\$51-\$60) | 39.3 |
| Transaction (\$21-\$30) | 0.52*** | Transaction (\$51-\$60) | 19.4 |
| Transaction (\$31-\$40) | 0.32*** | Transaction (\$51-\$60) | 11.3 |
| Transaction (\$61-\$70) | -0.18 | Transaction (\$51-\$60) | -5.6 |
| Transaction (\$71-\$80) | -0.11 | Transaction (\$51-\$60) | -3.5 |
| Transaction (\$81-\$90) | -0.29** | Transaction (\$51-\$60) | -8.5 |
| Transaction (\$101-\$110) | -0.33 | Transaction (\$51-\$60) | -9.7 |
| Transaction (\$111-\$120) | -0.35* | Transaction (\$51-\$60) | -10.2 |
| Transaction (\$131-\$140) | -0.23 | Transaction (\$51-\$60) | -7.0 |
| Transaction (\$141-\$150) | 0.06 | Transaction (\$51-\$60) | 2.1 |
| Transaction (\$151-\$160) | -0.53** | Transaction (\$51-\$60) | -14.3 |
| Transaction (\$161-\$170) | -0.07 | Transaction (\$51-\$60) | -2.3 |
| Transaction (\$171-\$180) | -0.18 | Transaction (\$51-\$60) | -5.5 |
| Transaction (\$181-\$190) | -0.56 | Transaction (\$51-\$60) | -14.9 |
| Transaction (\$191-\$200) | -0.54* | Transaction (\$51-\$60) | -14.6 |
| Transaction (\$201+) | -0.32*** | Transaction (\$51-\$60) | -9.4 |
| Holiday/travel | -0.35* | Retailer | -10.2 |
| Health/medical | -0.22** | Retailer | -6.6 |
| Petrol | -0.29*** | Retailer | -8.6 |
| Restaurant | 0.72*** | Retailer | 27.4 |
| Small food store | 0.58*** | Retailer | 21.8 |
| Pub/bar | 1.12*** | Retailer | 42.3 |
| Take-away | 0.87*** | Retailer | 33.2 |
| Transport | 0.43*** | Retailer | 15.5 |
| Constant | -0.62*** | | |

Number of observations = 8663

Prob > Chi2 = 0.0000

Pseudo R² = 0.37

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects evaluated at base case.

5.6 Implications of Results for Aggregate Payment Patterns

The results above provide some interesting insights into what factors drive the payment instrument choice of consumers. However, the results may also be able to give us some insight into broader policy issues, particularly given the Bank's reforms to date have largely targeted price incentives to consumers to promote payment system efficiency. In this Section, we present a few hypothetical calculations to provide a sense of the aggregate economic significance of these results.²⁵

If, for some reason, loyalty programs were removed from all credit cards in 2007 we calculate that, as a conservative estimate, the total value of credit card spending in 2007 would have been around 12 per cent lower. Or, put another way, the total value of credit card payments in 2007 would have been around \$170 billion rather than the actually observed \$190 billion.²⁶ Naturally, a change in loyalty programs would not occur in isolation and there would undoubtedly have been other changes occurring if this had actually happened. Hence, this estimate is best used to judge the economic significance of our earlier parameter estimate rather than as a prediction of what might occur if loyalty programs were removed.

²⁵ Ching and Hayashi (2008) conduct a similar policy experiment; however, their conclusions focus on the change in total card payment instruments (debit and credit), rather than just the change in credit card use.

²⁶ To construct this hypothetical scenario, we assume that if there were no loyalty programs there would be a shift from the use of credit cards to cash in line with our regression results. The proportion of credit card transactions that shift to cash are transactions that would otherwise have been made with cash except for the benefits of being in a loyalty program; hence, the transaction sizes of these shifting transactions are likely to be smaller than for the average credit card. As a result, we use the cash regression and calculate the increase in cash use if there were no loyalty programs. Specifically, we use the diary study and retail payment statistics collected by the Reserve Bank to estimate the number of cash payments in 2007 at around 7.5 billion, representing 59 per cent of the share of total payments. Data from the diary study over our estimation sample suggest 70 per cent of cash transactions are made by consumers with a loyalty program. Hence, if loyalty programs had been removed the share of cash transactions would have increased by 10.4 percentage points on the 70 percent of cash transactions made by consumers with a loyalty program. This would have increased the overall cash share of total transactions to 66 per cent. This implies a hypothetical number of cash transactions of 8.5 billion. Multiplying this by the average cash transaction of around \$24 and subtracting the actual number of cash payments we calculate an increase of \$23 billion in cash payments. Subtracting this \$23 billion from the actual value of credit card payments in 2007 implies a decrease of 12 per cent.

Nonetheless, the scenario still provides context for considering actual developments that have occurred in the market for credit cards since the reforms. In particular, as well as a reduction in reward points of around 20 basis points (from around 81 basis points in 2003)²⁷ as a proportion of consumer spending, there has been the emergence of low-rate credit cards that still have an interest-free period, but generally do not offer reward points. These cards are aimed at attracting revolver consumers, who represent around 34 per cent of credit card holders.²⁸ Hence, over the past five years there has been a reduction in reward points as well as a likely increase in the proportion of consumers who do not participate in a loyalty program. The results from our hypothetical scenario suggest that such changes may be large enough to at least partly explain the observed fall in growth of credit card use since the beginning of the reforms.

We can apply a similar hypothetical calculation to that done for 2007 data above, to data for the late 1990s to obtain a lower-bound sense of the effect of loyalty programs over the past decade or so. For this earlier period, our estimates suggest that without loyalty programs, annual compound growth between 1994 and 1999 would have been around 15 per cent, compared to actual growth of around 20 per cent. This estimate is likely to be conservative because it is based on the effect of loyalty programs at their current levels rather than at the more generous levels that prevailed when the programs were first introduced. Notwithstanding this, the widespread introduction of loyalty programs in the late 1990s appears to account for some of the rapid growth in credit card use over that period.²⁹ A rough interpolation of our 1990s and 2007 calculations also suggests that without loyalty programs for credit cards, debit cards may have been the dominant payment instrument on a per capita basis throughout the entire period.

²⁷ These are the earliest data available. Sources: Banks websites, ANZ Telstra Rewards Visa card, Commonwealth Bank MasterCard Awards card, National Australia Bank Visa Gold card, Westpac Altitude MasterCard.

²⁸ According to the diary study data.

²⁹ Australian Competition and Consumer Commission and Reserve Bank of Australia (2000).

6. Conclusion

Over the past decade, the payments landscape in Australia has undergone significant change. This is consistent with the international trend towards a greater use of electronic payment instruments. But it is also likely to reflect to some extent a series of reforms in Australia over the past five years, a significant effect of which has been to change the relative prices consumers face when choosing between payment methods. This paper provides estimates of how important price incentives are for influencing consumer payment patterns. We find that participation in a loyalty program and access to an interest-free period tends to increase credit card use.

The substitution patterns between credit, debit and cash found in this paper are intriguing. While interest-free periods induce substitution to credit cards from debit cards, loyalty programs induce substitution from cash. We find that for a base case consumer, with average characteristics, loyalty programs increase the probability of credit card use by 21 percentage points and reduce the probability of cash use by 10 percentage points. Debit card use is relatively unaffected by whether or not a consumer has a loyalty program. A revolver consumer is around 19 percentage points more likely to use their debit card (and 15 percentage points less likely to use their credit card) for a transaction than a transactor consumer.

Where there is no financial cost to accessing the line of credit because there is an interest-free period, consumers tend to use a credit card instead of a debit card; where there is a cost, in the form of interest charges, consumers prefer to use a debit card. These estimates suggest that, even though in certain circumstances a revolver may need to use credit and can not substitute to a debit card due to lack of funds, in many cases the two instruments would seem to have a reasonable degree of substitutability. The interest-free period, however, has little significant effect on cash use, possibly because cash tends to be most commonly used for small-value transactions. Nonetheless, consumer preferences between cash and credit cards can apparently be significantly affected by relatively minor price changes, such as those provided by loyalty programs. For the probability of debit cards use though, we find that the loyalty program price incentive has little effect.

We also find that the magnitude of these results is such that they can help to explain aggregate trends. The estimates suggest that the introduction of loyalty programs can account for at least some of the rapid growth in credit card use observed in the second half of the 1990s. Even with our conservative assumptions, the results suggest that debit cards would have remained the dominant payment instrument over the past decade in the absence of the price effects from loyalty programs.

Regardless of the precise numerical effect, the results of this paper suggest that price incentives, and loyalty programs in particular, can be influential when it comes to consumer decisions about which payment instrument to use. Therefore, it seems reasonable to attribute at least part of the changes in payment patterns over recent years to the changed price incentives consumers face as a result of the Reserve Bank reforms.

Appendix A: Diary Study Fields

| Table A1: Fields in the Diary Survey | | |
|---|---|--|
| | Payments ^(a) | Cash withdrawals |
| Date | Yes | Yes |
| Transaction amount | Yes | Yes |
| Method | One of the following methods: 1. Cash 2. Debit card using a PIN 3. MasterCard/Visa debit card 4. MasterCard/Visa credit card 5. American Express/Diners Club card 6. Petrol/store card 7. Personal cheque 8. BPAY 9. Other | One of the following methods: 1. ATM 2. EFTPOS cash-out 3. Over-the-counter 4. Other |
| Channel | One of the following channels: 1. In person 2. Phone 3. Internet 4. Mail | Not applicable |
| Merchant type | One of the following merchant types: A – Supermarket B – Liquor store C – Small food store E – Other retailer F – Petrol/fuel for motor vehicles G – Transport H – Take-away/fast-food J – Restaurant/formal dining K – Pub/bar L – Sporting and entertainment (Leisure) M – Holiday travel/hotel accommodation N – Insurance P – Health/medical care R – Housing/utilities S – Education/childcare U – Professional service/home repair/home improvements Z - Other | Not applicable |
| Surcharge paid | Yes | Not applicable |
| Special trip | Not applicable | Yes/No |

(a) Participants were asked to report payments of bills as payments but were asked not to include any repayments of loans such as credit card repayments or mortgage instalments. Participants were asked to record only personal payments and exclude 'business' payments such as those made on behalf of an employer.

Appendix B: Results Tables – Use of Payment Methods

Table B1: Credit Card Use
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|---------------------------|-------------|-------------------------|------------------------|
| No Loyalty Program | -0.57*** | Loyalty Program | -21.0 |
| Revolver | -0.39*** | Transactor | -14.9 |
| Male | 0.29*** | Female | 11.3 |
| Hold scheme debit card | -0.36*** | No scheme debit card | -14.0 |
| Transaction (\$0-\$10) | -1.65*** | Transaction (\$51-\$60) | -43.0 |
| Transaction (\$11-\$20) | -0.71*** | Transaction (\$51-\$60) | -25.6 |
| Transaction (\$21-\$30) | -0.26*** | Transaction (\$51-\$60) | -10.0 |
| Transaction (\$31-\$40) | -0.08 | Transaction (\$51-\$60) | -3.0 |
| Transaction (\$41-\$50) | -0.10 | Transaction (\$51-\$60) | -4.1 |
| Transaction (\$61-\$70) | -0.07 | Transaction (\$51-\$60) | -2.8 |
| Transaction (\$71-\$80) | 0.11 | Transaction (\$51-\$60) | 4.5 |
| Transaction (\$81-\$90) | 0.04 | Transaction (\$51-\$60) | 1.6 |
| Transaction (\$91-\$100) | -0.08 | Transaction (\$51-\$60) | -3.1 |
| Transaction (\$101-\$110) | 0.34** | Transaction (\$51-\$60) | 13.6 |
| Transaction (\$111-\$120) | 0.38** | Transaction (\$51-\$60) | 15.1 |
| Transaction (\$121-\$130) | 0.14 | Transaction (\$51-\$60) | 5.7 |
| Transaction (\$131-\$140) | -0.19 | Transaction (\$51-\$60) | -7.4 |
| Transaction (\$141-\$150) | 0.01 | Transaction (\$51-\$60) | 0.3 |
| Transaction (\$151-\$160) | 0.41** | Transaction (\$51-\$60) | 16.1 |
| Transaction (\$161-\$170) | -0.06 | Transaction (\$51-\$60) | -2.3 |
| Transaction (\$171-\$180) | -0.05 | Transaction (\$51-\$60) | -1.8 |
| Transaction (\$181-\$190) | 0.60* | Transaction (\$51-\$60) | 22.9 |
| Transaction (\$191-\$200) | 0.08 | Transaction (\$51-\$60) | 3.1 |
| Transaction (\$201+) | 0.02 | Transaction (\$51-\$60) | 0.6 |
| Holiday/travel | 0.62*** | Retailer | 23.7 |
| Health/medical | 0.17* | Retailer | 6.7 |
| Liquor store | 0.10 | Retailer | 4.0 |
| Insurance | 0.07 | Retailer | 2.8 |
| Petrol | 0.06 | Retailer | 2.3 |
| Supermarket | -0.10 | Retailer | -4.0 |
| Transport | -0.23 | Retailer | -9.1 |
| Housing/utilities | -0.26 | Retailer | -10.2 |
| Restaurant | -0.41*** | Retailer | -15.7 |
| Other | -0.48*** | Retailer | -18.1 |
| Professional services | -0.50*** | Retailer | -18.9 |

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|----------------------|-------------|-----------|------------------------|
| Small food store | -0.52*** | Retailer | -19.6 |
| Sports/entertainment | -0.66*** | Retailer | -24.0 |
| Pub/bar | -0.74*** | Retailer | -26.4 |
| Take-away | -0.88*** | Retailer | -30.2 |
| Education/childcare | -0.94*** | Retailer | -31.6 |
| QLD | 0.03 | NSW | 1.2 |
| VIC | 0.07 | NSW | 2.6 |
| TAS | 0.28 | NSW | 11.2 |
| SA/NT | 0.43* | NSW | 16.7 |
| WA | 0.46** | NSW | 18.1 |
| Constant | -0.07 | | |

Number of observations = 8663

Prob > Chi2 = 0.0000

Pseudo R² = 0.27

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects evaluated at the base case.

Table B2: Debit Card Use
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|---------------------------|-------------|-------------------------|------------------------|
| No Loyalty Program | 0.14 | Loyalty Program | 4.1 |
| Revolver | 0.57*** | Transactor | 19.2 |
| Age (18 - 29 years) | 0.18 | Age (45-59 years) | 5.4 |
| Age (30 - 44 years) | 0.06 | Age (45-59 years) | 1.6 |
| Age (60+ years) | -0.25* | Age (45-59 years) | -6.1 |
| Transaction (\$0-\$10) | -1.26*** | Transaction (\$51-\$60) | -17.7 |
| Transaction (\$11-\$20) | -0.52*** | Transaction (\$51-\$60) | -11.1 |
| Transaction (\$21-\$30) | -0.28*** | Transaction (\$51-\$60) | -6.7 |
| Transaction (\$31-\$40) | -0.23** | Transaction (\$51-\$60) | -5.7 |
| Transaction (\$41-\$50) | 0.02 | Transaction (\$51-\$60) | 0.5 |
| Transaction (\$61-\$70) | 0.12 | Transaction (\$51-\$60) | 3.4 |
| Transaction (\$71-\$80) | -0.02 | Transaction (\$51-\$60) | -0.6 |
| Transaction (\$81-\$90) | 0.14 | Transaction (\$51-\$60) | 3.9 |
| Transaction (\$91-\$100) | 0.02 | Transaction (\$51-\$60) | 0.5 |
| Transaction (\$101-\$110) | -0.11 | Transaction (\$51-\$60) | -2.8 |
| Transaction (\$111-\$120) | -0.09 | Transaction (\$51-\$60) | -2.4 |
| Transaction (\$121-\$130) | -0.12 | Transaction (\$51-\$60) | -3.0 |
| Transaction (\$131-\$140) | 0.36 | Transaction (\$51-\$60) | 11.4 |
| Transaction (\$141-\$150) | 0.14 | Transaction (\$51-\$60) | 4.2 |
| Transaction (\$151-\$160) | -0.25 | Transaction (\$51-\$60) | -6.0 |
| Transaction (\$161-\$170) | 0.15 | Transaction (\$51-\$60) | 4.4 |
| Transaction (\$171-\$180) | 0.20 | Transaction (\$51-\$60) | 5.8 |
| Transaction (\$181-\$190) | 0.02 | Transaction (\$51-\$60) | 0.6 |
| Transaction (\$191-\$200) | 0.19 | Transaction (\$51-\$60) | 5.7 |
| Transaction (\$201+) | -0.19 | Transaction (\$51-\$60) | -4.7 |
| Holiday/travel | -0.30 | Retailer | -7.1 |
| Health/medical | -0.12 | Retailer | -3.1 |
| Liquor store | 0.06 | Retailer | 1.5 |
| Insurance | -0.50* | Retailer | -10.8 |
| Petrol | 0.15 | Retailer | 4.2 |
| Supermarket | 0.26*** | Retailer | 7.8 |
| Transport | -0.43*** | Retailer | -9.6 |
| Housing/utilities | -0.76*** | Retailer | -14.2 |
| Restaurant | -0.60*** | Retailer | -12.3 |
| Other | -0.62*** | Retailer | -12.5 |
| Professional services | -0.39** | Retailer | -8.9 |
| Small food store | -0.29** | Retailer | -6.8 |

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|--------------------------------|-------------|---------------------|------------------------|
| Sports/entertainment | -0.75*** | Retailer | -14.0 |
| Pub/bar | -0.97*** | Retailer | -16.0 |
| Take-away | -0.50*** | Retailer | -10.8 |
| Education/childcare | -0.89*** | Retailer | -15.4 |
| Income (<\$20 000) | -0.30** | \$40 000 - \$59 999 | -7.2 |
| Income (\$20 000 - \$39 999) | -0.04 | \$40 000 - \$59 999 | -1.2 |
| Income (\$60 000 - \$79 999) | -0.15 | \$40 000 - \$59 999 | -3.7 |
| Income (\$80 000 - \$99 999) | -0.39* | \$40 000 - \$59 999 | -8.8 |
| Income (\$100 000 - \$119 999) | -0.74** | \$40 000 - \$59 999 | -13.9 |
| Personal Income (\$120 000+) | -0.26 | \$40 000 - \$59 999 | -6.3 |
| QLD | 0.24* | NSW | 7.2 |
| VIC | 0.43*** | NSW | 14.0 |
| TAS | 0.13 | NSW | 3.9 |
| SA/NT | -0.12 | NSW | -3.1 |
| WA | 0.04 | NSW | 1.0 |
| Constant | -0.86*** | | |

Number of observations = 8663

Prob > Chi2 = 0.0000

Pseudo R² = 0.22

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects evaluated at the base case.

Table B3: Cash Use
By credit card holders

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|---------------------------|-------------|-------------------------|------------------------|
| No Loyalty Program | 0.29*** | Loyalty Program | 10.4 |
| Revolver | -0.06 | Transactor | -1.9 |
| Hold scheme debit card | -0.16* | No scheme debit card | -5.1 |
| Age (18 - 29 years) | -0.32** | Age (45-59 years) | -9.3 |
| Age (30 - 44 years) | -0.13 | Age (45-59 years) | -4.1 |
| Age (60+ years) | 0.21** | Age (45-59 years) | 7.2 |
| Transaction (\$0-\$10) | 1.98*** | Transaction (\$51-\$60) | 64.5 |
| Transaction (\$11-\$20) | 1.04*** | Transaction (\$51-\$60) | 39.3 |
| Transaction (\$21-\$30) | 0.52*** | Transaction (\$51-\$60) | 19.4 |
| Transaction (\$31-\$40) | 0.32*** | Transaction (\$51-\$60) | 11.3 |
| Transaction (\$41-\$50) | 0.12 | Transaction (\$51-\$60) | 4.2 |
| Transaction (\$61-\$70) | -0.18 | Transaction (\$51-\$60) | -5.6 |
| Transaction (\$71-\$80) | -0.11 | Transaction (\$51-\$60) | -3.5 |
| Transaction (\$81-\$90) | -0.29** | Transaction (\$51-\$60) | -8.5 |
| Transaction (\$91-\$100) | -0.07 | Transaction (\$51-\$60) | -2.2 |
| Transaction (\$101-\$110) | -0.33 | Transaction (\$51-\$60) | -9.7 |
| Transaction (\$111-\$120) | -0.35* | Transaction (\$51-\$60) | -10.2 |
| Transaction (\$121-\$130) | -0.03 | Transaction (\$51-\$60) | -1.0 |
| Transaction (\$131-\$140) | -0.23 | Transaction (\$51-\$60) | -7.0 |
| Transaction (\$141-\$150) | 0.06 | Transaction (\$51-\$60) | 2.1 |
| Transaction (\$151-\$160) | -0.53** | Transaction (\$51-\$60) | -14.3 |
| Transaction (\$161-\$170) | -0.07 | Transaction (\$51-\$60) | -2.3 |
| Transaction (\$171-\$180) | -0.18 | Transaction (\$51-\$60) | -5.5 |
| Transaction (\$181-\$190) | -0.56 | Transaction (\$51-\$60) | -14.9 |
| Transaction (\$191-\$200) | -0.54* | Transaction (\$51-\$60) | -14.6 |
| Transaction (\$201+) | -0.32*** | Transaction (\$51-\$60) | -9.4 |
| Holiday/travel | -0.35* | Retailer | -10.2 |
| Health/medical | -0.22** | Retailer | -6.6 |
| Liquor store | -0.15 | Retailer | -4.6 |
| Insurance | -0.64* | Retailer | -16.5 |
| Petrol | -0.29*** | Retailer | -8.6 |
| Supermarket | -0.03 | Retailer | -1.1 |
| Transport | 0.43*** | Retailer | 15.5 |
| Housing/utilities | -0.26* | Retailer | -7.8 |
| Restaurant | 0.72*** | Retailer | 27.4 |
| Other | 0.13 | Retailer | 4.6 |
| Professional services | 0.23 | Retailer | 7.9 |

| Variable | Coefficient | Base case | Marginal effect (ppts) |
|----------------------|-------------|-----------|------------------------|
| Small food store | 0.58*** | Retailer | 21.8 |
| Sports/entertainment | 0.85*** | Retailer | 32.4 |
| Pub/bar | 1.12*** | Retailer | 42.3 |
| Take-away | 0.87*** | Retailer | 33.2 |
| Education/childcare | 0.79*** | Retailer | 30.0 |
| Constant | -0.62*** | Retailer | |

Number of observations = 8663

Prob > Chi2 = 0.0000

Pseudo R² = 0.37

Note: ***, ** and * denote the 1, 5 and 10 per cent levels of significance respectively. Marginal effects evaluated at the base case.

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