A genuine commercial justification for interchange fees

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1. Introduction[1]

Ronald Coase famously argued that "if an economist finds something – a business practice of one sort or other – that he does not understand, he looks for a monopoly explanation".[2] So it is with credit card interchange fees. Intellectual confusion has led to the phenomenon of interchange fees being misdiagnosed as being a monopoly problem leading to inappropriate policy intervention. Following George Stigler's path breaking analysis of the US Security and Exchange Commission he claimed that financial regulation was "founded upon prejudice and … reforms are directed by wishfulness".[3] In our opinion, Australian regulatory attitudes towards interchange fees should be placed into the same category: reforms initiated by ignorance and anti-bank prejudice.

Previously regulatory concerns have related to allegations of excessive pricing, price fixing, abuse of market power, the creation of barriers to entry, increased consumers prices generally, and excessive use of credit cards relative to alternate payment methods. Consequently Australian regulators have imagined that regulatory intervention can easily correct these apparent market flaws and result in improve economic performance.

It now seems that the Productivity Commission has a somewhat different view.[4]

> Regulation of bank interchange fees and surcharging has proved complex and there is little genuine commercial justification for interchange fees.

We suggest that if regulators do not understand the function and role of bank interchange fees that it is unsurprising that regulation has proved to be "complex". This lack of understanding, we believe, has led to the Productivity Commission's rather radical proposal:

> The Payments System Board of the RBA should ban, by mid-2019, all card interchange fees as a way to lower overall costs to users.

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[1] This submission draws extensively from Davidson and Potts (2015), and Berg, Davidson and Potts (forthcoming).

[2] Coase, 1972 [1988], pg. 67.

[3] Stigler, 1964, pg. 142.

[4] Productivity Commission, 2018, pg. 26.

The remainder of the paper is set out as follows. In section 2 we explain what an interchange fee is and in section 3 we demonstrate that it does have a "genuine commercial justification". A conclusion follows.

2. What is an interchange fee?

Interchange fees are fees that banks charge each other as a result of their respective clients entering into a credit card transaction. Neoclassical economists describe this type of arrangement as being a "two-sided" market. Two-sided markets consist of two sets of end-users who have their needs met simultaneously. In the case of credit cards the two sets of users include consumers who use the credit (card holders) and merchants who accept the card. The card itself is useless if either consumers will not use the card, or merchants will not accept the card in payment. Credit card companies, or associations, have a joint maximisation problem: maximising the number of consumers who will use the card, and maximising the number of merchants that will accept the card. The incentives facing consumers and merchants being somewhat different Hayashi and Weiner argue that the interchange fee is "an instrument that networks can use to achieve a desired balance of cardholder usage versus merchant acceptance across the two sides of the market … In other words, interchange fees are a mechanism that can be used to transfer revenues from one side of the market to the other to generate the desired level of card activity."[5]

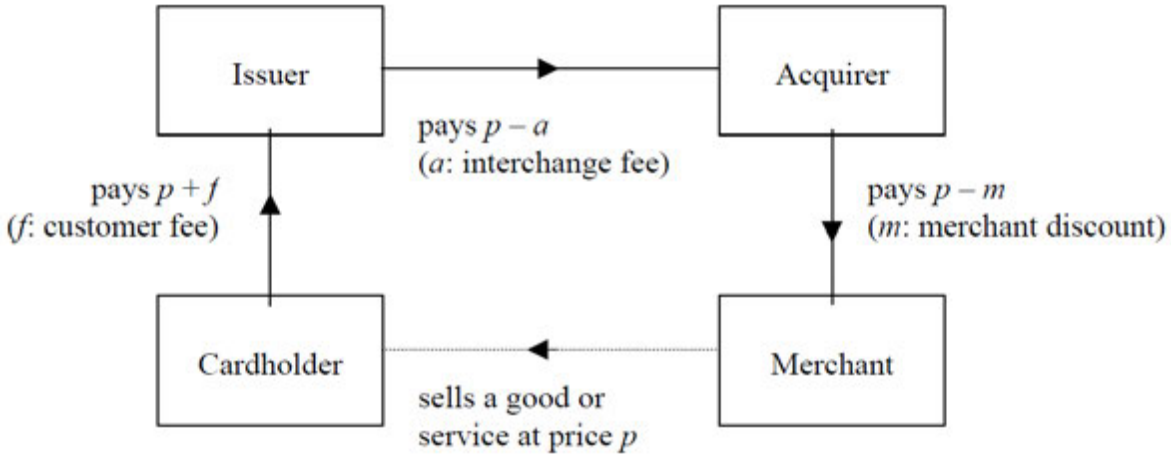
In most credit card systems the interchange fee flows from the merchant side of the transaction towards the consumer side of the transaction.[6] This implies that in some economies consumers require more of an inducement to hold and use credit cards than merchants need to accept those cards. To argue that this relationship is somehow inefficient is to argue that consumers have monopoly power over merchants. While it is true that merchants are subject to consumer sovereignty few economists, or policy makers, would argue that consumers have monopoly power over merchants, or if they did that this monopoly power should be restrained.

To illustrate the argument consider Rochet and Tirole's exposition of interchange fees that we reproduce in figure 1.

[5] Hayashi and Weiner, 2006, 76 – 77.

[6] This is not always the case. In some markets the interchange fee has gone from the consumer side of the transaction to the merchant side, and in some economies the interchange fee is zero.

Figure 1: Rochet and Tirole depiction of an interchange fee



Source: Rochet and Tirole (2003: 74)

This depiction shows the net cash flows in the various relationships. The consumer (cardholder) buys goods and services from the merchant. The consumer then pays the price (p) and a net fee to his financial institution. The consumer's financial institution then pays the price (p) less the interchange fee (a) to the merchant's financial institution who then pays the merchant the price (p) less their own net fee. This depiction of the issue makes very plain that if both financial institutions are to remain profitable that m > a. *The merchant pays the interchange fee.* This prediction is counter to the claims made by Australian regulators, and now the Productivity Commission.[7]

> These are, in turn, paid by consumers either as surcharges on particular purchases or more commonly in the case of smaller merchants, as higher prices overall.

It is misleading to suggest that consumers pay for the interchange fee as a surcharge – it is only government intervention and regulation that has facilitated and permitted surcharging. Credit card companies historically maintained so-called "no-surcharge" rules. More importantly, however, the notion that credit card usage would result in higher consumer prices has never been demonstrated. To the contrary, the banning of a no-surcharge rule has led to increased consumer prices for consumers using their credit cards, and has not led to decreased consumer prices for consumers paying cash. In 2015, the Reserve Bank of Australia was forced to admit:[8]

> It is **impossible** – given the imprecision in any econometric model of consumer price inflation – **to measure exactly** how these reductions in merchant service fees have flowed through into prices for consumers.

[7] Productivity Commission, 2018, pg. 26.
[8] RBA, 2015, pg. 23 (emphasis added).

Of course, it is not surprising that retailers have led the charge to reduce interchange fees. The interchange fee exists to rebalance the relationships within the two-sided market. In a competitive market for financial services, the interchange fee would be used to reduce the net consumer fee for credit cards. Interchange fees are a cost of doing business and reduces profitability. The subsequent regulation of the market is then well explained by the 1981 economics laureate George Stigler's theory of regulatory capture. Australian regulators have facilitated rent-seeking by Australian business to the detriment of Australian consumers.

3. The institutional economics of interchange fees

The credit payments system is not, and cannot ever be, an interlinked series of anonymous spot markets exchanging financial commodities because the information asymmetries and moral hazards inherent in these exchanges require the parties to the transactions to make idiosyncratic investments (also known as asset specificity) that bind them into a bilateral monopoly – i.e. the fundamental transformation[9] – in which quasi-rents are only secured through mechanisms to inhibit opportunism by aligning incentives to long term relational contracting.[10]

The interchange fee, we argue, has evolved as an efficient governance mechanism to achieve this outcome without requiring horizontal integration (itself a controversial aspect of financial institution regulation) – i.e. collapsing the four party payments system into a three-party payments system, and the associated losses of technical and information efficiency and competition that would imply. Banks need to make transaction specific investments in acquiring information about the properties of customers and merchants, the value of which – the quasi-rent – is realised through a long term relationship.

In a simple model of economic coordination, all exchanges take place in spot markets between firms (which in this model are hierarchical organizations whose boundaries are determined by the technology of production). In such a world, payments networks and consumer finance would be modelled as a natural monopoly (because of scale economies and network effects) such that the most efficient form of economic organization would be a single monopoly firm – call it The Bank. All consumers and all merchants would be customers of The Bank. The Bank would levy a fee across consumers and merchants, but the incidence of which would ultimately fall on consumers either directly or through higher prices as a function of the substitution margin with cash. An interchange fee would simply be an internal aspect of the firm's cost accounting. The total price The Bank charges would likely be regulated.

But under competition in retail payments networks, consumer banking and finance, and merchant banking we expect there will be multiple banks and that the boundaries of banks and

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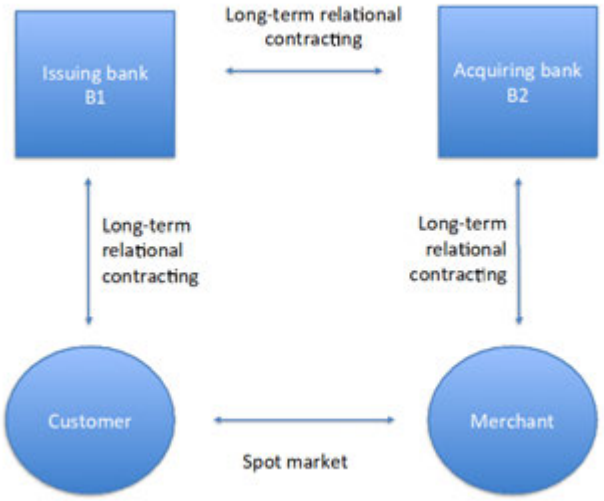
[9] The 2009 economics laureate Oliver Williamson (1973, 1975, 1979, 1983, 1985) has extensively investigated the "fundamental transformation" that occurs in consequence of transactions that require both parties to make idiosyncratic investments – transforming ex ante competition into an ex post bilateral monopoly – that can subsequently give rise to opportunism.

[10] Klein et al (1978), pg. 289 – 307.

financial services firms will depend upon specialization, competences and capabilities, often tied to specific assets (including reputational assets and context specific knowledge). This will be governed in large part by long term relational contracts between agents and firms, such as between customers and a bank, both consumers and merchants, and between firms within the banking and payments network. Indeed, for the most part the only spot contracts in this system of economic coordination are the exchanges of goods and services for money between consumers and merchants.

Figure 2 re-imagines figure 1 from a contractual governance perspective.

Figure 2: Interchange fee in a governance framework



Source: Davidson & Potts 2015

The argument we make (expanding on Chang and Evans 2000) is that the interchange fee, as it has emerged and developed around the world over many decades, is an efficient governance outcome in a largely private ordering of mostly long term relational contracting between consumers, issuing banks, acquiring banks and merchants, all operating in the context of uncertainty, opportunism and asset specificity (Williamson 1985). See the Appendix for a detailed explanation.

There are two specific aspects that we seek to highlight, both of which point to the fact that these are non-standard exchanges, and that the particular institutional and contractual features of the overall economic organization that depart from an Arrow-Debreu zero-transaction cost and complete markets model – i.e. the interchange fee – most likely reflects efficient contractual governance adaptations to these particular aspects of the exchange situation.

(1) The four-party exchange involves different types of contractual relationships, only one of which (between customer and merchant) is typically a spot-market transaction. The other

three that have banks at one or more ends are typically long-term relational contracts. These involve complex contractual agreements that trade-off risks from uncertainty, opportunism, and asset specificity. The conditions of the spot market will be considerably shaped by the agreements made in the other three long run relational contract markets.

(2) The default payments model is assumed to be cash, which is *assumed to be costless* as a two-party-exchange between consumer and merchant. The four-party credit exchange relation is assumed to be more costly because of the additional services offered in the interbank payments and processing network that benefit both consumers (by extending finance) and merchants (by facilitating payments, screening credit-worthiness, covering credit risk). Both consumers and merchants benefit from these services and are willing to pay for these services. However, cash is also costly to both consumers and merchants (carry cost, risk, opportunity cost) and thus both will be willing to pay to use an alternative payments technology that mitigates these costs. Yet in a pure exchange spot market, merchants will only accept cash because to extend credit requires them to assume the costs of screening or of a long-term relationship that exposes them to consumer opportunism. By leveraging off the long-term relations established in the interbank payments networks, however, merchants can become indifferent at some fee margin between cash and credit transactions in the spot market, thus maximizing the overall transaction value by accepting all bids.

Our central argument then, as informed by transaction cost economics and the New Institutional theory of the firm (Williamson 2002), is that the various structures of fees that we observe in the long-term relation contracts that banks intermediate are most likely to represent an efficient bargaining outcome to arrive at stable long term relational contracts, given the various risks associated with opportunism and asset specificity, and are therefore not prima facie evidence of monopoly rent extraction.

The spot market between consumer and merchant is likely to be efficient when effective governance institutions in the long-term credit networks and payments systems emerge. These are facilitated by the inter-banking system, at the core of which is the interchange fee.

In consequence, regulatory attempts to treat these fees as if they were the result of collusive rent-extraction by seeking to constrain them within a price ceiling can risk harming an otherwise efficient system of institutional adaptation through long-run relational contracting to specific governance problems associated with uncertainty and transactions costs in the supply of consumer finance and payments systems (Balto 2000, Chang and Evans 2000).

4. Summary and analytic conclusions

Interchange fees are not a problem of monopoly exploitation, but rather their genuine commercial justification arises as an efficient solution to an unavoidable bilateral monopoly that arises because banks need to form long term relations with customers and merchants – what are in

effect irreversible investments that pay off only if the relationship continues – and which are therefore vulnerable to opportunism.

We make a specific theoretical claim as to the genuine commercial benefit of interchange fees. This claim hinges on recognizing that the governance structure of the card payments system is composed of mostly long run relational contracts. The interchange fee equilibrates the issuing (B1) and acquiring (B2) sides of payment cards systems. A fee setting association of banks is not evidence of collusive monopoly, but of minimizing transactions costs across the network in achieving economic coordination between all transacting parties. Failure to recognise this point now leads regulators and the Productivity Commission to label interchange fee regulation as being "complex". In fact, constraints placed on internal bargaining and side-payments – i.e. an interchange fee ceiling – have caused less efficient outcomes, resulting in higher fees to consumers, and an unnecessary loss of social welfare.

A further implication is that interchange fees also enable an efficient network governance structure based around relational contracting that it avoids horizontal integration between issuing and acquiring banks, maintaining incentive intensity and minimizing administrative monitoring burden arising from information impactedness.

Appendix: Williamsonian economics and interchange fees

Figure 2 indicates that of the four types of transactions relations between consumers (C), issuing banks (B1), acquiring banks (B2), and merchants (M), three of those relations (C-B1; B1-B2; B2-M) will usually be governed by long-term relational contracting, and with only C-M being a spot market transaction. Why is this?

First, why are they not all spot contracts? Specifically, why are C-B1 and B2-M typically long-run relational contracts rather than spot contracts?

One, they are engaged in multiple repeated transactions, and minimizing transactions costs associated with processing scale economies are achieved through bundling transactions through a single supplier. This incentivizes B1 to form a long-term contract with C.

Two, there is asymmetric information about creditworthiness of C that accumulates through repeated transactions, and which then enables a cumulatively better offer to be made to C as their true risk is cumulatively revealed, which then incentivizes C (if their 'true type' is low risk) to form a long-term contract with B1. This moral hazard problem of constraining C to good behaviour is enforced with threat of expulsion from the contract by B1, which would then take them back to a higher rate with a new issuing bank that had not accumulated information about the credit properties of C.

This in turn works as an effective screening mechanism by B1 on C, because only a high quality C will accept the conditions of a long-term contract, which will be valuable to C and profitable to B1, only if C can be effectively constrained from opportunistic behaviour.

Three, the same arguments apply between B2 and M, where B2 accumulates information about the transaction volume of M and their propensity to accept fraudulent sales (which require chargebacks). This information is a specialized asset that is profitable to B2 (and B1) if they can constrain opportunism by M (and C). The long-term relational contract, and the credible threat of expulsion from that contract, is an efficient governance mechanism to organize economic coordination in the context of the threat of opportunism and information asymmetry.

Four, incomplete relational contracts enable many specific contingencies to be dealt with by negotiation between the parties under the threat of exit, with the ensuing costs that imposes. These are a private ordering that may have final recourse to courts, but will often be most efficiently handled through direct bargaining under credible commitments and threats through the various hostages (threat of default versus threat to harm credit score) that each side has offered the other (Williamson 1983).

Five, long-term contracts may arise because of differential risk preferences between consumers, merchants and banks, which banks being systematically risk neutral and consumers and merchants being risk adverse.

Second, why is B1-B2 a relational contract, rather than either a spot exchange or horizontally integrated within a single firm (see Williamson 1985: ch6)?

A single bank – integrating B1 and B2 within a single firm – might be technologically efficient, but would be informationally inefficient, would be exposed to greater risk of shirking behaviour because of information impactedness and costly monitoring, and would be exposed to opportunism in internal pricing transfers. Because retail consumers and merchants are highly heterogeneous and geographically distributed, specialized skills and investments are required in assessing quality (i.e. true type) and in delivering services. Banks will therefore tend to specialise under competition in order to economise on information. Long-run relational contracts then reconnect this into a payments network under high-powered incentives. In general this can be observed in the relative market success of open payments networks over closed payments networks.

Long-term relation contracting is efficient because banks take different sides of many transactions, giving rise to threat of exploitation through non-cooperative play. However, opportunism is disciplined only by threat of retaliation. Furthermore, repeated transactions enable learning and synchronising of processes and transaction routines in order to generate an efficient payments system, all without loss of high-powered incentives if the transactions were integrated into a single firm.

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AUSTRALIAN INTERCHANGE FEE REGULATION

a regulation in search of market failure

About the Authors

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Executive Summary

The Reserve Bank of Australia has been a world leader in interchange fee regulation. In this paper we suggest that this regulatory intervention has been based on wishful thinking at best and represents a failure to understand the actual working of the market economy.

In short, the Reserve Bank of Australia engaged in an extensive regulatory intervention based on poor theory, and no empirical evidence. Theory has not provided an unambiguous indication of market failure, and there is no empirical evidence to support the notion of monopoly pricing – other than a vague notion that interchange fees were "excessive". What the Reserve Bank identified as being "externality" any fair minded observer would label "gains from trade".

We argue that interchange fees are the outcome of an efficient bargaining process given that banks and consumers, and banks and merchants form long term relationships with each other. For as long as there is competition in the banking sector and competition in the retail sector, the interchange fee itself is subject to competitive pressure.

There is no market failure and no economic justification for government intervention. The $13 billion "saving" to merchants that the Reserve Bank identifies following its regulatory reform is simply a redistribution away from consumers (and banks) towards merchants. The Reserve Bank assumes that the saving has been passed onto consumers, but cannot provide any evidence to support that hypothesis.

It is not at all clear that consumers have benefited from interchange fee regulation. To the contrary is likely that consumers are worse off – while merchant fees have declined, so too have the benefits of using credits while the costs (including the interest rate premium over the cash) have increased.

1. Introduction

Ronald Coase famously argued that "if an economist finds something – a business practice of one sort or other – that he does not understand, he looks for a monopoly explanation".[1] So it is with credit card interchange fees. As we will demonstrate intellectual confusion has lead to the phenomenon of interchange fees being misdiagnosed as being a monopoly problem leading to inappropriate policy intervention. Following George Stigler's path breaking analysis of the US Security and Exchange Commission he claimed that financial regulation was "founded upon prejudice and … reforms are directed by wishfulness".[2] In our opinion, Australian regulation of interchange fees should be placed into the same category: reforms initiated by ignorance and anti-bank prejudice.

A 2000 joint study by the Reserve Bank and Australian Consumer and Competition Commission concluded *inter alia*:[3, 4]

II Credit card interchange fees are significantly above levels suggested by cost-based methodologies and contribute to margins of revenues over average costs of around 39 per cent for card issuers. …

IV 'No surcharge' rules in credit card schemes prevent purchasers from confronting the cost of this payment instrument vis-à-vis lower cost payment instruments such as debit cards. It means that other consumers subsidise credit cardholders and financial institutions which are card scheme members. An alternative arrangement would have merchants exercising discretion to charge customers prices that are net of the cost of the payment instrument, and add a surcharge to cover that cost.

V Competition in credit card issuing and acquiring is limited by restrictions on access to credit card schemes. Excluding all institutions other than authorised deposit-takers from access to acquiring, in particular, is difficult to justify on risk grounds.

…

Interchange fees are set by card issuers and acquirers at 'one step removed' from the cardholders and merchants who ultimately bear these fees through transaction charges or through the general cost of goods and services. Users therefore do not have a direct influence on the pricing of card payment services but must rely on their financial institutions to represent their interests. As a consequence, the price signals and competitive responses that would be expected to put pressure on margins in card payment networks have not worked effectively. These difficulties are reinforced by restrictions on access to the card networks, both explicit and informal, and by the 'no surcharge' rules in credit card schemes.

The regulatory concerns then relate to excessive pricing, price fixing, abuse of market power, the creation of barriers to entry, increased consumers prices generally, and excessive use of credit cards relative to alternate payment methods. The fact that end-users do not observe the interchange fee

[1] Coase, 1972 [1988], pg. 67.
[2] Stigler, 1964, pg. 142.
[3] Reserve Bank and Australian Consumer and Competition Commission, 2000, pg. 73 – 74.
[4] Hereinafter RBA – ACCC.

makes it opaque, and less prone to competitive pressure. All these arguments suggest that regulatory intervention can easily correct these apparent market flaws and result in improve economic performance.

As a result of these concerns and the apparent ease at which corrective action could be undertaken Australia embarked on a program of regulatory intervention. In this paper, we argue that the regulatory concerns were over-sold and rely on a faulty understanding of the underlying economic principles. There is no case for intervention.

The remainder of the paper is set out as follows. In section 2 we explain what an interchange fee is. In section three we critique the Australian arguments for regulatory intervention and show data as to consequences of that intervention. In section 4 we provide alternative, non-monopoly but efficiency enhancing, explanations for interchange fees.

2. What is an interchange fee?

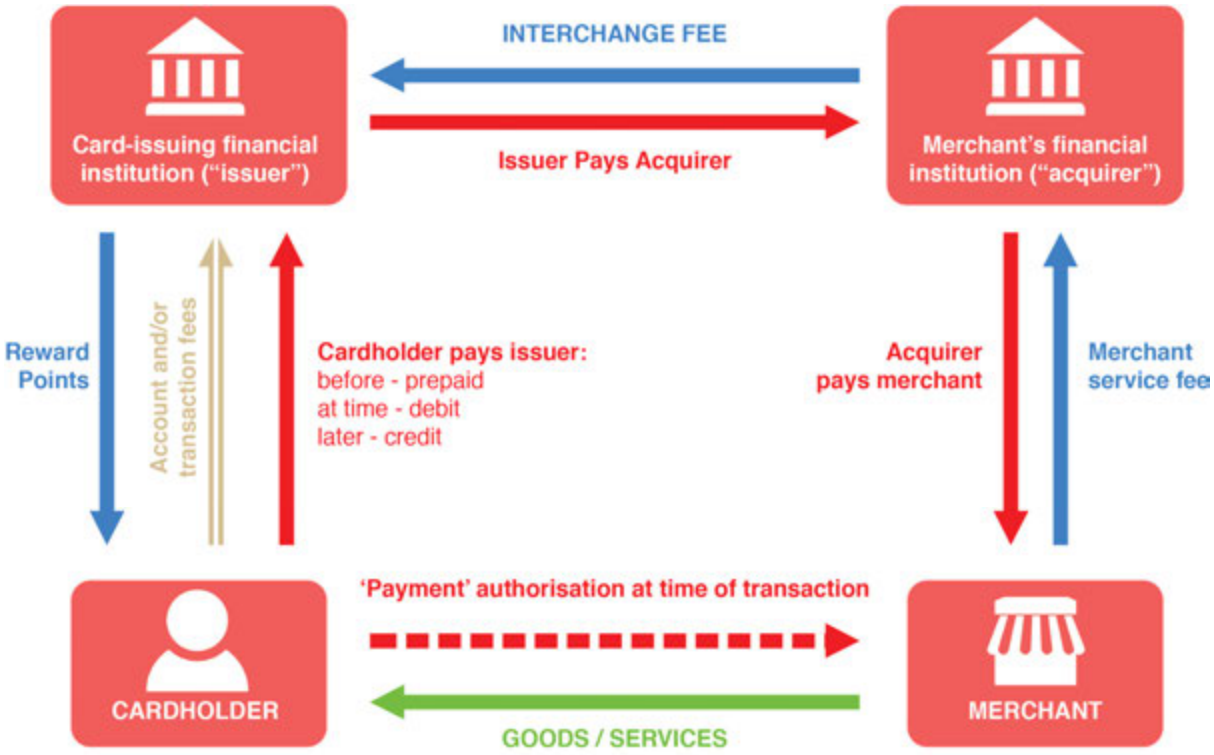
Interchange fees are fees that banks charge each other as a result of their respective clients entering into a credit card transaction. Figure 1 below shows how the Reserve Bank of Australia depicts an interchange fee. The figure shows a stylised (four-party system) example of transactions involving a credit card.

The consumer (cardholder) purchases goods and services from a merchant and pays for the goods and service using a credit card. Underpinning that particular transaction is two prior transactions and a long-term relationship. The first prior transaction is between the consumer and their own financial institution whereby they acquire a credit card and pay a fee for the credit card use. As part of that transaction the consumer may or may not earn reward points as a function of the credit card usage. The second prior transaction is between the merchant and their financial institution whereby the merchant pays a fee to their financial institution in order to process credit card payments. The long-term relationship is between the two financial institutions that provide financial services to the consumer and merchant.

When the merchant sells goods and services to the consumer, the consumer authorises his financial institution to pay a sum of money to the merchant. The merchant passes the authorisation to his financial institution which then collects the money from the consumer's financial institution and pays the merchant. Finally the consumer's financial institution gets paid once the consumer pays off their outstanding credit card balance.[5]

[5] What is missing from the Reserve Bank explanation is that the consumer's bank as extended credit to the consumer while immediately paying the merchant's bank. The risk of non-payment is borne by the consumer's bank.

Figure 1: RBA depiction of an interchange fee



Source: RBA 2015, pg. 6

The interchange fee is a fee paid by the merchant's bank to the consumer's bank.

Neoclassical economists describe this type of arrangement as being a "two-sided" market. Two-sided markets consist of two sets of end-users who have their needs met simultaneously. In this case the credit card example the two sets of users include consumers who use the credit (card holders) and merchants who accept the card. The card itself is useless if either consumers will not use the card, or merchants will not accept the card in payment. Credit card companies, or associations, have a joint maximisation problem: maximising the number of consumers who will use the card and maximising the number of merchants that will accept the card. The incentives facing consumers and merchants being somewhat different Hayashi and Weiner argue that the interchange fee "an instrument that networks can use to achieve a desired balance of cardholder usage versus merchant acceptance across the two sides of the market … In other words, interchange fees are a mechanism that can be used to transfer revenues from one side of the market to the other to generate the desired level of card activity."

There are two issues of importance.

- The direction the interchange fee flows in.
- The magnitude of the interchange fee.

In most credit card systems the interchange fee flows from the merchant side of the transaction towards the consumer side of the transaction.[6] This implies that in some economies consumers require more of an inducement to hold and use credit cards than merchants need to accept those cards. To argue that this relationship is somehow inefficient is to argue that consumers have monopoly power over merchants. While it is true that merchants are subject to consumer sovereignty few economists, or policy makers, would argue that consumers have monopoly power over merchants, or if they did that this monopoly power should be restrained.

There is a rich *academic theoretical* literature that considers the magnitude of the interchange fee. In their 2006 survey paper, Hayashi and Weiner categorise the theoretical literature into one of four categories.

1. Assumptions about the (credit card) networks. Are the networks themselves competitive, or monopolies?
2. Assumptions about financial institutions. Are financial institutions competitive or monopolies?
3. Assumptions about consumers and merchants. Do merchants have monopoly power? Do consumers have single cards or multiple cards?
4. Other factors that might be important. What network rules are in place? No-surcharge rules? Honour all card rules?

Recall that the regulatory concern relating to credit card interchange fees is that the fees themselves were opaque, excessive, and encouraged excessive usage of credit cards relative to other payments mechanisms.

With a rich theoretical literature, including contributions from the 2014 economics laureate Jean Tirole, we might expect that clear unambiguous theoretical results could inform real world observations and shed light on the need, if any, for regulatory intervention. That, however, is not the case. For example, Katz (2001) reports that monopolistic networks with no-surcharge rules and reward points will result in excessive credit card use. That result appears to be consistent with the regulatory concerns. But credit card networks are not monopolistic. Studies that assume competitive networks have conflicting results. Rochet and Tirole (2002) show that if networks are competitive and consumers hold more than one card that interchange fees are not affected. But if consumers do not hold more than one card that merchants reduce acceptance of cards and interchange fees fall. In the same paper, however, they also show that even if networks are monopolistic as long as financial institutions are competitive (in issuing credit cards) that interchange fees will fall. Several other papers show similar mixed results. Interchange fees may either be higher or lower depending on the assumptions made in the analysis.

Importantly for our purposes, changing assumptions about network rules such as the no-surcharge rule or honour all cards rule has differing results. Again interchange fees could be higher or lower depends on a host of other factors or assumptions being made in the analysis.

[6] This is not always the case. In some markets the interchange fee has gone from the consumer side of the transaction to the merchant side, and in some economies the interchange fee is zero.

After an extensive survey of the literature Hayashi and Weiner conclude:[7]

What one comes away with after surveying this rich theoretical literature is an appreciation for the many factors that may affect interchange fees. Even a single factor may impact interchange fees differently, depending on other factors. Determining the actual impact of such variables is, in the end, an empirical question.

What that implies is that the theoretical results are not robust to changes in the underlying assumptions in the modelling. The 1990 economics laureate Merton Miller has claimed that there is nothing more practical than good theory. By that benchmark the theoretical analysis of interchange fees is simply not good theory as it give no practical guidance to what we might expect to observe in the real world.

In a 2003 paper Rochet and Tirole had come to the same conclusion, summarising the theoretical academic literature as follows:[8]

On the contrary, recent academic work concurs to establishing that there is no systematic bias in the IFs selected by cooperative networks: there is no reason to think that privately optimal IFs are higher or lower than socially optimal ones. Misunderstanding the economics of the problem and imposing cost-based regulation could impose substantial distortions in the industry.

They are even more damning that Hayashi and Weiner. Rochet and Tirole claim, quite correctly as we will argue below, that the very nature of the economic problem at hand has been misunderstood.

3. The Australian literature

Rochet and Tirole establish the basis for public intervention in markets as being a two-fold process:[9]

> The standard approach to public intervention in industries involves two steps:
>
> (1) the theoretical identification of a serious market failure and the validation of its empirical relevance,
>
> (2) the identification of the least distortionary way of addressing the market failure and a check that the remedy will not be worse than the illness.

As we have shown above, the very first step of that process has not been achieved. There is no theoretical basis for regulation of interchange fees. Rochet and Tirole are clear – the problem is a misunderstanding of the economics. In this section we highlight those misunderstandings in the Australian literature.

[7] Hayashi and Weiner, 2006, pg. 88.
[8] Rochet and Tirole, 2003, pg. 71.
[9] Rochet and Tirole, 2003, pg. 70.

The Australian literature on interchange fees consists of a joint report by the RBA – ACCC, a series of papers by Joshua Gans and Stephen King[10], and a more recent 2015 Reserve Bank of Australia Issues paper. In this section, we mostly focus our attention on the work undertaken by the Reserve Bank.

The RBA – ACCC report provides a description of credit card networks as per figure 1. It then describes how networks provide benefits to users (both consumers and merchants) as they increase in size i.e. more consumers hold a particular card and/or more merchants accept that particular card. Rather than considering an increase in network size as an increase in the size of the market and therefore any benefits flowing from that increase as being the gains from trade, the RBA – ACCC report instead views the benefits as being an externality.[11] This, in our opinion, constitutes a methodological error. Gains from trade constitute a benefit of the market mechanism, while externalities arise from market failure.

In this particular case the argument is that a network can generate positive externalities for users (suggesting that it should increase in size), but negative externalities for non-users (suggesting that networks can become too big). This possibility occurs if and when the merchant has monopoly power and can pass their service fees (including the interchange fee, see figure 2 below) onto consumers. At this point the interchange fee could be increased and result in greater private benefits to cardholders but higher prices to non-card holders. Given a somewhat non-standard definition of efficiency, "A payment network is said to operate efficiently if the net benefits it provides to society are being maximised", the RBA – ACCC study is able to argue that credit card networks may be too large in Australia. [12] Definitions of efficiency would normally suggest that an institution or process was meeting stated objectives at least possible cost. The argument here results in the proposition that increased competition to expand the network could result in increasing prices if merchants have some monopoly power.

The problem being exacerbated, the RBA – ACCC claim, by the fact that cardholders and merchants "are not involved in determining the interchange fee".[13] As we argue below, that statement is not strictly speaking true. It is correct to say that the interchange fee is not established in a spot market, but to argue that cardholders and merchants are not involved in overall price determination in a network is simply incorrect.

Nonetheless in the early 2000s Australia embarked on a series of regulatory interventions. The Reserve Bank of Australia announced its intention to introduce a series of reforms in August 2002. See table 1 for a time-line of reforms.[14]

Hayashi and Weiner are blunt in their assessment of the literature and regulation in Australia: "None of the models appears to closely fir the Australian market over a large number of parameters".[15] In other words there is no theoretical basis to support the introduction of regulation in Australia.

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[10] Gans and King, 2001, 2002, 2003a, 2003b, 2003c.
[11] RBA – ACCC, 2000, pg. 24.
[12] RBA – ACCC, 2000, pg. 27.
[13] RBA – ACCC, 2000, pg. 28.
[14] In this paper we are primarily interested in credit card interchange fees, but include other reforms for completeness.
[15] Hayashi and Weiner, 2006, pg. 100.

Table 1: A time line of payment reforms

Date	Reform
October 200	Joint RBA – ACCC study published
December 2001	RBA consultation document released
August 2002	Intention to reform announced
January 2003	No Surcharge Rule eliminated
July 2003	Interchange fees capped
January 2004	Access regime modified
February 2004	Debit card reform (Visa)
September 2004	Debit card reform (MasterCard)
April 2006	Debit card reforms announced
July 2006	Debit card reforms implemented
November 2006	Common cost-based Interchange fee Benchmark introduced
January 2007	Honour all card rule abolished

Source: Authors, RBA 2015

Two Australian academics, Joshua Gans (now at Toronto University) and Stephen King (now at Monash University) have published a series of theoretical papers looking at interchange fees and regulatory concerns in credit card markets. It is fair to say that their views, while in favour of regulation, are nuanced. Overall their view is that the no-surcharge rule should be eliminated and as a result the interchange fee would become irrelevant. There is no need then to both eliminate the no-surcharge rule and regulate interchange fees.

The Gans and King analysis is predicated on resolving what they refer to as being "the inefficiency". They define an efficient transaction as follows:[16]

If a credit card transaction was efficient then it would probably be implemented if the customer and merchant as joint consumers and the issuer and acquirer as joint suppliers all negotiated over that transaction.

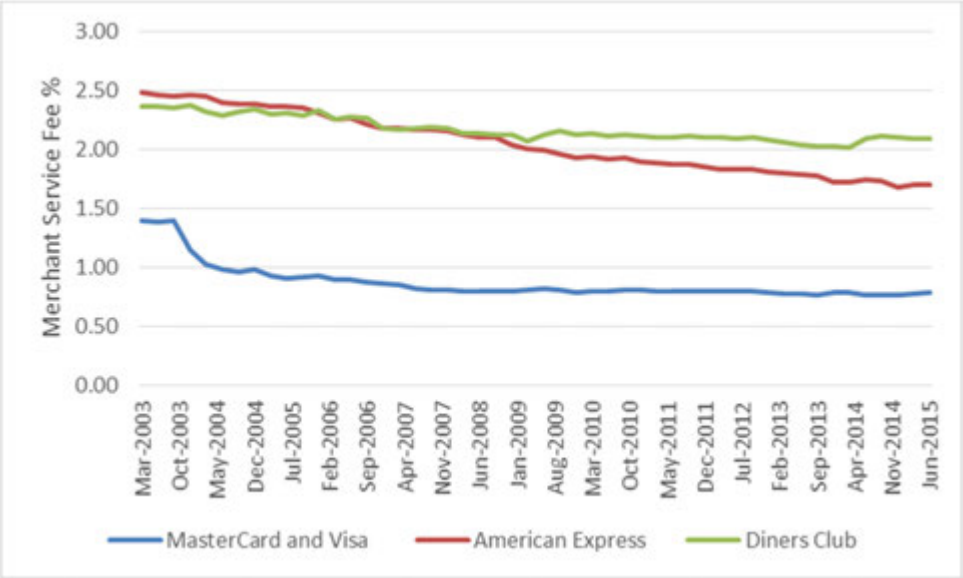
They refer to this description of a transaction as being Coasian bargaining after the economics laureate Ronald Coase.[17] They are making, at least, two errors at this point. First they are characterising only spot market transactions as possibly being efficient. Second they are ignoring the efficiency gains that can come about by entering into long-term relationships. We discuss this in greater detail in the next section. For our purposes here it is important to note that *the* inefficiency that Gans and King analyse is *an assumption based on a methodological error*.

They then canvass three possible "solutions" to their "inefficiency". The first solution involves horizontal integration – the two financial institutions merge into one (converting a four party credit card system into a three party credit card system). This is how American Express and Diner's Club are organised. In practice, however, the costs associated with those two providers tend to be higher than those

[16] Gans and King, 2001, pg. 99.
[17] This, of course, is a (common) mischaracterisation of Coase 1960.

associated with four-party systems (see exhibit 1). Alternatively a no-surcharge rule could resolve the inefficiency, or the existence of interchange fees could resolve the inefficiency.

Exhibit 1: Merchant Service Fees across four-party systems and three-party systems



Source: RBA Statistics

Gans and King are of the opinion that in the absence of a no-surcharge rule that interchange fees are competitively neutral.[18] The RBA – ACCC was concerned that excessively high interchange fees would distort consumer preferences towards excessive usage of credit cards relative to other payment mechanisms. A consequence of this possibility is that cash paying consumers pay too much for their goods and services and effectively "cross-subsidise" credit card paying consumers. Rather than have regulators set prices, Gans and King prefer regulators to eliminate the no-surcharge rule allowing merchants to charge differential prices (if the market will bear a price differential) depending on payment mechanism. They sum up:[19]

In the absence of a no surcharge rule, cooperative setting of interchange fees cannot have any anticompetitive effect.

Even in the presence of a no surcharge rule, the setting of interchange fees only creates competitive concerns if there is inadequate retail level competition.

Overall Gans and King consider the no-surcharge rule and the interchange fee as substitutes and argue that eliminating the no-surcharge rule makes regulating the interchange fee redundant. Overall, they doubted that the RBA interventions would result in many benefits.[20]

[18] Gans and King 2003a.
[19] Gans and King, 2003a, pg. 39.
[20] Gans and King, 2003c, pg. 472.

In summary, our analysis casts doubt on the benefits that will be created by the RBA's credit card reforms. While allowing surcharging makes sense, it is not certain that the regulated approach to interchange fees adopted by the RBA will lead to lower costs of transacting.

While we believe the Gans and King analyses are methodologically flawed it is interesting to note that they argue the interchange is competitively neutral. Of course, the RBA does not agree with assessment.

The RBA 2015 issues paper seems to suggest that its regulatory interventions are been successful. It restates unproven regulatory concerns as having been fact. For example,[21]

Competition between the schemes had, if anything, created upward – not downward – pressure on these fees. The higher the interchange fee paid to card issuers, the greater their incentive to issue the cards of a scheme and the larger the subsidies that can be paid to cardholders to encourage use of those cards. At least up to some limit, merchants appear unable to resist the high merchant service fees that result, typically finding it difficult to decline acceptance of cards given the risk of losing sales.

Whether or not competition resulted in increased interchange fees and increased merchant service fees (resulting in downward pressure on merchant profit margins) is an empirical question. If the evidence to validate that view exists, it is not in the public domain. It is true that interchange fee regulation did lead to a decline in merchant services fees, but as the RBA admits:[22]

*It is **impossible** – given the imprecision in any econometric model of consumer price inflation – **to measure exactly** how these reductions in merchant service fees have flowed through into prices for consumers.*

The RBA do report, however, that the reduction in merchant service fees since the regulatory intervention has been some $13 billion. They assume that those "savings" have been passed onto consumers claiming, "it seems reasonable to assume that they have mostly flowed through to lower retail prices for consumers".[23] Yet the RBA provides no reason why it would not be equally reasonable to assume that the $13 billion flows mostly to the merchants' profit margins. Indeed profit is something that is curiously missing from the entire RBA analysis.

We are told, for example, "competition in well-established payment card networks can lead to the perverse result of increasing the price of payment services to merchants (and thereby leading to higher retail prices for consumers)".[24] It simply never occurs to the RBA that, alternatively, increased costs to merchants could result in reduced profit margins. Much the same as the economic incidence of taxation is determined by the market, so too the economic incidence of costs is determined by the market.

It is important to note that the $13 billion is not a saving to the economy. It is simply a redistribution. If that money had been paid in interchange fees it would have been shared between consumers, in the

[21] RBA, 2015, pg. 4.
[22] RBA, 2015, pg. 23 (emphasis added).
[23] RBA, 2015, pg. 23.
[24] RBA, 2015, pg. 7.

form of reduced fees and loyalty programs, and their financial institutions. At best the RBA argument is that the $13 billion is being shared by merchants and consumers.

In addition, the RBA appears to be ignorant of standard business practices such as the "cash discount". It writes, "the consumer typically decides which means of payment is tendered and used in a transaction".[25] Yet merchants and consumers often bargain over price and over payment method. The cash discount is a very common mechanism to induce consumers to switch payment method. This is an astonishing oversight for the RBA given that it assumes the alternative payment mechanism to credit cards is a cash payment.

In summary, the RBA engaged in an extensive regulatory intervention based on poor theory and no empirical evidence. Theory has not provided an unambiguous indication of market failure, and there is no empirical evidence to support the notion of monopoly pricing – other than a vague notion that interchange fees are "excessive".

While we have other criticisms of the RBA approach – for example, we suspect the regulatory interventions were protectionist measures designed to support the local eftpos system – those arguments are beyond the current paper.

In March 2006, the Melbourne Business School hosted a Payment Systems conference discussing the interchange fee regulations in Australia.[26] Jean-Charles Rochet (of Rochet and Tirole fame) presented at that conference and made a number of predictions:[27]

First predicted consequences of a reduction in interchange fees:

- *increase in cardholders fees,*
- *decrease in merchants fees,*
- *reduction of the profit of issuers,*
- *increase in the profit of acquirers.*

Reduction in interchange fees likely to decrease the share of card payments (maybe after a delay). Ambiguous impact on consumer demand and consumer surplus:

- *Merchants may* ***decrease retail prices*** *(small?)*
- ***Transaction costs for consumers increase*** *(less convenient to use cards)*

Most important consequences of a reduction in interchange fees are medium to long term:

- *Issuing is likely to become more concentrated and less efficient*
- *Issuers may be tempted to bypass the regulation of interchange fees (socially inefficient)*

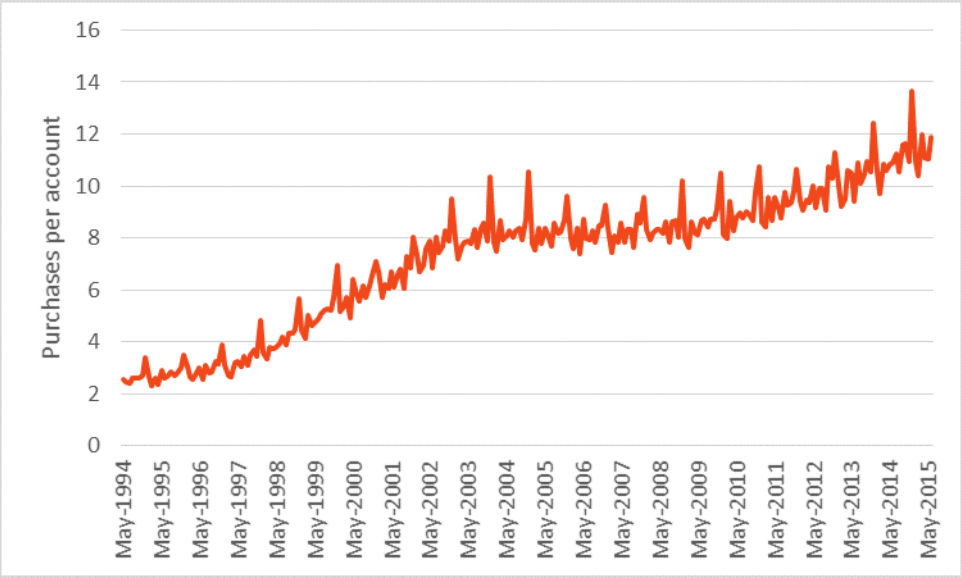
While it is not possible to test all of these predictions – it is possible to test some of them. What is particularly noteworthy, however, is that Rochet clearly identifies that profitability can and will be

[25] RBA, 2015, pg. 8.
[26] Papers available at http://web.archive.org/web/20060613224511/http://www.mbs.edu/payments_system/
[27] Emphasis original.

impacted by regulatory change, yet the RBA fails to discuss that issue. Rather the RBA focusses on consumer price changes, something that Rochet suggests will be small.

It is clear from the data that there was some impact in the credit card market following the RBA's regulatory intervention. We show that consistent with Rochet's predictions the advantages of using credit cards declined and the benefits associated with using credit cards declined. In Exhibit 2 we calculate the average number of transactions per credit card account using RBA data.[28]

Exhibit 2: Transactions per card



Source: RBA Statistics, Author calculations.

There is a very clear turning point in the data following the RBA's initial regulatory interventions. The growth in credit card transactions plateaus for nearly six years. Clearly the advantages associated with using credit cards declined.

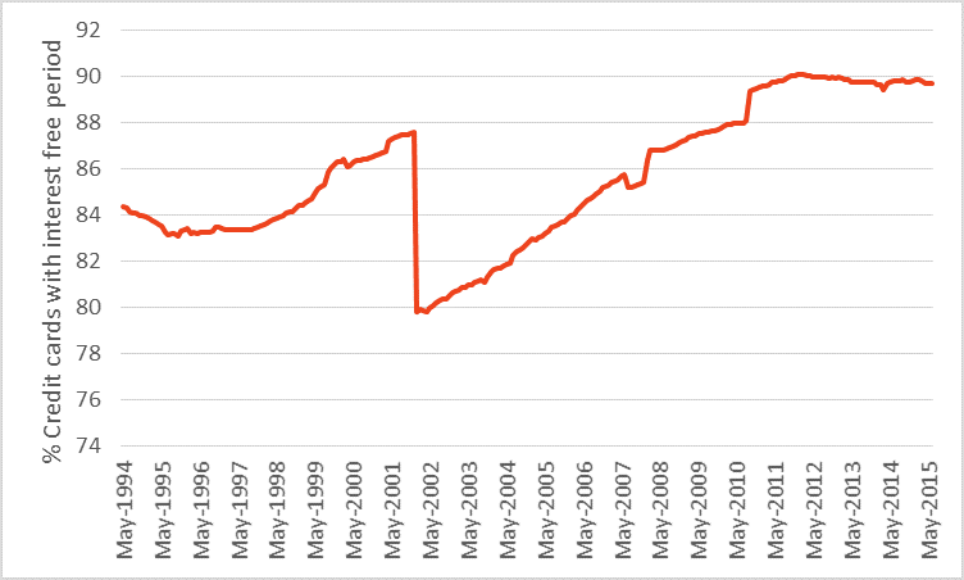
Similarly the benefits of using credit cards declined too. In Exhibit 3 we show the proportion of cards that had an interest free period.[29] Looking at the exhibit, the result is quite stark. A sudden decline from 86.7% in December 2001 to 79.8% in January 2002 is a massive change. While those dates do not quite line up with the actual regulatory timeline set out in table 1, it does immediately follow the publication of an RBA consultation document into the Australian credit card market. If we were to assume that financial institutions and consumers correctly anticipated the RBAs intentions then it is plausible to imagine that they would modify their behaviour before the regulatory intervention.

At the same time Rochet had predicted that issuing would become more concentrated. The RBA provides market share data for credit card schemes but indicates that one of the original three schemes

[28] Number of credit and charge card purchase transactions divided by Number of credit and charge card accounts.
[29] Number of personal credit card accounts with an interest-free period divided by Number of credit and charge card accounts.

that it initially regulated, Bankcard, closed in January 2007. At the same the domestic payments scheme eftpos has lost market share too.

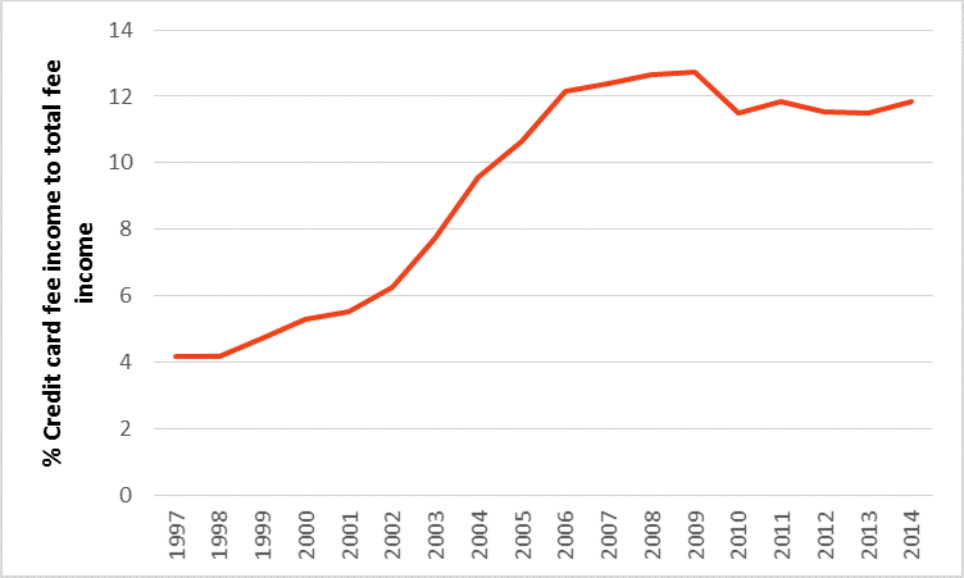
Exhibit 3: Proportion of credit card accounts with an interest free period



Source: RBA Statistics, Author calculations.

In Exhibit 4 we show the proportion of bank fee income from credit cards as a percentage of total bank fee income. It is clear over the period the RBA was introducing its regulations that fee income from credit cards accelerated as percentage of total bank fee income.

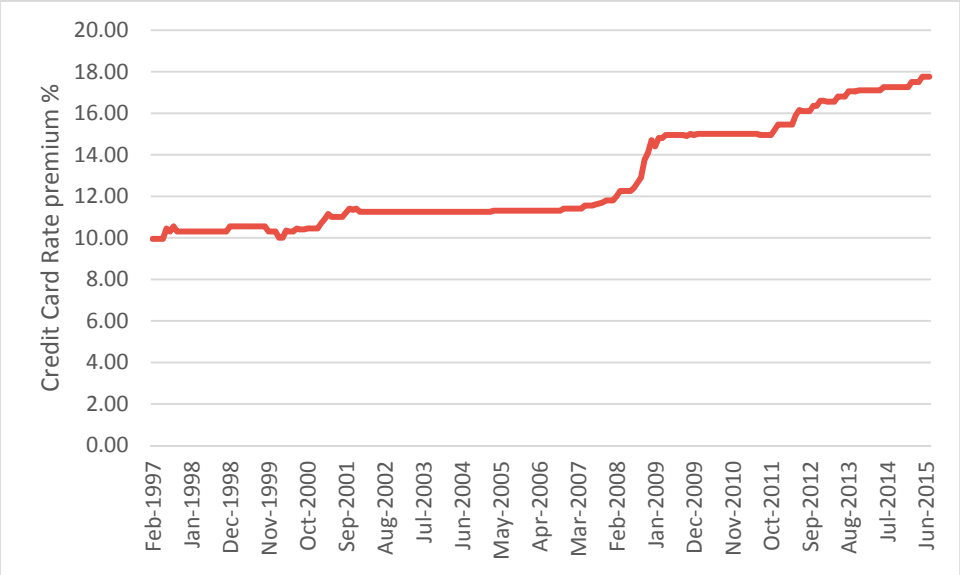
Exhibit 4: Credit card fee income to total fee income



Source: RBA Statistics, Author calculations.

Finally we show the credit card (standard) rate premium over the cash rate in Exhibit 5. Between December 2000 and December 2001 there is a 95 basis point increase in the credit card interest rate premium over the cash rate. In the context of the subsequent global financial crisis and risk-rerating that has occurred over the past few years, that increase is small. Nonetheless it is clear that interest rates charged by financial institutions moved in anticipation of regulatory change.

Exhibit 5: Credit card premium over Cash Rate



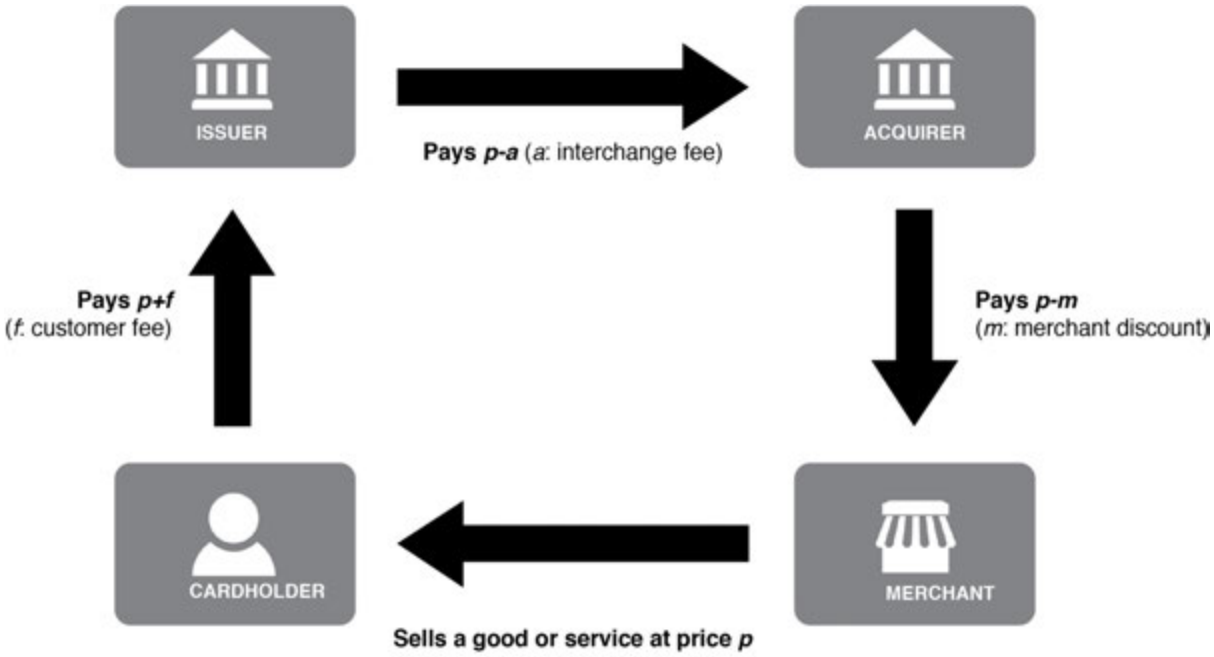
Source: RBA Statistics, Author calculations.

Consistent with Rochet's predictions, the RBA regulatory intervention has resulted in consumers paying more for their credit cards in the form of interest and increasing the fee income of banks while the benefits of the cards declined. The usage of credit cards relatively declined. All that for the $13 billion saving to merchants that the RBA identifies – yet the RBA is uncertain as to what actually happened to that money. They assume that it was passed onto consumers, but cannot know for sure. In addition, they are unable to point to any actual decreases in consumer prices following their intervention.

4. Alternative perspectives

We believe that the Reserve Bank has failed to understand the problem at hand. To see the issue more clearly consider not their exposition of the interchange fee as shown in figure, but rather Rochet and Tirole's exposition that we reproduce in figure 2.

Figure 2: Rochet and Tirole depiction of an interchange fee



Source: Rochet and Tirole (2003: 74)

This depiction shows the net cash flows in the various relationships. Again the consumer (cardholder) buys goods and services from the merchant. The consumer then pays the price (p) and a net fee to his financial institution. The consumer's financial institution then pays the price (p) less the interchange fee (a) to the merchant's financial institution who then pays the merchant the price (p) less their own net fee. This depiction of the issue makes very plain that if both financial institutions are to remain profitable that m > a. The merchant pays the interchange fee. Of course, this is not surprising. The interchange fee exists to rebalance the relationships within the two-sided market. In a competitive market for financial services, the interchange fee would be used to reduce the net consumer fee for credit cards. It is also unsurprising then that retail associations have led the charge against interchange fees. After all it is cost of doing business to them and reduces the profitability of their businesses. The subsequent regulation of the market is then well explained by the 1981 economics laureate George Stigler's theory of regulatory capture.

However, the basic issue is not one of monopoly exploitation, which has thus far been the guiding regulatory impulse that Stigler criticises, but rather is one of efficient contracting in the shadow of what 2009 economics laureate Oliver Williamson (1973) called the Fundamental Transformation that occurs in consequence of transactions that require both parties to make idiosyncratic investments – transforming ex ante competition into an ex post bilateral monopoly – that can subsequently give rise to opportunism.

The credit payments system is not and cannot ever be an interlinked series of anonymous spot markets exchanging financial commodities because the information asymmetries and moral hazards inherent in these exchanges require the parties to the transactions to make idiosyncratic investments (also known as asset specificity) that bind them into a bilateral monopoly – i.e. the fundamental transformation – in

which quasi-rents[30] are only secured through mechanisms to inhibit opportunism by aligning incentives to long term relational contracting.

The interchange fee, we argue, has evolved as an efficient governance mechanism to achieve this outcome without requiring horizontal integration – i.e. collapsing the four party payments system into a three-party payments system, and the associated losses of technical and information efficiency and competition that would imply. Banks need to make transaction specific investments in acquiring information about the properties of customers and merchants, the value of which – the quasi-rent – is realised through a long term relation.

4.1. Argument 1: The interchange fee represents an efficient institutional mechanism, not monopoly exploitation

Alternatives to collective setting of interchange fees, varying from bilateral negotiation to government-regulated cost-based fees, all have serious drawbacks in terms of generating excessive transactions costs, failing to internalize external benefits and costs, and distorting incentives.

Chang and Evans (2000: 461)

The existence of the interchange fee at what appears to be both a fixed and high level has been criticized by competition regulators because of its seeming departure from what would be expected in a perfectly competitive market. Among competition authority regulators, this is widely taken to be prima facie evidence of collusive price fixing and monopoly exploitation.

In an institutionally frictionless world of zero transaction costs, perfect rationality, perfect information, and zero uncertainty, any such fixed fee structure collectively agreed upon by competitors that seemed to generate permanent uncontestable flows of what would appear to be (natural) monopoly rents would certainly appear to be evidence of collusive monopoly exploitation. In this version of the story, the monopoly aspect of these rents are attributed to high entry costs owing to strong network effects on payments platforms.

In consequence, banking and competition regulators around the world have sought price caps on bank interchange fees (Schmalensee 2002). In Australia, this was reduced from 0.95% to 0.55% in 2003 (Europe Economics 2014: 27-32). These regulatory imposed fee caps are allegedly justified because they restrain anti-competitive behaviour and therefore benefit consumers.

Not only is there no evidence for this supposed regulatory benefit (ATA & IAEP 2015), but we argue that the economic theory behind it is also flawed. What it neglects is the adapted efficiency of the contractual and governance structure of the economic organization of payments systems and consumer finance.

[30] Klein et al (1978), pgs 289 – 307.

The argument we make (expanding on the work of Chang and Evans 2000) is that the interchange fee, as it has emerged and developed around the world over many decades, is an efficient governance outcome in a largely private ordering of mostly long term relational contracting between consumers, issuing banks, acquiring banks and merchants, all operating in the context of uncertainty, opportunism and asset specificity (Williamson 1985).

There are two specific aspects that we seek to highlight, both of which point to the fact that these are non-standard exchanges, and that the particular institutional and contractual features of the overall economic organization that depart from an Arrow-Debreu zero-transaction cost and complete markets model – i.e. the interchange fee – most likely reflects efficient contractual governance adaptations to these particular aspects of the exchange situation.

(1) The four-party exchange involves different types of contractual relationships, only one of which (between customer and merchant) is typically a spot-market transaction. The other three that have banks at one or more ends are typically long-term relational contracts. These involve complex contractual agreements that trade-off risks from uncertainty, opportunism, and asset specificity. The conditions of the spot market will be considerably shaped by the agreements made in the other three long run relational contract markets.

(2) The default payments model is assumed to be cash, which is assumed to be costless as a two-party-exchange between consumer and merchant. The four-party credit exchange relation is assumed to be more costly because of the additional services offered in the interbank payments and processing network that benefit both consumers (by extending finance) and merchants (by facilitating payments, screening credit-worthiness, covering credit risk). Both consumers and merchants benefit from these services and are willing to pay for these services. However, cash is also costly to both consumers and merchants (carry cost, risk, opportunity cost) and thus both will be willing to pay to use an alternative payments technology that mitigates these costs. Yet in a pure exchange spot market, merchants will only accept cash because to accept credit requires them to assume the costs of screening or of a long-term relationship that exposes them to consumer opportunism. However, by leveraging off the long-term relations established in the interbank payments networks, merchants can become indifferent at some fee margin between cash and credit transactions in the spot market, thus maximizing the overall transaction value by accepting all bids.

Our central argument then, as informed by transaction cost economics and the New Institutional theory of the firm (Williamson 2002), is that the various structures of fees that we observe in the long-term relation contracts that banks intermediate are most likely to represent an efficient bargaining outcome to arrive at stable long term relational contracts, given the various risks associated with opportunism and asset specificity, and are therefore not prima facie evidence of monopoly rent extraction.

The spot market between consumer and merchant is likely to be efficient when effective governance institutions in the long-term credit networks and payments systems emerge. These are facilitated by the inter-banking system, at the core of which is the interchange fee.

In consequence, regulatory attempts to treat these fees as if they were the result of collusive rent-extraction by seeking to constrain them within a price ceiling can risk harming an otherwise efficient system of institutional adaptation through long-run relational contracting to specific governance problems associated with uncertainty and transactions costs in the supply of consumer finance and payments systems (Balto 2000, Chang and Evans 2000).

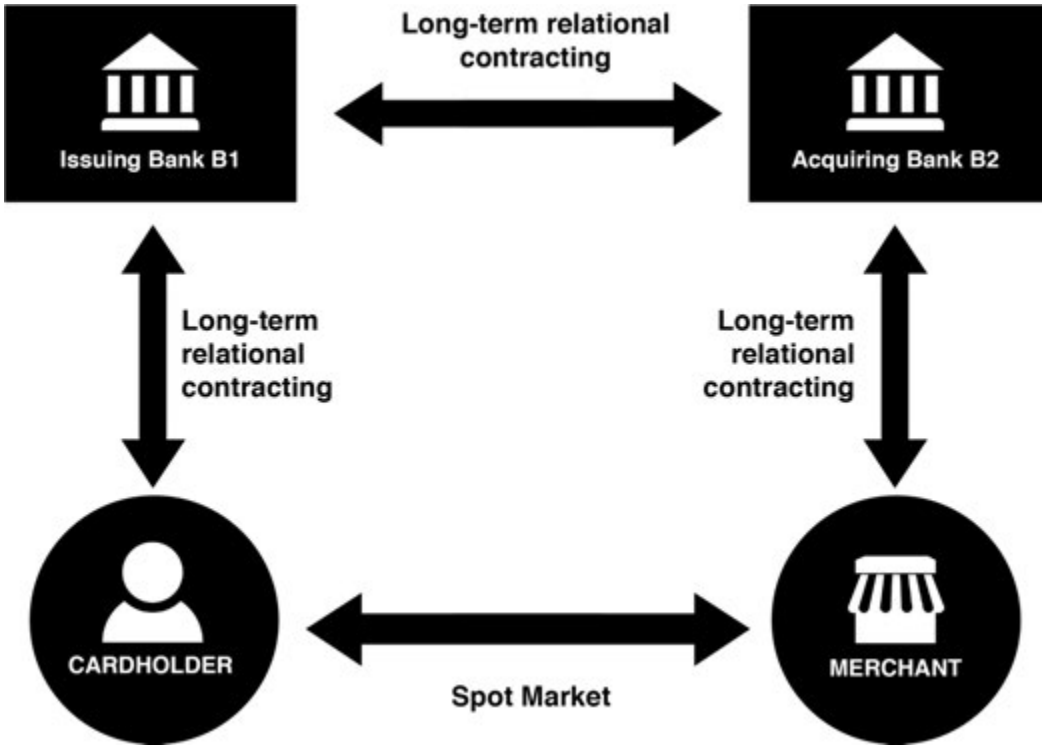
Models of the four-party and two-party payments systems

In a simple model of economic coordination, all exchanges take place in spot markets between firms (which in this model are hierarchical organizations whose boundaries are determined by the technology of production). In such a world, payments networks and consumer finance would be modelled as a natural monopoly (because of scale economies and network effects) such that the most efficient form of economic organization would be a single monopoly firm – call it The Bank. All consumers and all merchants would be customers of The Bank. The Bank would levy a fee across consumers and merchants, but the incidence of which would ultimately fall on consumers either directly or through higher prices as a function of the substitution margin with cash. An interchange fee would simply be an internal aspect of the firm's cost accounting. The total price The Bank charges would likely be regulated.

But under competition in retail payments networks, consumer banking and finance, and merchant banking we expect there will be multiple banks and that the boundaries of banks and financial services firms will depend upon specialization, competences and capabilities, often tied to specific assets (including reputational assets and context specific knowledge). This will be governed in large part by long term relational contracts between agents and firms, such as between customers and a bank, both consumers and merchants, and between firms within the banking and payments network. Indeed, for the most part the only spot contracts in this system of economic coordination are the exchanges of goods and services for money between consumers and merchants.

Figure 3 re-imagines the credit card network from a contractual governance perspective. Our central argument in this report is that figures 1 and 2 (above) have dominated discussion and analysis without sufficient consideration of the implications of figure 3.

Figure 3: Interchange fee in a governance framework



Source: Davidson & Potts 2015

Theoretical foundations: efficiency, not monopoly

The efficient organization of economic activity entails matching governance structures with these transactional attributes [uncertainty, frequency of exchange, asset specificity] in a discriminating way.

Oliver Williamson (1979: 261)

Economics laureate Oliver Williamson won his prize in large part for his classic work *The Economic Institutions of Capitalism*. Building on the work of Ronald Coase, Williamson developed the transaction cost-based field of New Institutional Economics, at the heart of which was a clear distinction between the monopoly branch and the efficiency branch of microeconomic analysis. As Williamson (1985: 23) explains:

The monopoly approaches ascribes departures from the classical norm to monopoly purpose. The efficiency approaches hold that departures serve economizing purpose instead.

Williamson explained how economic agents will seek to 'organize transactions so as to economise on bounded rationality while simultaneously safeguarding them against the hazards if opportunism' (ibid: 32). Williamson's point is that sometimes forms of economic organization that may look like collusive or monopolistic behaviour when examined in terms of resource allocations are actually forms of economizing when analysed from the institutional perspective of transactions.

We argue that the dominant regulatory view of payments networks and interchange fees is through the lens of the monopoly view of economic organization (Carlton and Frankel 1995). This view focuses on resource flows and rents (as in figure 1), and within that seeks to identify the exercise of monopoly power. The monopoly view of bank interchange fees is based around an applied price theory approach in which barriers to entry give rise to leverage and price discrimination, resulting in rent capture. The implied correction to this outcome is to restrict the ability to exploit the rents through a legislative price ceiling – i.e. fixing a maximum interchange fee.

But this same situation looks rather different when the unit of analysis is the transaction (as in figure 3). The notion of a transaction includes both exchanges and contracts. Economic organization can occur in a spot-market (exchange) with neither future promises nor responsibility, or through long-term relational contracting, where parties make investments of which the profitability and utility depends on the other parties subsequent behaviour (Alchian and Woodward 1988: 66). Transaction cost economics predicts that where there are transaction specific assets, trading regularities will emerge that support and signal continuity intentions (Rochet and Tirole 2000), thus expanding trade from a unilateral spot-market relation to a bilateral ongoing relational contract.

From the transactions cost perspective, observed departures from the classical model may therefore reflect economizing behaviour in conducting ongoing transactions, and in the context of risk of opportunism and bilateral investment may already be ex post efficient forms of organization of economic activity. In consequence, if these adapted institutions and contracts are efficient forms of economic organization, then regulatory intervention will harm efficiency. Consider why this might be so.

Long term contracting and spot markets in credit and payments systems

Figure 3 indicates that of the four types of transactions relations between consumers (C), issuing banks (B1), acquiring banks (B2), and merchants (M), three of those relations (C-B1; B1-B2; B2-M) will usually be governed by long-term relational contracting, and with only C-M being a spot market transaction. Why is this?

First, why are they not all spot contracts? Specifically, why are C-B1 and B2-M typically long-run relational contracts rather than spot contracts?

One, they are engaged in multiple repeated transactions, and minimizing transactions costs associated with processing scale economies are achieved through bundling transactions through a single supplier. This incentivizes B1 to form a long-term contract with C.

Two, there is asymmetric information about creditworthiness of C that accumulates through repeated transactions, and which then enables a cumulatively better offer to be made to C as their true risk is cumulatively revealed, which then incentivizes C (if their 'true type' is low risk) to form a long-term contract with B1. This moral hazard problem of constraining C to good behaviour is enforced with threat of expulsion from the contract by B1, which would then take them back to a higher rate with a new issuing bank that had not accumulated information about the credit properties of C.

This in turn works as an effective screening mechanism by B1 on C, because only a high quality C will accept the conditions of a long-term contract, which will be valuable to C and profitable to B1, only if C can be effectively constrained from opportunistic behaviour.

Three, the same arguments apply between B2 and M, where B2 accumulates information about the transaction volume of M and their propensity to accept fraudulent sales (which require chargebacks). This information is a specialized asset that is profitable to B2 (and B1) if they can constrain opportunism by M (and C). The long-term relational contract, and the credible threat of expulsion from that contract, is an efficient governance mechanism to organize economic coordination in the context of the threat of opportunism and information asymmetry.

Four, incomplete relational contracts enable many specific contingencies to be dealt with by negotiation between the parties under the threat of exit, with the ensuing costs that imposes. These are a private ordering that may have final recourse to courts, but will often be most efficiently handled through direct bargaining under credible commitments and threats through the various hostages (threat of default versus threat to harm credit score) that each side has offered the other (Williamson 1983).

Five, long-term contracts may arise because of differential risk preferences between consumers, merchants and banks, which banks being systematically risk neutral and consumers and merchants being risk adverse.

Second, why is B1-B2 a relational contract, rather than either a spot exchange or horizontally integrated within a single firm (see Williamson 1985: ch6)?

A single bank – integrating B1 and B2 within a single firm – might be technologically efficient, but would be informationally inefficient, would be exposed to greater risk of shirking behaviour because of information impactedness and costly monitoring, and would be exposed to opportunism in internal pricing transfers. Because retail consumers and merchants are highly heterogeneous and

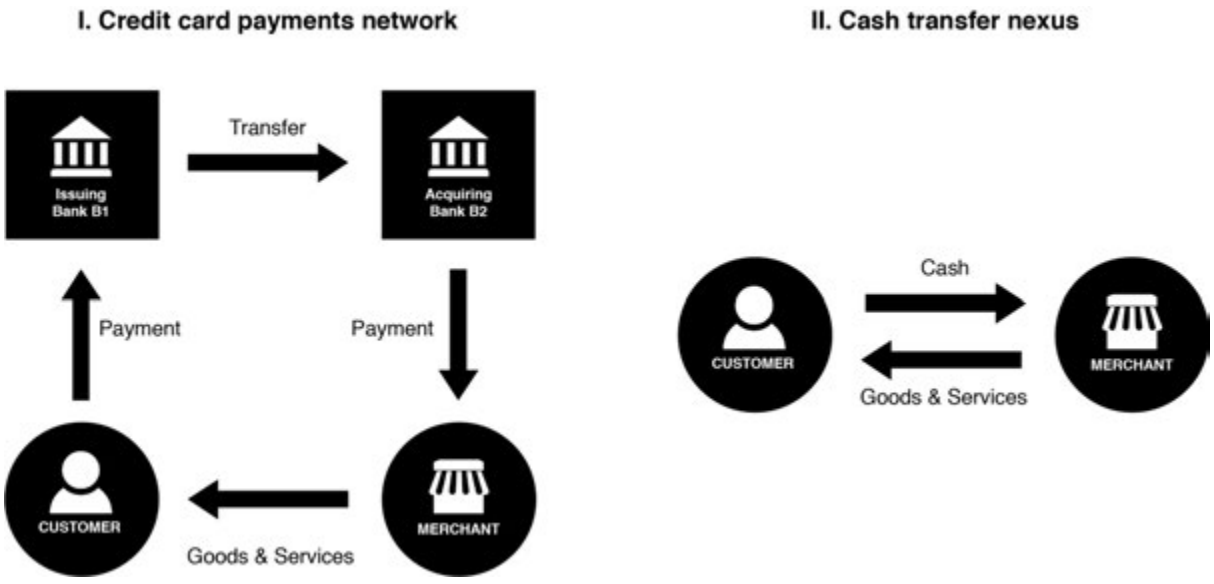
geographically distributed, specialized skills and investments are required in assessing quality (i.e. true type) and in delivering services. Banks will therefore tend to specialise under competition in order to economise on information. Long-run relational contracts then reconnect this into a payments network under high-powered incentives. In general this can be observed in the relative market success of open payments networks over closed payments networks.

Long-term relation contracting is efficient because banks take different sides of many transactions, giving rise to threat of exploitation through non-cooperative play. However, opportunism is disciplined only by threat of retaliation. Furthermore, repeated transactions enable learning and synchronising of processes and transaction routines in order to generate an efficient payments system, all without loss of high-powered incentives if the transactions were integrated into a single firm.

4.2. Argument 2: Equilibrium in choice of payments: cash versus credit cards

An important point follows from these considerations of the payments system in terms of transaction costs and the institutions that develop to efficiently govern these. In essence, these will be some margin of equivalence between alternative governance institutions, which we represent in figure 4 below with the credit card payments network on the left and the cash transfer nexus on the right.

Figure 4: Payment Networks and Cash Transfer



Source: Davidson & Potts 2015

First, the added complexity and physical and organizational resources involved in the card payments network, which are approximated by the flow of fees that consumers and merchants pay to the banks, will in equilibrium be competitively disciplined by the threat of exit to the cash transfer nexus (on the right in Figure 4 above). What is crucial to understand is that the cash transfer nexus is not the default setting of free, against which to compare the costs and fees of the card payments network. There are significant costs associated with the use of cash, for both customer and merchant, and both will be willing to pay some margin to avoid those costs. For the consumer, the costs are the carry costs and risks of using cash. For the merchant, these are the same costs in processing cash, but also in the

reducing in sales due to financing constraints by the consumer. The merchant will be willing to pay some margin to enable the consumer to access credit.

Second, the merchant is not indifferent between cash and credit because of asymmetric information and adverse selection. For the customer, in their relation with Bank1 and Merchant, the equivalence between cash and credit depends on the benefit of liquidity plus the carrying cost of liquidity (cost of carrying cash, cost of credit cards). In equilibrium, the cost of carrying and using cash will equal the maximum credit fee charge. However, this assumes that the customer is of a type: 'creditworthy and solvent', and that this is known to the merchant and the bank. Yet there is no reason to suppose the merchant knows this, or can acquire this information at low cost.

An equivalent argument occurs on the merchant side of the equation. In a long-term relationship between Customer and Merchant there would emerge an equivalence between cash and credit, plus the transaction cost that would be self-enforcing in long run equilibrium of a repeated game only if the exchange relation was at least a one-sided monopoly. But in a competitive spot market the logic is different because the consumer choosing credit over cash is not just facing a transaction cost decision but also signalling information about their 'true type' as a credit risk [i.e. good or bad]. A consumer choosing credit in the C-M transaction risks signalling that they expect not to pay (that they are a bad type), which drives an adverse selection/moral hazard spiral that will drive credit out of the spot market, leaving only cash. This will result in a lower equilibrium level of transactions because good credit use in the spot market (i.e. 'good' customers, for whom the cash carrying cost greater than the credit fee cost) suffers a 'lemons' problem (Akerlof 1971). B1, however, has a long term relation with C, and thus can effectively underwrite that use of credit in the spot market.

5. Summary and Analytic Conclusions

Interchange fees are not a problem of monopoly exploitation, but rather an efficient solution to an unavoidable bilateral monopoly that arises because banks need to form long term relations with customers and merchants – what are in effect irreversible investments that pay off only if the relationship continues – and which are therefore vulnerable to opportunism.

We make two specific theoretical claims that explain why regulatory intervention to cap the interchange fee will harm consumer welfare. Both claims hinge on recognizing that the governance structure of the card payments system is composed of long run relational contracts, the threat of exit from which disciplines short run opportunism in the system.

First, the interchange fee equilibrates the issuing (B1) and acquiring (B2) sides of payment cards systems. A fee setting association of banks is not evidence of collusive monopoly, but of minimizing transactions costs across the network in achieving economic coordination between all transacting parties. Constraints placed on internal bargaining and side-payments – i.e. an interchange fee ceiling – cause less efficient outcomes, resulting in higher fees to consumers and an unnecessary loss of social welfare.

A further implication is that interchange fees also enable an efficient network governance structure based around relational contracting that avoids horizontal integration between issuing and acquiring banks, maintaining incentive intensity and minimizing administrative monitoring burden arising from information impactedness.

Second, the relevant theoretical comparison between the four-party card payments system and the simple two-party cash nexus exchange must recognize that cash is also costly to consumer and merchant and that both parties will be willing to pay some margin to use a superior payments technology. This can be seen clearly when we consider why merchants do not usually offer credit payments to customers – or are risk averse in doing so – but banks can be risk neutral in this offering, namely because they are in a long term relational contract with the customer, and can effectively punish opportunism. Both consumers and merchants are willing to pay to avoid cash transactions by agreeing to enter long term contacting relations with banks.

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WHAT DOES THE BLOCKCHAIN MEAN FOR GOVERNMENT? CRYPTOCURRENCIES IN THE AUSTRALIAN PAYMENTS SYSTEM

Chris Berg, Sinclair Davidson and Jason Potts

EXECUTIVE SUMMARY

- This paper introduces the radical opportunities that the invention of distributed ledger technologies offer for government, using the Australian payments system as a case study.
- Blockchains were invented as the underlying technology behind the Bitcoin cryptocurrency in 2009.
- With the blockchain the pseudonymous inventor 'Satoshi Nakamoto' solved the 'double spending' problem endemic to digital currencies and created a fully distributed ledger.
- The paper presents a guide to some of the major cryptocurrencies released since 2009.
- However, blockchains have more uses than just as cryptocurrencies. Blockchains are an 'institutional technology' which allow for the creation of new methods of exchange.
- The paper presents a model for the reform of government in light of the blockchain based on the new comparative institutional economics literature.
- In response to invention of the blockchain, governments should:
  - Allow firms to experiment and introduce blockchain enabled services – that is, take "permissionless innovation" approach.
  - Adapt regulatory environments to accommodate the use of blockchain applications where those applications cross over existing regulatory requirements – for example, in the space of taxation, and financial and prudential reporting.
  - Directly adopt blockchain technologies for delivering government services and to enhance (or replace) existing government processes.
- The paper presents as a case study the use of blockchain for the Australian payments system
- It provides a brief history of the development of the payments system since the colonial period
- Blockchains bring the payments system closer to the monetary system envisaged by Friedrich Hayek, where money and payments systems were structured by the market, rather than political demands
- The paper explores the implications of payments systems as two-sided market.
- Interchange fees exists to rebalance financial relationships within a two-sided market
- The paper explores how blockchains could be used more deeply in the financial system, suggesting the possibility of a 'cryptobank'
- The nature of blockchain technologies means that their adoption presents significant governance challenges for the Australian government
- The paper recommends that the Australian government adopt the organisational approach of the United Kingdom, which has a payments system regulator institutional separate from the central bank.
- Realising the huge opportunity of the blockchain will require forward-thinking and often dramatic reform.

1. INTRODUCTION

Blockchains and the cryptocurrencies they support offer potentially revolutionary opportunities for the Australian economy. In coming years, it is likely that we will see blockchain and distributed ledger technologies introduced into some of our most important economic and legal institutions, from the financial system, to identity management, to the organisation of private property rights.

The benefits from these blockchain applications could be immense. Blockchains can reduce and even eliminate some of the most fundamental barriers to efficient markets. They can drive deeper and more liquid markets, reduce the costs of finding and building economic relationships, and can return economic control to individuals away from hierarchical firms and states.

For policymakers, blockchains present a particular form of the 'innovation problem'. Most innovation policy questions focus on where the ideas for new innovations come from, how that development can be funded, and how innovations can be commercialized. There is a large amount of work globally on blockchain applications, and no obvious need for government intervention in their development. Australia is already participating in that work and has a number of promising blockchain firms.

However, the most potentially revolutionary and beneficial blockchain applications cross over, and often contradict, much of the existing regulatory and economic system. The significance of this is that the countries which best take advantage of blockchain opportunities will not necessarily be the ones that develop the technologies themselves. Rather, the countries which are able to adapt and reform their institutional frameworks will be best placed to take advantage of the blockchain revolution.

Taking advantage of the blockchain revolution means having regulatory environments that are able to accommodate blockchain applications. It means being willing to experiment with and adopt blockchains for the delivery of public services. It means having a taxation system that is adapted to the needs of blockchain-enabled firms and smart contracting arrangements.[1] In summary, to take exploit this opportunity, governments need to:

- Allow firms to experiment and introduce blockchain enabled services – that is, take "permissionless innovation" approach.[2]
- Adapt regulatory environments to accommodate the use of blockchain applications where those applications cross over existing regulatory requirements – for example, in the space of taxation, and financial and prudential reporting.
- Directly adopt blockchain technologies for delivering government services and to enhance (or replace) existing government processes.

This paper addresses the latter two points, by looking at one relatively simple blockchain use-case: the introduction of cryptocurrencies into the Australian payments system. Cryptocurrencies were the first

[1] We raise some issues in this area here http://chrisberg.org/2017/10/opening-statement-to-house-standing-committee-on-tax-and-revenue-inquiry-into-taxpayer-engagement-with-the-taxation-system/

[2] A.D. Thierer, *Permissionless Innovation: The Continuing Case for Comprehensive Technological Freedom* (Mercatus Center, George Mason University, 2014).

application developed on the blockchain and are currently in the most advanced state of development. Introducing cryptocurrencies into the payment system offers a wide array of potential benefits, including faster and more reliable transaction processing, automatic auditing (that is, verifiability), and transaction permanence. However, integrating cryptocurrencies into the regulatory framework that governs payments is a non-trivial problem. The existing institutions have been developed and structured around specific technologies that have distinct economic properties and limitations. Blockchains materially change the economics of payments systems, and, if Australia is to realize the benefits of cryptocurrencies, will require significant regulatory reform.

This paper proceeds as follows. In Part 2 we provide a brief introduction to blockchain technologies. In Part 3 we explore the blockchain as an institutional technology and introduce the field of 'institutional cryptoeconomics'. In Part 4 we outline some economic principles that will underpin the introduction of the blockchain into political, legal and regulatory systems. In Part 5 we look at how blockchains can be used in the Australian payment system, beginning with a history of the payments system, and how the introduction of cryptocurrencies will have broad consequences for regulation and the monetary system. In Part 6 we offer a speculative proposal for a 'cryptobank' that follows from the prior analysis. Part 7 discusses the institutional framework that should govern these changes. Part 8 concludes.

2. A BRIEF INTRODUCTION TO THE BLOCKCHAIN

The blockchain is the underlying technology that powers the cryptocurrency Bitcoin and other cryptocurrencies. It was first outlined in 2008 by the pseudonymous 'Satoshi Nakamoto' in his white paper "Bitcoin: A Peer-to-Peer Electronic Cash system".[3] The blockchain is a decentralised, distributed ledger that records transactions without the need for a trusted third party or intermediary. Nakamoto's purpose was to develop a native digital currency that was not vulnerable to centralised authorities. In this sense he was contributing to a project that was already two decades old, and had been contributed to by DigiCash (founded in 1990), E-Gold (founded in 1996), and PayPal (founded in 1998).

Digital currencies are vulnerable to the 'double spending' problem. This problem derives from the fact that it is trivially easy to copy a digital item. Opportunistic users might try to buy two goods with one unit of currency. The double spending problem is similar to the counterfeiting problem with fiat currency. Typically this problem has been solved with a trusted intermediary that validates transactions to ensure they are not double spent. Bitcoin decentralised that validation, creating an open network governed by a protocol in which 'miners' compete to solve a difficult puzzle to validate the most recent transactions on the network.

The technologies which make up the blockchain were not especially new when they were brought together by Nakamoto. The blockchain uses **asymmetric cryptography**. Where symmetric cryptography uses the same key to both encrypt information and decrypt it, asymmetric cryptography has separate keys for encryption (a public key) and decryption (a private key). This system of cryptography allows strangers to deposit information with a user but prevents strangers from withdrawing that information. Blockchains are distributed **peer-to-peer networks**. Networks can be either client-server or distributed. Client-server

[3] Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," (www.bitcoin.org2008).

networks are easy to administer, secure and police but rely on a trusted client to update the network, and consequently present a single point of vulnerability. By contrast, peer-to-peer networks are decentralized, robust, hard to police and censor, but also hard to administer and ensure consistency (consensus) about the state of the network. Blockchains also utilize an **append-only database**, where information is immutable, and transactions are recorded as additional data rather than overwriting existing data (as, for instance, a simple Excel spreadsheet does). Each block in the blockchain includes a 'hash' (a secure cryptographic summary) of the previous block in a chain all the way back to the genesis block mined by Nakamoto himself.

Finally, the blockchain uses **game theory** in order to distribute consensus about the state of the network. In the Bitcoin blockchain, miners solve a difficult cryptographic puzzle for the right to update create a new block on the chain containing recent transactions. Successful miners are awarded with an amount of Bitcoin (currently 12.5 Bitcoin) for each correctly solved block. The difficulty of the puzzle updates periodically and the reward decreases periodically in order to maintain a steady rate of inflation. Mining is a costly signal that seeks to make the blockchain incentive compatible; that is, align users incentives to maintain and protect valid data and reject invalid data (such as double spending). The resulting network bakes economic incentives into the structure of the network itself, distributing economic value to those who maintain it.

Bitcoin was the first implementation of the blockchain but blockchains have been used for a wider range of applications. Bitcoin provides a public ledger which raises privacy issues, leading to the development of privacy-focused cryptocurrencies like ZCash and Monero. Developers quickly realized that other information – that is, records of ownership other than 'money' – could be carried on the blockchain. In 2011 Namecoin was established: a cryptocurrency that resolves domain names. Bitcoin includes a scripting language allowing users to develop contingent contracts – such as escrow services and multisignature transactions – into the network itself.

Blockchain technologies are in a rapid state of development. For example, Bitcoin (in its current form) does not scale well, transactions can be slow to reconcile, its verification algorithm is vulnerable to centralization, is extremely energy intensive, its scripting language is limited, and has governance problems surrounding technical updates. Each of these problems are being tackled by developers and entrepreneurs. Ethereum, launched in 2015, is a blockchain implementation that offers a more complex ('turing complete') scripting language, and is developing a 'proof of stake' consensus mechanism that seeks to resolve the high cost and potential centralization of Bitcoin mining. Other blockchains and adaptations of the original Bitcoin protocol provide solutions to these problems.

In 2017, the range of blockchain use cases has blossomed. Utilizing the enhanced scripting of Ethereum, more complex 'smart contracts' ensure that financial and other transactions are completed exactly as they have been written, without the need for human intervention or the possibility of censorship. A 'decentralised autonomous organisation' could utilize smart contracts and pays in cryptocurrency in order to solve economic problems, such as managing a fleet of self-driving cars or an insurance network. Private and permissioned blockchains enable organisations to implement their own blockchains in a trusted or semi-trusted environment. In the next section we describe some of the main cryptocurrencies as a guide to the blockchain ecosystem.

A guide to significant cryptocurrencies

Bitcoin

Bitcoin is the original cryptocurrency. Invented by the pseudonymous Satoshi Nakamoto, Bitcoin was released as open-source software in 2009. Bitcoin is limited to 21 million bitcoins, a limit which is expected to be reached around 2140. Nakamoto stepped back from development in 2010. The software which manages the Bitcoin network is managed by a team of volunteer developers. The miners, who validate transactions in return for the right to forge new Bitcoins, also exercise influence over changes to the network.

Namecoin

Namecoin was the first 'fork' of the Bitcoin network, which occurred in 2011. Namecoin's key usecase is as a censorship proof domain system. In the current internet, domain registration and resolution is provided by the Internet Corporation for Assigned Names and Numbers (ICANN), a centralised non-profit multistakeholder authority. Namecoin runs .bit, a distributed rather than centralised top level domain. Namecoin has broader uses for identity management.

Litecoin

Litecoin was established in 2011 as a fork of Bitcoin designed to resolve some of the technical issues in Bitcoin. Litecoin speeds up the creation of new blocks, aiming at a target of a new block every 2.5 minutes rather than every 10 minutes. Litecoin also has a different hashing algorithm and a larger limit on total coins (84 million).

Ripple

Ripple is a real-time currency exchange settlement initialed released in 2012. Ripple does not use a public blockchain. Rather, it is secured by a private blockchain connected a set of verified nodes (such as participating financial institutions). Ripple's coins, XRP, are not mined but are issued. Ripple is being experimented with and used by a large number of major financial institutions to speed up interbank payments.

Dash

Dash was originally released as XCoin in 2014. Dash is a fork of Litecoin, which divides its governance and verification into two tiers. Blocks are created by miners. Governance functions are provided by masternodes, that operate Dash as a decentralised autonomous organisation. Dash also has privacy features utilizing a coin-mixing tool (PrivateSend) and features near instant transactions (InstantSend).

Ethereum

Ethereum was developed by Vitalik Buterin and went live in July 2015. Ethereum is a cryptocurrency with a large number of distinct features from Bitcoin. Its primary feature is that it offers a 'turing complete' scripting engine which allows for complex computation. Ethereum acts as a universal global computer. Ethereum's currency is called Ether and computations on the network require 'gas' to pay for and ration scarce computational resources.

Monero

Monero was released in 2014 as a privacy focused cryptocurrency. Monero hides the sender, recipient and volume of a transaction by mixing addresses for recipients,, generating 'stealth' addresses for senders, and hiding transaction volumes.

Zcash

Zcash was released in 2016 as a privacy focused cryptocurrency that both utilizes a public blockchain and allows users to conduct private transactions that conceal the sender, recipient, and volume of a transaction. Zcash utilizes zero-knowledge succinct non-interactive arguments of knowledge (zk-SNARKs), a type of cryptography that allows provers to demonstrate to verifiers that a statement is true without providing any information beyond the verification.

Augur

Augur is a decentralised prediction market built on top of the Ethereum network. Released in 2016, Augur has its own native cryptocurrency (reputation or REP). REP is used to resolve predictions and successful predications are paid out in Bitcoin or Ethereum.

3. THE BLOCKCHAIN AS AN INSTITUTIONAL TECHNOLOGY

Beyond the internet payments envisioned by Nakamoto and early digital currency proponents, some early and obvious financial use cases of blockchains include trade finance, the facilitation of international payments, banking and financial settlement, the creation and maintenance of new financial instruments. Other uses include permanently recording property ownership on the blockchain, such as property titles, caveats, and encumbrances, and for supply chain management, such as offering a permanent and indelible record of provenance. Further down the track but potentially revolutionary is digital identity management on the blockchain which, when combined with privacy enhancing features, could significantly change the relationship between the government and citizen data.[4]

Institutional cryptoeconomics is an economic approach to understand the economic consequences of the adoption of blockchain technologies for governments, firms and society more generally. Institutional cryptoeconomics provides a framework to identify potential uses of blockchains and how the institutions of society might shift and adapt in response.

The study of blockchain technologies is in a very early stage but we can distinguish two schools of thought. The first conceptualises blockchain as a new *general purpose technology*.[5] General purpose technologies are innovations which are characterised by their broad potential use-cases ('pervasiveness'), their capacity for technological improvement and their complementarity with other technologies. In this,

[4] See Chris Berg, "Medicare Details Available on Dark Web Is Just Tip of Data Breach Iceberg," *Canberra Times*, 17 July 2017.

[5] Timothy F Bresnahan and Manuel Trajtenberg, "General Purpose Technologies: 'Engines of Growth'?," *Journal of econometrics* 65, no. 1 (1995); Trent J MacDonald, Darcy WE Allen, and Jason Potts, "Blockchains and the Boundaries of Self-Organized Economies: Predictions for the Future of Banking," in *Banking Beyond Banks and Money* (Springer, 2016).

blockchain joins the ranks of steam power, electricity, and the semi-conductor. Blockchains reduce the costs of verifying identifies and networking without intermediaries, opening up the possibility of new markets and to significantly reduce transaction costs in existing markets.[6]

By contrast, institutional cryptoeconomics sees blockchain as an *institutional technology*. Rather than enhancing existing economic institutions, blockchains opens up new opportunities for exchange – that is, to create new *economies*.[7] Blockchain is a distributed computation technology for coordinating activity in a distributed economy. Institutional cryptoeconomics is in the transaction school tradition of Nobel laureates Ronald Coase and Oliver Williamson and sees the blockchain as a new type of economic institution that enhances (and competes with) the existing economic institutions of capitalism: firms, markets, commons, relational contracting, and governments.

A decentralised distributed ledger is significant because ledgers have a previously unheralded critical role in economic organisation. Ledgers consist of data structured by rules. A ledger records (that is, maintains consensus about) ownership and provides a mechanism to verify that ownership. As Davidson, Potts and De Fillipi write,

> A ledger is an ancient accounting technology to record (i.e. maintain consensus about) whom (or what) owns what, of who (or what) has agreed to what, of what counts as a what, and to record when anything of value is transacted. As the fundamental instruments of transactional legitimation, ledgers are an elemental technology of modern market capitalism and statecraft (Nussbaum 1933, Yamey 1949, Allen 2011). So a significant shift in ledger technology—from a centralised method of producing consensus in the ledger (using trust) to a distributed approach to consensus (using the blockchain)—could transform the transactional mechanics of a modern economy.[8]

This approach places ledgers at the center of any structure of property ownership. Any system of property rights needs a ledger to record ownership and for owners and others to consult. Institutional cryptoeconomics says it is not enough to assert the existence of a property rights regime. Property rights require institutional technologies (firms, markets, governments, etc.) to maintain ledgers of ownership. Owners need their ownership to be recorded on the ledger to draw on the rights associated with that property. Buyers need to know what they are buying can be legitimately sold.[9]

As this suggests, the most basic property right is a property and land title register. But much of what government does is maintain ledgers of property rights. The register of Births, Deaths and Marriages records the existence of individuals at key moments in their life. Business registers record information about taxable corporate forms. Citizenship is a ledger, recording who enjoys the privileges and

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[6] Christian Catalini and Joshua S Gans, "Some Simple Economics of the Blockchain," (National Bureau of Economic Research, 2016); Marc Pilkington, "Blockchain Technology: Principles and Applications," in *Research Handbook on Digital Transformations*, ed. F Olleros and M Zhegu (Cheltenham: Edward Elgar, 2015); David Yermack, "Corporate Governance and Blockchains," *Review of Finance* 21, no. 1 (2017).

[7] Sinclair Davidson, Primavera de Filippi, and Jason Potts, "Blockchains and the Economic Institutions of Capitalism," *Journal of Institutional Economics* (forthcoming); Chris Berg, "What Diplomacy in the Ancient near East Can Tell Us About the Blockchain," *SSRN* (2017).

[8] Davidson, Filippi, and Potts.

[9] Chris Berg, Sinclair Davidson, and Jason Potts, "The Blockchain Economy: A Beginner's Guide to Institutional Cryptoeconomics," *Medium* 2017.

responsibilities of citizenship – voting, taxation, and jury duty - and who (through their absence on the ledger) is excluded from their privileges and responsibilities. Ledgers record who can sit in parliament, who can work with children, who has security clearance. Social security rights are a ledger, recording who (and under what circumstances) has a right to an entitlement – subsidized health care, subsidized education, disability and old-age pension support.

Much regulation and regulatory technology is structured around ledgers. Ledgers structure tax obligations. Ledgers record who can practice medicine, who can serve liquor, and which firms can mine and where. Ledgers record who can offer banking services (authorized deposit institutions) and which firms (and accounts) have their deposits protected by law. Governments audit firms (or license private auditors) to ensure they are solvent. The monetary system is a ledger. Since the end of the free banking system in Australia, the government has assumed the role of the maintenance and validation of the ledger of money ownership. While the ownership of physical currency is indicated by its possession, the existence of a note is recorded, released, authorised and validated by the Reserve Bank of Australia.

The ideal ledger has ten properties: completeness (all relevant economic elements of the real world are mapped on the ledger), correspondence (its data corresponds to the real world), compactness (it is a minimum efficient representation of the real world), predictability (it changes only when the real world changes), robustness (it is resistant to changes that are not reflected in the real world), integrity (the ledger only contains 'good' information), legibility (the ledger needs to be readable), accessibility (the ledger can be accessed a low cost), and updatability (the ledger is immutable – it cannot be rewritten, only added to). Finally, and most fundamentally the ideal ledger represents a social consensus about the state of the world.

Each of these ledgers described above operated (or supervised) by the hierarchical institution of the state. Government variously plays the role of trusted authority with the responsibility of maintaining the ledger, authorizing transactions on (that is, changes to) the ledger, and verifying ledger entries. Government plays these roles because it was both practically and technically necessary for it to do so. The government, with a monopoly of the use of force and funded by compulsory taxation, is in the best position to manage ledgers that approximate the attributes of an ideal ledger.

The invention of the blockchain significantly changes this technical and economic calculus. On a number of characteristics blockchains can more closely approximate the ideal ledger than government run ledgers. The censorship-resistance of the blockchain makes has superior robustness and integrity properties. The distributed nature of the blockchain is more accessible than government ledgers: the blockchain is 'always-on' (by comparison with a government ledger which can often only be accessed during, for instance, business hours) and accessible to users who simply have internet access. The blockchain is immutable – and verifiably so – unlike many government databases. For the purposes of both verification and updating the blockchain is decentralised and (for public blockchains at least) accessible to all.

At the first approximation this means that many ledgers maintained and operated by the government can now be more effectively and efficiently operated by the blockchain in a decentralised fashion. In the next section we outline some principles to understand how introducing the blockchain to government policy and process represents a fundamental institutional change.

4. REFORM OF GOVERNMENT AND THE STATE IN LIGHT OF THE BLOCKCHAIN

The blockchain is just as likely to disrupt government as it will disrupt industry and the private sector. Government, however, is a very loose term that describes the public, and usually not-for-profit, sector of the economy. There is much more to government than the traditionally understood executive, legislature, and judiciary. At this very high level of abstraction the blockchain is likely to disrupt a lot of the activities currently perform by the judiciary. In order to gain a better understanding of disruption it is worthwhile examining some of the functions of the state (rather than a narrow examination of government).

Adam Smith prescribes three governmental functions: national defence, the administration of justice, and public works "which though they may be in the highest degree advantageous to a great society, [they] are, however, of such a nature, that the profit could never repay the expense to any individual or small number of individuals".[10] Smith, however, provides a strong caveat to his public goods argument; these public works exist chiefly to "facilitate the commerce of society" and "instruction of the people". Herbert Spencer had a more limited role for government; "to defend the natural rights of man – to protect person and property – to prevent the aggressions of the powerful upon the weak – in a word, to administer justice".[11] Ludwig von Mises provides a similar perspective.[12]

> As the liberal sees it, the task of the state consists solely and exclusively in guaranteeing the protection of life, health, liberty, and private property against violent attacks. Everything that goes beyond this is an evil. A government that, instead of fulfilling its task, sought to go so far as actually to infringe on personal security of life and health, freedom, and property would, of course, be altogether bad.

A minimal state that exists simply to deter violence and administer justice will not suffer too much disruption – apart from fewer contractual dispute entering the courts. The modern state, however, does much more than simply deter violence. According to Friedrich Hayek, there are at least (additional) four areas when government action occurs.[13]

- First, where the market would not provide any service, for example, "a reliable and efficient monetary system", "setting of standards of weights and measures", "land registration, statistics, etc". Hayek includes here "the support, if not also the organization, of some kind of education".
- Second, those services that are clearly desirable, including "most sanitary and health services, often the construction and maintenance of roads, and many of the amenities provided by municipalities".
- Third, other activities such as to "encourage the advancement of knowledge".
- Fourth general regulation is a legitimate function of government.

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[10] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (Chicago: University of Chicago Press, 1976), vol 2, p. 244.
[11] Herbert Spencer, "The Proper Sphere of Government," in *The Man Versus the State: With Six Essays on Government, Society, and Freedom* (Indianapolis: Liberty Fund, 1982), 187.
[12] Ludwig von Mises, *Liberalism: The Classical Tradition* (Indianapolis: Liberty Fund, 2005), 30.
[13] Friedrich Hayek, *The Constitution of Liberty: The Definitive Edition* (Taylor & Francis, 2013), 332-34.

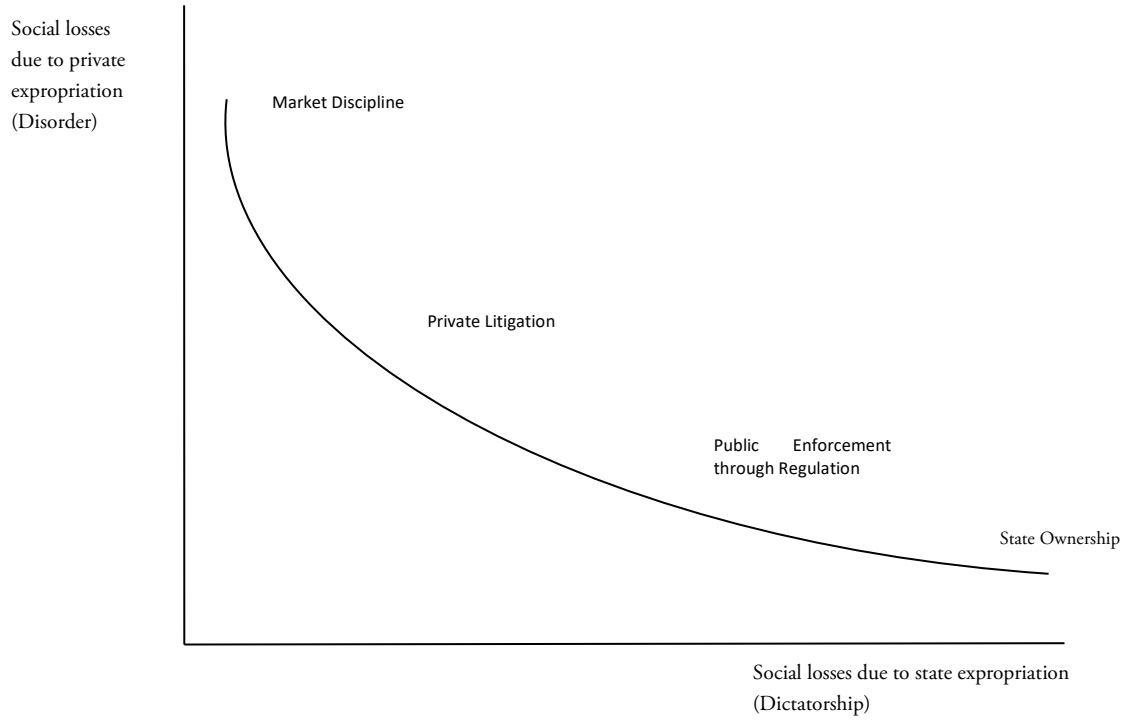
Tellingly Hayek describes the first of these four activities as facilitating "the acquisition of reliable knowledge about facts of general significance". In other words being either an information broker or a trusted third party. It is here that the activities of the government and state will be directly disrupted. Any organisation be it public or private that simply acts as an information broker or trusted third party is very likely going to be disrupted by the blockchain. Importantly to the extent that the government earns revenue from those roles that revenue is also likely to be disrupted. Hayek's idea that the private sector cannot or will not provide a reliable and efficient monetary system is discussed below. It is also very likely that many – but not all – of the regulatory functions of the state will be disrupted.

When it comes to government intervention and regulation James Buchanan has argued that society stands between anarchy and leviathan.[14] A regulatory model that incorporates this insight has been proposed by Andrei Shleifer (and co-authors) who developed an institutional regulatory theory that posits regulation as emerging from societal trade-offs between the *costs of private disorder* (anarchy) and the *costs of government dictatorship* (leviathan).[15] Disorder relates to the ability of private individuals to inflict harm on others, while dictatorship relates to the ability of government and its bureaucrats to inflict harm on citizens.

Shleifer then investigates examines four broad governance strategies that 'society' can pursue in order to achieve some objective relative to the trade-offs associated with those strategies. These strategies are; 'market discipline', 'private litigation', 'public enforcement through regulation', and 'state ownership'. The relationship between the trade-off between disorder costs and dictatorship costs and these four strategies is traced out in figure showing the so-called institutional possibilities frontier.

[14] James Buchanan, *The Limits of Liberty: Between Anarchy and Leviathan* (Indianapolis: Liberty Fund, 2000).
[15] Andrei Shleifer, *The Failure of Judges and the Rise of Regulators*, Walras-Pareto Lectures (Cambridge, Mass.: MIT Press, 2012)..

Figure 1. Institutional Possibilities Frontier



In this framework, market discipline should be considered as the regulatory default. Of course, that is not always possible and at this point the control strategy becomes private litigation. The state begins to play a role as the rules of contract and tort law are administered by courts of law staffed by bureaucrats and judges. Courts of law exist, at this level, to enforce private agreements and to adjudicate disputes between private parties.

Chicago school economists have argued that the combination of market discipline and courts of law should suffice for any regulatory framework. Shleifer, however, has argued that courts cannot always resolve disputes cheaply, predictably, or impartially. This is especially the case when the parties to the dispute have vastly different resources that they can deploy to a legal dispute.

Regulation occurs when the state not only provides a dispute resolution mechanism but also writes the rules that govern economic behaviour and transactions. There is substantial variation in how government can enforce its regulations. It can, for example, allow bureaucrats to engage in a regime of inspection and verification with fines being issued for non-compliance. Alternatively, the state can provide a set of rules that are privately litigated, or publicly litigated. Public litigation can consist of either civil or criminal charges. Similarly the regulatory agency can initiate litigation itself for breeches of the regulations, or act once a complaint has been received. This notion has been extensively debated in the context of financial regulation.

La Porta, Lopez-de-Silanes, and Shleifer investigate the impact of security laws on financial markets across 49 economies including Australia.[16] In particular they investigate how security laws operate to protect investors and whether regulators with public enforcement or rules with private enforcement lead to better outcomes. After exhaustive empirical analysis, they find that legal rules matter, but that regulators do not always matter. So long as rules can be enforced in courts investors do not need to be protected by regulators. Barth, Caprio and Levine (2006) find an analogous result in their investigation of bank regulation and supervision across 107 countries including Australia.[17] They summarise their results as raising a cautionary flag against regulatory practices that involve direct oversight and restrictions on banks. Barth et al. (2006) conclusions are remarkably similar to the La Porta et al. results. Regulations involving prescriptive behaviour and powerful regulators using public enforcement mechanisms are not the better techniques to employ for the purpose of social control.

The important point being that even before the advent of the blockchain that the role of regulators (as opposed to regulation) was being questioned.

Finally, state ownership appears to be an efficient response to those situations where the disorder costs are likely to be very high. Shleifer gives the examples of prisons, police force, and military where this is likely to be the case. The costs of disorder resulting from private ownership here are potentially so large that government needs to maintain control over these institutions. A group of scholars at RMIT University have applied this general model to several very specific instances, including the scope for regulatory reform leading to productivity improvements, environmental protection laws, the regulation of free speech, the institutions of innovation policy and entrepreneurship, prudential bank regulation, tobacco control, and education.[18] Berg and Allen extend the institutional possibility frontier to incorporate subjective perceptions of dictatorship and disorder costs.[19]

Introducing the impact of blockchain into this regulatory framework requires an analysis of the source of disorder costs. The full definition of disorder is as follows:[20]

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[16] Rafael La Porta, Florencio Lopez-de-Silane, and Andrei Shleifer, "What Works in Security Laws?," *The Journal of Finance* 61 (2006).

[17] James R. Barth, Gerard Caprio, and Ross Levine, *Rethinking Bank Regulation : Till Angels Govern* (Cambridge England ; New York: Cambridge University Press, 2006).

[18] Sinclair Davidson, "Productivity Enhancing Regulatory Reform," in *Australia Adjusting: Optimising national prosperity* (2013). "Environmental Protest: An Economics of Regulation Approach," *Australian Environment Review* 29, no. 10 (2014). Chris Berg and Sinclair Davidson, "Section 18c, Human Rights, and Media Reform: An Institutional Analysis of the 2011-13 Australian Free Speech Debate," *Agenda: a Journal of Policy Analysis and Reform* 23, no. 1 (2016). Sinclair Davidson and Jason Potts, "Social Costs and the Institutions of Innovation Policy," (2015); "A New Institutional Approach to Innovation Policy," *Australian Economic Review* 49, no. 2 (2016); Chris Berg, "Safety and Soundness: An Economic History of Prudential Bank Regulation in Australia, 1893-2008" (RMIT University, 2016); Sinclair Davidson, "Some (Micro)Economics of Red Tape and Regulation," in *Australia's Red Tape Crisis*, ed. Darcy Allen and Chris Berg (Connor Court Publishing, forthcoming); Darcy WE Allen, "The Subjective Political Economy of Innovation Policy," (2016); Aaron Lane, "Institutions of Public Education," (SSRN2017).

[19] Darcy WE Allen and Chris Berg, "Subjective Political Economy," *New Perspectives on Political Economy* (Forthcoming).

[20] Simeon Djankov et al., "The New Comparative Economics," *Journal of comparative economics* 31, no. 4 (2003).

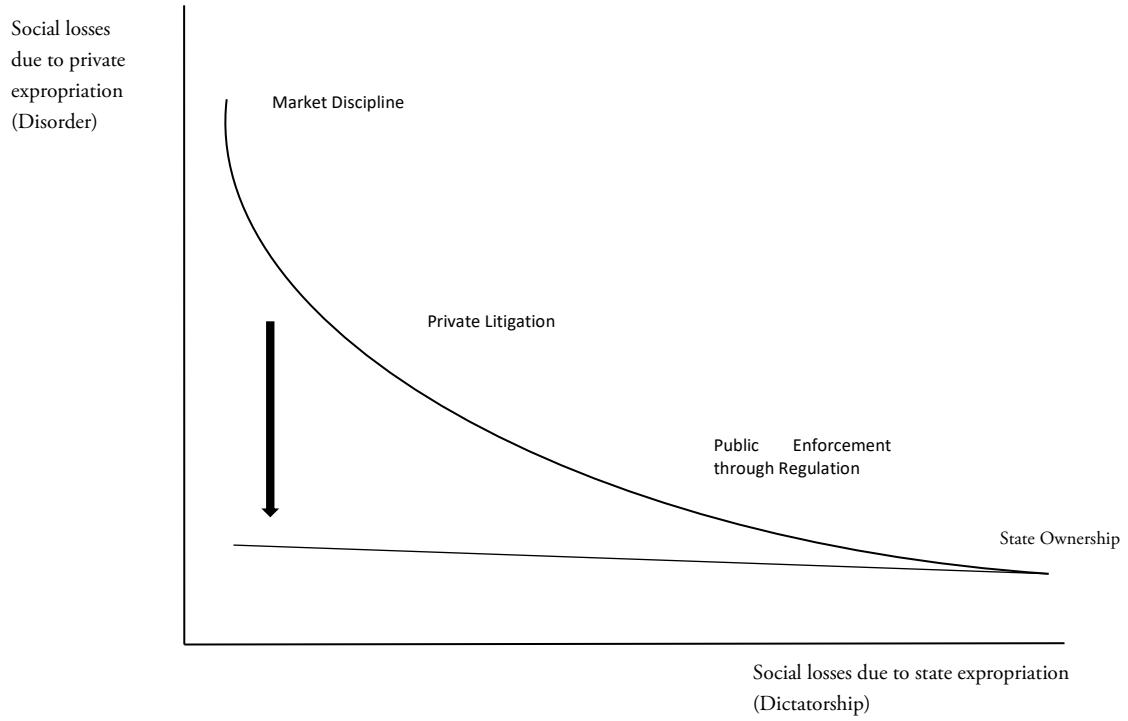
> Disorder refers to the risk to individuals and their property of private expropriation in such forms as banditry, murder, theft, violation of agreements, torts, or monopoly pricing. Disorder is also reflected in the private subversion of public institutions, such as courts, through bribes and threats, which allows private violators to escape penalties.

From that definition there are two sources of disorder: violence and opportunism. Violence is easy to understand and quite legitimately the state works to suppress violence. Opportunism requires some more explanation. Economists generally assume that individuals are self-interested. This seems to be an uncontroversial assumption – but in standard economic theory there are strict limits to self-interest. In standard theory individuals do not cheat, do not lie, and do not steal. It is well-known, however, even by economists that individuals do engage in dishonest practices, and these practices are usually discussed under the headings of adverse selection and moral hazard. Oliver Williamson, the 2009 economics laureate, has suggested the term opportunism to describe a strong-form of self-interest.[21] He argues that individuals engage in "self-interest seeking with guile", specifically "calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse". In Williamson's scheme adverse selection and moral hazard are special cases of opportunism. In the presence of opportunism disorder costs are likely to be high as individuals cannot trust their trading partners. Consequently some transactions never occur or do occur at price discounts (the market for lemons) or resources need to be expended to either engage in monitoring or bonding. In such an environment auditing and surveillance by both private actors and the government (via regulatory agencies) becomes efficient. Efficient – but at great cost to society as resources are diverted from otherwise productive use to these activities.

The blockchain is often (incorrectly) described as being a "trustless" technology. Rather than being a trustless technology, the blockchain has design principles that incentivize good behaviour on the part of market participants and ensure that transactions are self-verifying. In other words, opportunism is severely constrained – if not actually eliminated from transactions. To the extent that opportunism is constrained, the disorder costs associated with transacting on the blockchain are much lower than otherwise. This in turn has a profound impact on the shape of the institutional possibilities frontier.

[21] O.E. Williamson, *The Economic Institutions of Capitalism* (Free Press, 1985).

Figure 2: Institutional Possibilities Frontier with Constrained Opportunism



Social control to ensure good private behaviour is largely unnecessary. The design of the blockchain ensures cooperative behaviour amongst market participants and the scope for private litigation declines. So too the role of regulators is diminished. As those industries whose business models are based on information brokerage and the creation of trust are disrupted, so the regulators of industries will be disrupted too. This argument, however, does not mean that policing activities will necessarily be disrupted – to the extent that the blockchain is deployed for purposes that are illegal the need for criminal enforcement remains unchanged.

5. A CASE STUDY: REFORMING THE AUSTRALIAN PAYMENTS SYSTEM

The Australian financial system developed in the wake of the Victorian gold rush. Payments were made in private bank notes, coins, and by cheque. Even in the earliest periods of the Australian financial system currency and coins were only a small portion of the payments system – most payments were made by cheque. Prior to the establishment of a clearing house in Melbourne in 1867, cheques were settled manually, with bank clerks carting gold around the city between banks.[22] One of the minor consequences of the banking crisis of 1893 was the establishment of more formal cheque clearing houses the year later.

The framework of the Australian payments system was established as part of the takeover of Commonwealth control of the financial sector. Until 1911 the Australian financial system was a free banking system. Banks and bank-like firms were (relatively) unregulated, and Australia had no central bank with regulatory or monetary policy function. In the wake of the 1893 crisis there was a concerted

[22] C. B. Schedvin, *In Reserve : Central Banking in Australia, 1945-75* (St Leonards, NSW: Allen & Unwin, 1992).

political push for a central bank. The government took over note issue in 1910 (imposing a prohibitive tax on private notes). The Commonwealth Bank was established in 1911 as a competitor to the private banks. The Commonwealth Bank Act 1924 handed control of the note issue to the central bank, and simultaneously sought to nationalize exchange settlement by requiring banks to keep an exchange account for interbank settlement at the central bank. The Commonwealth Bank's status as a fully-fledged central bank (both with monetary and prudential regulatory purposes) was established after the 1936 Royal Commission into Money and Banking and the Banking Act 1945 which implemented the Royal Commission's recommendations.[23] In 1959 the Commonwealth Bank was divided between its commercial arm and its central banking functions, now called the Reserve Bank of Australia (RBA).

Banking deregulation and the introduction of foreign banks put significant pressure on the structures of the payments system. Non-bank financial institutions (NBFIs) chafed against the privileges held by banks in the financial sector. In 1993 the establishment of the Australian Payments Clearing Association gave foreign banks and NBFIs direct access to the payments system. Previous to this, the non-banks and foreign banks would need to have their cheques settled by the domestic major banks. Amendments to the *Reserve Bank Act* in 1998 in the wake of the Wallis inquiry gave the RBA a specific mandate for control and regulation of the payments system.

Today, the RBA both directly provides payments system services and regulates private sector payments services.[24] The RBA designates which payments systems are subject to regulation, determines the rules for access to those systems (including controlling which financial institutions and users can access those systems), sets technical and regulatory standards for the systems, and arbitrates disputes. The RBA oversees and sets standards for licensed clearing and settlement facilities. The continued responsibility for the note issue is one of the key direct services provided by the RBA. But RBA also hosts settlement exchange accounts for the final settlement of payments between banks, credit unions and building societies, and operates the Reserve Bank Information and Transfer System (RITS), a real time gross settlement service for high value settlements. The RITS was established in 1998 to reduce settlement risk between Australian banks.

The RBA's longstanding role in the payments system has a number of unappreciated downstream consequences. Historically, the prudential control of banking was justified (albeit not entirely) on the specific importance of the payments system and the reduction of settlement risk between financial institutions.

Banks have long been accorded special privileges within the Australian financial system. Section 51 (xiii) gave the Commonwealth responsibility for the banks (and state banking that extends beyond the limits of the state) and the 1909 *Huddart Parker* decision gave responsibility for NBFIs such as building societies to the states. This divided regulatory control between the Commonwealth-regulated banks and state-regulated NBFIs that gave each a distinct regulatory character. Entry to the banking sector was strictly

[23] A history of prudential bank regulation in Australia is provided in Berg, "Safety and Soundness: An Economic History of Prudential Bank Regulation in Australia, 1893-2008."

[24] A useful overview of the Australian payment system and the RBA's role within it is Committee on Payments and Market Infrastructures, "Payment, Clearing and Settlement Systems in Australia," (Bank for International Settlements, 2011).

controlled, and requests by foreign banks to enter the market knocked back, reducing competitive pressure in the sector. The *quid pro quo* provided was that banking products – particularly interest rates - were strictly regulated.

The landmark 1981 Committee of Inquiry into the Australian Financial System which set the stage for the subsequent reform of the financial system (known colloquially as the 'Campbell committee') identified competitive neutrality was one of the desirable attributes of an efficient financial system. Nevertheless, it maintained that banks had a 'special' place in the financial system, demanding higher levels of prudential regulation than NBFIs. It based this argument on three reasons: small depositors needed a safety haven for their funds, a banking collapse could have systemic consequences, and "Trust is a pre-condition for an efficient payments system: cheque-clearing institutions must be able to deal confidently with one another".[25]

The 1996 Wallis inquiry sought to make the financial system more competitively neutral in part by eliminating the distinctions between financial institutions. Banks, building societies and other NBFIs were compressed into a category 'authorised deposit institution' (ADI) which was categorized by providing deposit services that had a high 'intensity' of promise. A major goal of the Wallis inquiry was to try to remove implication that the government would support depositors in the wake of a banking failure.[26] One of the strategies by which it sought to achieve that was by removing any suggestion that banks were 'special' in a public policy sense. Yet this was only partial. Rules surrounding access to the payments system was still under Wallis pegged to the higher prudential standards that applied to banks. As Rayna Brown and Kevin Davis wrote, much competitive advantage conferred on banks would be lost under the ADI distinction but the perseverance of banks' unique regulatory position in the payments system would "do little to dispel the notion that banks are special".[27]

As this suggests, government regulatory control over the payments system is one of the key factors behind the continued 'specialness' of banks. Why does it matter if banks are special? As one of us has argued, the implied and explicit guarantee of Australian bank deposits is a reflection of the stubborn policy belief that banks are unique institutions in the financial system that require unique policy settings.[28] The development of the explicit deposit guarantee between 2001 and 2008 in Australia was facilitated by this continued belief; a belief that was justified in part because of the role banks had in the payments system.

The consequences of that relationship are significant. Deposit guarantees represent a transfer of wealth from taxpayers to depositors of failed banks. Guarantees reduce the effectiveness of market discipline on banks, distort incentives for bank management and can make a financial system less stable. Charles W. Calomiris and Stephen H. Haber have documented how political alliances between populist politicians

[25] Committee of Inquiry into the Australian Financial System, *Final Report* (Canberra: A.G.P.S, 1981), 296.
[26] For a prehistory of the deposit guarantee in Australia, see Chris Berg, "The Curtin-Chifley Origins of the Australian Bank Deposit Guarantee," *Agenda: A Journal of Policy Analysis and Reform* 22, no. 1 (2015).
[27] Rayna Brown and Kevin Davis, "The Wallis Report: Functionality and the Nature of Banking," *Australian Economic Review* 30, no. 3 (1997).
[28] Berg, "Safety and Soundness: An Economic History of Prudential Bank Regulation in Australia, 1893-2008."

and depositors can make a financial system significantly less stable.[29] As we have shown here, government regulation and control over the payments system is one (mostly unrecognized) mechanism by which that political relationship can manifest itself.

The Payments System Board determines the RBA's payment system policy. The Board is intended to be separate from the RBA's monetary policy approach by its existence as a board distinct from the Reserve Bank Board. However the RBA Governor sits on the top of each board with a mandate resolve inconsistencies. To the extent that decisions about payments system may contradict the RBA's monetary stance – as it is quite possible crypto currency decisions may do – the payments system is subordinate to monetary policy.

Bringing blockchain into the payments system

The monetary system very heavily relies on trust. Money is a social institution of trust that overcomes the double coincidence of wants that makes barter so inefficient. An instrument that can be traded for any other good or service and that has wide social acceptance as such increases the scope for mutually beneficial trade and enriches society. What is important to understanding money is the understanding of the role of trust. The individuals who receives money, however, defined must be confident that they can and will be able to exchange that money for goods and services of equal value to what they have just sold.

Money is very often defined in terms of its functions:

- Medium of exchange – money breaks the double coincidence of wants.
- Unit of account – money can be used to express prices.
- Store of value – money can be stored for future usage.

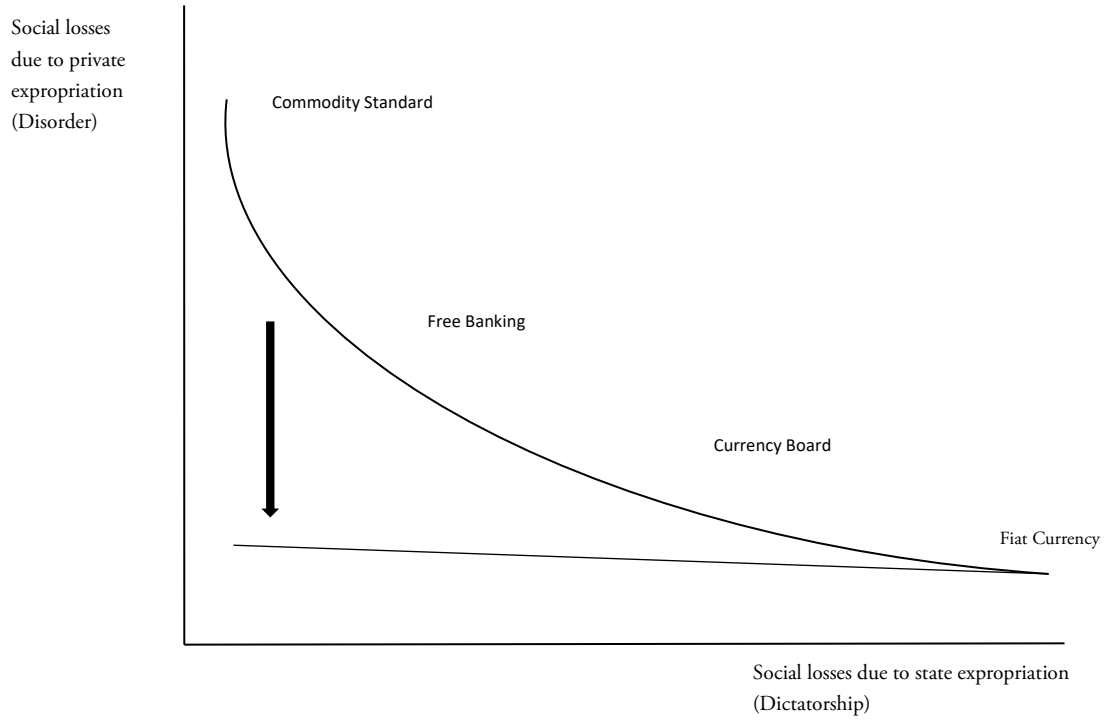
These functions, however, provide little guidance as what it is that can be used as money. Money can be plotted along an institutional possibilities frontier showing the relative disorder and dictatorship costs of the various instruments used as money (see figure 3). Disorder costs in this sense can be summarised as counterfeiting while dictatorship costs can be summarised as inflation. An obvious commodity standard would be the gold standard. In such a monetary system gold is used as money but is subject to large value fluctuations as gold supplies become relatively scare (i.e. no new sources of gold are discovered) or inflations (as new supplies of gold become available due to gold rushes or colonial acquisition). The social cost of using gold is that both individuals and governments have an incentive to debase the gold. In this instance individuals have to trust the circulating medium itself. The government has very little control over money itself.

In a free banking environment each bank is able to issue its own bank notes and individuals have to trust the institution issuing the notes to not inflate the currency. In this environment counterfeiting is the biggest problem facing the monetary system. A currency board exists where government set a fixed exchange rate between the domestic currency and a foreign currency and simply exchange currency at that

[29] Charles W. Calomiris and Stephen H. Haber, *Fragile by Design the Political Origins of Banking Crises and Scarce Credit*, The Princeton Economic History of the Western World (Princeton: Princeton University Press, 2014).

rate. Finally a fiat currency system exists where government declares money to be valuable *and* individuals accept that declaration. The biggest social costs associated with fiat currency is inflation.

Figure 3: The Monetary System on an Institutional Possibilities Frontier



Before we explain how the blockchain and cryptocurrencies can modify the institutional possibilities frontier we first discuss the dictatorship costs associated with the monetary and payments system.

It is important to clearly define what inflation is, and the assign blame for inflation. Hayek defines inflation as 'an excessive increase in the quantity of money which will normally lead to an increase in prices'.[30] Modern readers may have difficulty with this definition; inflation is now taken to mean a general and sustained increase in the level of prices. Prices increases, however, are a symptom of inflation as Milton Friedman makes clear, 'more rapid increase in the quantity of money than in the quantity of goods and services available for purchase will produce inflation, raising prices in terms of that money'.[31]

Hayek did propose, that for practical purposes, the monetary authority could aim to stabilise 'some comprehensive price level'.[32] That does appear to be the standard anti-inflation technique. Hayek, however, indicated that the index should not only contain consumer prices and that the index should be based on international prices and not just local consumer prices. Hayek was emphatic that there can be no such thing as 'cost-push' inflation. Inflation is a monetary phenomenon; 'neither higher wages nor higher

[30] Friedrich Hayek, "Further Considerations on the Same Topic," in *New Studies in Philosophy, Politics, Economics and the History of Ideas* (London: Routledge, 1975), 217.
[31] Milton Friedman and Rose D. Friedman, *Free to Choose: A Personal Statement* (Pelican, 1980), 297.
[32] Hayek, *The Constitution of Liberty: The Definitive Edition*, 464.

prices of oil, or perhaps of imports generally, can drive up the aggregate price of all goods *unless the purchasers are given more money to buy them*' (emphasis original).[33]

Hayek did believe that government was responsible for inflation and that it had become easy to inflate after the 'destruction of the gold standard'. He sympathised with people who regarded a return to that system as being the 'real solution' to inflation. He went as far as to say, 'I still believe that, *so long as the management of money is in the hands of government*, the gold standard with all its imperfections is the only tolerable safe system' (emphasis original).[34] He did not think, however, that a return to the gold standard was a practical proposition. He gave two reasons for this; first the gold standard was an international standard and international coordination would be required to reintroduce it and second, the gold standard relied on the 'mystique of gold' and 'the general belief that to be driven off the gold standard was a major calamity and a national disgrace'.[35] This attitude and belief had ceased to exist.

By the 1970s Hayek had come to support the denationalisation of money – choice in currency. Choice in currency is the idea that individuals should be able to transact in any currency or commodity that they choose.[36]

> There could be no more effective check against the abuse of money by the government than if people were free to refuse any money they distrusted and to prefer money in which they had confidence.

By exposing national currency to competition governments' would have to behave responsibly and maintain the value of their currency. Under such an arrangement, 'those countries trusted to pursue a responsible monetary policy would tend to displace gradually those of a less reliable character'.[37] Hayek did propose that various banks or other institutions issue their own currencies and that these currencies be allowed to trade alongside all other currencies. He also suggested that the notion of legal tender be abandoned, except that if the government were to issue its own currency that it should specify what currency be accepted for tax purposes, the settlement of debt, and the payment of torts. With some minor exceptions financial institutions do not issue their own currencies and the notion of 'legal tender' is still with us.

One critic of Hayek's proposal Douglas Jay wrote:[38]

> But in thinking you can take control of the currency out of the hands of modern elected governments, and put it in the hands of some mysterious wise men meditating in some ivory tower, Professor Hayek is flying in the face of reality. The public simply will not allow control of money to be put beyond their control any more than control of laws or taxes. The only hope, even if a frail one, is to educate governments to act sensibly.

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[33] *Denationalisation of Money: The Argument Refined*, Hobart Special Papers (London: Institute of Economic Affairs, 1978), 91.
[34] Ibid., 126.
[35] *The Constitution of Liberty: The Definitive Edition*, 462.
[36] "Choice in Currency: A Way to Stop Inflation," in *New Studies in Philosophy, Politics, Economics and the History of Ideas,* (London: Routledge, 1976), 225.
[37] Ibid., 227.
[38] Douglas Jay, "Commentary," in *Choice in Currency: A Way to Stop Inflation* (London: Institute of Economic Affairs, 1976).

Jay's critique is quite prescient – it is not clear why trust should be placed in 'in the hands of some mysterious wise men'. On the other hand, that appears to be his only criticism of Hayek's proposal.

The current domestic and international financial monetary system does not immediately resemble what Hayek called for in his proposal – yet the monetary system does have remarkable similarities to Hayek's proposals. Governments' continue to issue their own currency, but most financial institutions issue their own credit cards. Individuals can, in many economies, hold a credit card from any bank in the world. Individuals can own bank accounts anywhere in the world – often denominated in (almost) any currency. Currencies do compete against each other in international markets and in many economies the US dollar has displaced the local currency as the currency of choice. Exchange controls have been lifted in many parts of the world, and the control of money is largely beyond public control. Individuals can chose to contract in any currency, yet in most advanced economies are happy to use the local currency. As Hayek indicated, 'unless the national government all too badly mismanaged the currency it issued, it would probably continue to be used in everyday retail transactions'.

At face value then it appears that bank issued credit cards can approximate Hayek's denationalized money proposal. There are, however, two vulnerabilities to this notion. First credit cards are subject to government regulation and censorship, and second credit cards require banks to resolve asymmetric information problems and as such involve trust within the banking system.

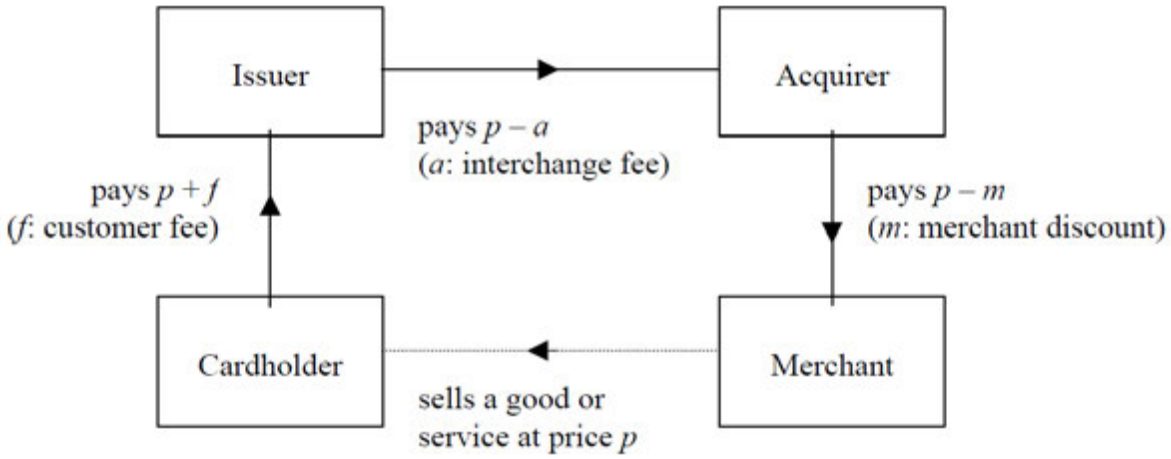
Governments around the world have used their regulatory powers to undermine the use of credit cards by alleging that so-called interchange fees are excessive or anti-competitive. Ronald Coase famously argued that "if an economist finds something – a business practice of one sort or other – that he does not understand, he looks for a monopoly explanation".[39]

Interchange fees and two-sided markets

Interchange fees are fees that banks charge each other as a result of their respective clients entering into a credit card transaction. The regulatory 'concerns' relate to excessive pricing, price fixing, abuse of market power, the creation of barriers to entry, increased consumers prices generally, and excessive use of credit cards relative to alternate payment methods.

[39] Ronald H Coase, "Industrial Organization: A Proposal for Research," in *The Firm, the Market, and the Law* (University of Chicago Press, 2012), 67.

Figure 4: The operation of an interchange fee



Source: Rochet and Tirole[40]

This depiction shows the net cash flows in the various relationships. The consumer (cardholder) buys goods and services from the merchant. The consumer then pays the price (p) and a net fee to his financial institution. The consumer's financial institution then pays the price (p) less the interchange fee (a) to the merchant's financial institution who then pays the merchant the price (p) less their own net fee. This depiction of the issue makes very plain that if both financial institutions are to remain profitable that m > a. The merchant pays the interchange fee. Of course, this is not surprising. The interchange fee exists to rebalance financial relationships within a market arrangement often described as being a two-sided market – sometimes also referred to as a platform economy.

Two-sided markets exist when two distinct groups of economic agents must be simultaneously satisfied to facilitate trade. The traditional media model is a typical and easily understood example. A platform (e.g. a newspaper) must simultaneously meet the needs of both advertisers and subscribers in order to be profitable. In the traditional media business model advertisers pay for the news, not subscribers. In the equivalent credit card model, merchants more often than not pay for the use of credit cards, not credit card users. This is due to consumers requiring more of an inducement to hold and use credit cards than merchants need to accept those cards. To argue that this relationship is somehow inefficient is to argue that consumers have monopoly power over merchants.[41]

In a competitive market for financial services, the interchange fee would be used to reduce the net consumer fee for credit cards.[42] The basic issue, then, is not one of monopoly exploitation, but rather is one of efficient contracting in the shadow of what 2009 economics laureate Oliver Williamson called the

[40] Jean-Charles Rochet and Jean Tirole, "An Economic Analysis of the Determination of Interchange Fees in Payment Card Systems," *Review of Network Economics* 2, no. 2 (2003).
[41] For more discussion on this point see Sinclair Davidson and Jason Potts, "Australian Interchange Fee Regulation: A Regulation in Search of Market Failure," (International Alliance for Electronic Payments, 2015).
[42] See the corresponding case of debit cards see Mark Manuszak and Krzysztof Wozniak, "The Impact of Price Controls in Two Sided Markets: Evidence from Us Debit Card Interchange Fee Regulation," in *Working Paper* (Federal Reserve System, 2017).

Fundamental Transformation that occurs in consequence of transactions that require both parties to make idiosyncratic investments – transforming ex ante competition into an ex post bilateral monopoly – that can subsequently give rise to opportunism.[43]

The credit payments system is not and cannot ever be an interlinked series of anonymous spot markets exchanging financial commodities because the information asymmetries and moral hazards inherent in these exchanges require the parties to the transactions to make idiosyncratic investments (also known as asset specificity) that bind them into a bilateral monopoly – i.e. the fundamental transformation – in which quasi-rents are only secured through mechanisms to inhibit opportunism by aligning incentives to long term relational contracting.

The interchange fee, we argue, has evolved as an efficient governance mechanism to achieve this outcome without requiring horizontal integration – i.e. collapsing the four party payments system into a three-party payments system, and the associated losses of technical and information efficiency and competition that would imply. Banks need to make transaction specific investments in acquiring information about the properties of customers and merchants, the value of which – the quasi-rent – is realised through a long term relationship.

Cryptocurrencies, like Bitcoin for example, are an even closer approximation to Hayek's notion of private money than are credit cards issued by private banks. In the very first instance cryptocurrency is less likely to be subject to government regulation and censorship than are credit cards. Furthermore cryptocurrencies – Bitcoin in particular – were developed for the very purpose of making them non-counterfeit (i.e. Bitcoin cannot be double-spent) and trustless. Depending upon the design of the cryptocurrency they may also be inflation-proof. This is especially the case if we accept the Hayekian argument that inflation is driven by government. Our argument is that cryptocurrency substantially reduces disorder costs within the monetary system; indeed it could also reduce dictatorship costs. Furthermore the blockchain while recording and facilitating transactions acts as an automatic clearing system, with clearance occurring on average every ten minutes, it becomes difficult to imagine what role, if any, the government or any of its agencies would play in the payments system if payments occur on the blockchain.

The important question is whether cryptocurrency can operate as money. In terms of the functions it can perform all three and does. The government has previously expressed some concerns around the use of Bitcoin:[44]

> The Australian Crime Commission's acting chief executive, Paul Jevtovic, says the virtual currency's anonymity makes it highly attractive to criminals and money launderers, though little is yet known about how widespread it is in illicit markets. Bitcoin has become of growing concern to the agency. ''The ACC is currently working with partners to explore the Bitcoin market and other digital currencies, to better understand its size and criminal threat,'' he said.

[43] Williamson.
[44] Ilya Gridneff, "More Than Play Money: A Virtual Currency Loved by Geeks Is Fast Becoming the Currency for Crooks," *Sydney Morning Herald*, 1 June 2013.

> Meanwhile, Bitcoin is being used legitimately in Australia for everything from buying meat via online butcher Honestbeef to electronics at Gadget Direct, clothes from Patcht or books from Favoryta.

The problem being that those "concerns" are just as true for the use of cash.

> The Australian Crime Commission's acting chief executive, Paul Jevtovic, says [cash's] anonymity makes it highly attractive to criminals and money launderers, though little is yet known about how widespread it is in illicit markets. [Cash] has become of growing concern to the agency. ''The ACC is currently working with partners to explore the [cash] market and other […] currencies, to better understand its size and criminal threat,'' he said.
>
> Meanwhile, [cash] is being used legitimately in Australia for everything from buying meat via online butcher Honestbeef to electronics at Gadget Direct, clothes from Patcht or books from Favoryta.

An argument can be mounted that Bitcoin is too volatile to serve as a store of value or as a unit of account. Yet most government backed currencies are also somewhat volatile in value on the foreign exchange markets and all suffer from persistent inflation. By contrast, we believe that Bitcoin in particular is too valuable to use for day-to-day transactional purposes. That, however, does not preclude some or other cryptocurrencies being developed for day-to-day usage.

6. FROM PAYMENTS SYSTEMS TO CRYPTOBANKING

The introduction of cryptocurrencies into the payments systems is likely just the beginning of the more widespread adoption of blockchain for economic activity throughout the economy. Smart contracts provide an opportunity for financial institutions to be built directly on blockchain, as a 'layer' above the cryptocurrency. Such applications would take advantage of the immutability and cryptographic verifiability of the blockchain to algorithmically manage financial transactions and contracts.

To understand the possibilities blockchain offers the monetary and financial system, we should first consider how blockchains are likely to affect the accounting profession. As a Deloitte report published in 2016 outlined,

> Blockchain technology may represent the next step for accounting: Instead of keeping separate records based on transaction receipts, companies can write their transactions directly into a joint register, creating an interlocking system of enduring accounting records. Since all entries are distributed and cryptographically sealed, falsifying or destroying them to conceal activity is practically impossible. It is similar to the transaction being verified by a notary – only in an electronic way.
>
> The companies would benefit in many ways: Standardisation would allow auditors to verify a large portion of the most important data behind the financial statements automatically. The cost and time necessary to conduct an audit would decline considerably. Auditors could spend freed up time on areas they can add more value, e.g. on very complex transactions or on internal control mechanisms.[45]

This automated verification process would have significant consequences for regulatory and legal systems that currently rely on direct or third-party auditing. For example, governments impose prudential controls on banks in order to ensure that they have adequate liquidity and capital buffers in the case of an

[45] Deloitte, "Blockchain Technology: A Game-Changer in Accounting?," (2016).

economic crisis. At the first instance, publicly verifiable and secure blockchains could lower the cost observing banks to ensure they are compliant with prudential requirements.

However, these blockchains also change the regulatory dynamics in more fundamental ways. One of the primary justifications for prudential regulation in banking is that shareholders and depositors lack the information to observe the financial practices and stability of their bank. Shareholders and depositors are therefore unable to impose market discipline on banking practices, freeing management to act recklessly with their funds, and consequently creating a need for external government regulation. As Barth, Caprio and Levine describe the perverse dynamic of a lack of information in banking,

> If depositors and other creditors cannot readily verify the condition of banks, the once some begin withdrawing funds, others, not knowing the condition of the bank, may also withdraw their funds, thereby setting in motion a bank run. And if a run is going on at one bank, unless there is an explanation that is specific to that institution, it can spill over to neighbouring banks.[46]

Barth, Caprio and Levine contrast this with a situation where there is "literally perfect information (all eventualities in the world known with certainty)" where runs would not occur. Banks tend to be less transparent than other firms as their assets are both non-physical and consist of long term liabilities. However, publicly verifiable blockchains go some way to reversing this. Algorithmically audited records of liabilities on a publicly verifiable blockchain has the potential to make financial firms significantly *more* transparent than firms which have their assets tied up in physical capital and real property. This application reduces information asymmetries between depositors and shareholders on the one side and bank management on the other, providing the former with the information necessary to impose market discipline.

An extension of this idea is what we call a cryptobank. As we have written, a cryptobank is

> an autonomous blockchain application that borrows short and lends long, perhaps matching borrowers with lenders directly. A cryptobank structured algorithmically by smart contracts would have the same transparency properties as the bank with a public blockchain ledger but with other features that might completely neglect the need for regulators. For example, a cryptobank could be self-liquidating. At the moment the cryptobank began trading while insolvent, the underlying assets would be automatically disbursed to shareholders and depositors.[47]

This is necessarily speculative. But it demonstrates the far reaching consequences of blockchain for the regulatory structures that have governed Australia's financial and monetary system for a century.

7. INDEPENDENT PAYMENTS REGULATION: THE UK MODEL

Australia has an opportunity to be a world leader in the adoption of blockchain technology. Australia's regulatory system is robust and (compared to many other developed countries) relatively adaptable. A number of Australian authorities are already investigating blockchain applications. In this paper we have discussed challenges and opportunities for integrating blockchains into the Australian payment system.

[46] Barth, Caprio, and Levine.
[47] Berg, Davidson, and Potts.

Blockchains are in a state of rapid development. The question is what governance arrangement is best placed to oversee the introduction of cryptocurrencies and to bring about the necessary reform.

The RBA itself is an independent statutory authority, meaning that it is formally separated from the lines of delegation and accountability in a Westminster democracy.[48] This structure has a number of benefits and weaknesses. Central banks were the first independent regulators, instituted in this way under the belief that political incentives might harm the neutral application monetary policy.[49]

At the international level, the institutional framework for the implementation of payments system regulation varies considerably. Here we recommend the Australian government consider the institutional example of the United Kingdom, which has a structurally separate payments regulator.

The UK's *Financial Services (Banking Reform) Act 2013* created a new independent regulator for payments, Payment System Regulator (PSR). Until the 2013 legislation, payments regulation was governed largely by the Bank of England and the Financial Services Authority. The UK Treasury was empowered to designate a system as a regulated ('recognised') payment system. In addition the Payments Council existed as a self-regulatory body for firms involved in the payments system. In 2009 the Payments Council announced that cheques were to be phased out in a decade. Controversy surrounding this decision (which was reversed) led to a series of reviews that culminated in the 2013 reforms.

The 2013 reforms established the PSR as an independent body subsidiary to the Financial Conduct Authority. The PSR has its own statutory objectives and PSR board. The chair of the board is also the chair of the Financial Conduct Authority. The PSR is funded by a levy on the regulated payments firms. The industrial representation embodied by the former Payments Council is included in the Payment Systems Regulator Panel. This body is established by statute as an advisory panel, and takes positions that are independent of the PSR.

The United Kingdom provides a model for payments system regulation in Australia. It provides more legitimacy than the current arrangement: interchange fee regulation in particularly is a form of regulatory taxation, and ought not to be the province of the central bank. Vesting payments regulation in a dedicated regulatory authority would encourage greater regulatory expertise. The creation of the Australian Prudential Regulatory Authority in 1998 was driven by the recognition that the task of central banking and the task of financial regulation are distinct and can create conflicts of interest as single authorities try to balance the needs of one of its mandates against the other.

Finally, and more crucially for the blockchain economy, an independent payments system regulatory brings greater adaptability than the current system. As Potts and MacDonald have argued:

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[48] For discussions on independent regulatory authorities, see Chris Berg, *Liberty, Equality & Democracy* (Ballarat, Victoria: Connor Court Publishing, 2015); *The Growth of Australia's Regulatory State: Ideology, Accountability and the Mega-Regulators* (Melbourne: Institute of Public Affairs, 2008).

[49] On the other side, independent regulators suffer a democratic legitimacy problem, as their powers derive from a democratic mandate but are not controlled democratically. Rather than relitigating that debate here, in this paper we assume the bipartisan agreement that monetary and payments system regulation ought to be independent is maintained.

> The regulatory role cannot stand outside the design and implementation of the technology, thus requiring specialised competence. As a specialist in monetary policy, the RBA does not have, nor should it have, these technical capabilities in code development or platform design. The Payments System Board was never well-placed within the Reserve Bank of Australia because of the very different specialisations.
>
> These exciting developments in cryptocurrency as a new technology for payments furnish yet another reason why the Payment Systems (Regulation) Act 1998 should be repealed, and Payment Systems regulation moved to a specialist regulator.[50]

The analysis in this paper supports those recommendations. The United Kingdom's system of a dedicated payments regulator – potentially subsidiary to the Australian prudential regulator, APRA – provides a model for the Australian government to manage the introduction of blockchain financial services and cryptocurrencies into the Australian payments system.

8. CONCLUSION

The analysis in this paper suggests that the optimal regulatory control over cryptocurrencies in the payment system – indeed in the financial system in general – is likely to look significantly different than that which prevails in a pre-blockchain world. As we have argued, cryptocurrencies look a lot more like Friedrich Hayek's private banking and private money than the state fiat currency which has dominated the twentieth century financial system. Blockchain powered smart contracts will also reshape the structure of financial institutions. Blockchains are a potentially revolutionary technology that could shape almost every part of the political and economic system. The questions that policymakers will have to face as blockchain applications become more widespread are not just *how* government regulates, but *why* it regulates.

9. ABOUT THE AUTHORS

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[50] Jason Potts and Trent MacDonald, "Who Should Regulate Bitcoin? Challenges and Opportunities for Blockchain Technology in Australia," (2016).

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