

Lecture Notes on Multi-Sided Platforms

(July 2019)

These lecture notes will provide an introduction to platform-based markets. A *platform* is a mechanism that enables two or more groups of people or firms to interact. For example, the Visa credit card network is a *two-sided platform* that enables merchants and consumers to interact, i.e., it enables consumers to purchase things from merchants. Visa competes with other credit card networks, such as MasterCard, American Express, and Discover, and we will want to examine *how* that competition works. Likewise, Uber is a two-sided network that enables drivers and riders to interact; in this case riders can request a ride from A to B, and nearby drivers can provide that ride. And Uber competes with other “ride-sharing” networks, such as Lyft.

The Chinese firm Alipay, on the other hand, is a *multi-sided platform* that enables consumers to interact with each other (e.g., make payments to each other), merchants to interact with each other, and consumers to interact with merchants (by making payments to merchants). Alipay competes with other “mobile payment” platforms, such as Weichat Pay and Apple Pay.

In all of the two-sided and multi-sided platforms mentioned above, competing firms have different “networks” or “standards.” A Visa credit card, for example, operates on a different network than an Amex card. Thus network externalities play an important role in the economics of platforms. The Visa credit card network, for example, can only work if there are many consumers that hold and use a Visa credit card, and there are many merchants that accept Visa cards. Hence the marginal social benefit of one more person or firm joining

or using the platform is greater than the marginal private benefit. As a result, there can be a role for government in promoting and/or regulating the network. And as we will see, it is the Chinese government that enabled the UnionPay credit card network to get off the ground, and ultimately become the worlds largest card network, as measured by the number of cards outstanding.

We will begin with some basic concepts: how platforms can get started, how they work (and sometimes fail to work), and how they compete. Then we will turn to two examples, which we will examine in some detail: ride-sharing platforms (e.g., Uber and Lyft) and credit card networks.

1 Examples of Platforms

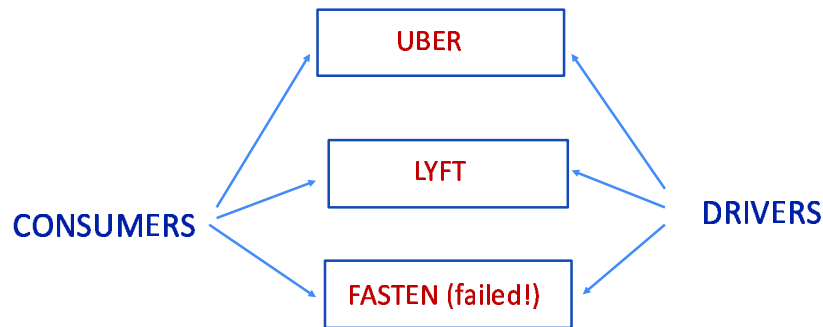
An important two-sided platform familiar to most readers is *ride sharing*, which is illustrated in Figure 1. Uber, started in 2009, was the first ride-sharing platform. Its development and growth was made possible by two things: (1) the development and ubiquity of smart phones (which enabled riders to request rides and drivers to respond to those requests); and (2) the regulation of taxicab markets, including city-by-city limits on the number of taxi medallions, and thus on the number of cabs available to riders.¹ These regulations existed in most American cities, but also in many cities worldwide, which enabled Uber to rapidly expand worldwide.²

In most large American cities, Uber competes with Lyft, another ride-sharing platform. Other platforms have entered, but in most cases have failed. One example, shown in Figure 1, is Fasten, which began operating in 2015 in Austin, Texas and Boston, Massachusetts, but went out of business three years later. The entry and then failure of Fasten raises an important question: How many ride-sharing platforms can co-exist and compete in any given market? The CEO of Lyft has said that “Ride Sharing is a natural duopoly,” but that

¹In New York City, for example, the total number of taxi medallions in 2011 was 13,150, roughly the same number as in 1939. For more details, see Example 9.5, “Why Can’t I Find a Taxi,” in R. Pindyck and D. Rubinfeld, *Microeconomics*, 9th Ed.

²As of July 2019, Uber operates in 63 countries and 785 metropolitan areas, its 2018 revenue was \$11.3 billion, and it had a 2018 net loss of \$1.8 billion.

TWO-SIDED PLATFORMS: RIDE SHARING



COMPETITION AMONG NETWORKS; STRONG NETWORK EXTERNALITIES, LOW SWITCHING COSTS

PROBLEM: HOW TO PRICE EACH SIDE OF THE PLATFORM?

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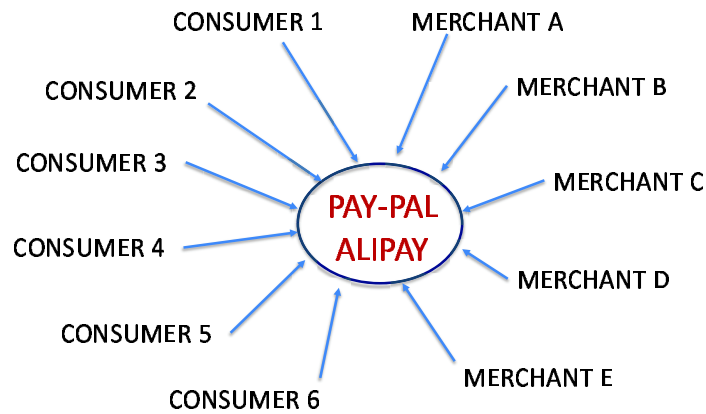
Figure 1: Ride Sharing Platforms

statement might just be self-serving. On the other hand, in most markets there are typically only one or two ride-sharing platforms.

I just said “in most markets.” But what is a “market” when it comes to ride-sharing? Are ride-sharing services in Boston, Chicago, and San Francisco all in the same market? As always, market definition is determined by elasticities of substitution on both the demand and supply sides. On the demand side, riders in Boston can easily respond to price differences by substituting Lyft for Uber (or vice versa), but riders in Boston cannot substitute a Lyft ride in Chicago for an Uber ride in Boston. Likewise, an Uber driver in Boston can easily offer his or her services to riders on Boston’s Lyft network, but not to riders in Chicago. Thus markets for ride sharing are regional in nature — ride sharing in the Boston area is a different market than ride sharing in the Chicago area.

Figure 1 points out some important characteristics of ride-sharing platforms. First, there are strong network externalities. Lyft can only operate successfully in any give (regional) market if there are many consumers who have the Lyft app on their phones and want to use it, and if there are many drivers who are willing to provide rides under the Lyft network. Second, switching costs are relatively low, both for drivers and riders. In fact many drivers

ALIPAY AND PAY PAL: MULTI-SIDED PLATFORMS



PRICING: TWO-SIDED, WITH PRICE DISCRIMINATION BUT MOST TRANSACTIONS ARE CONSUMER TO MERCHANT

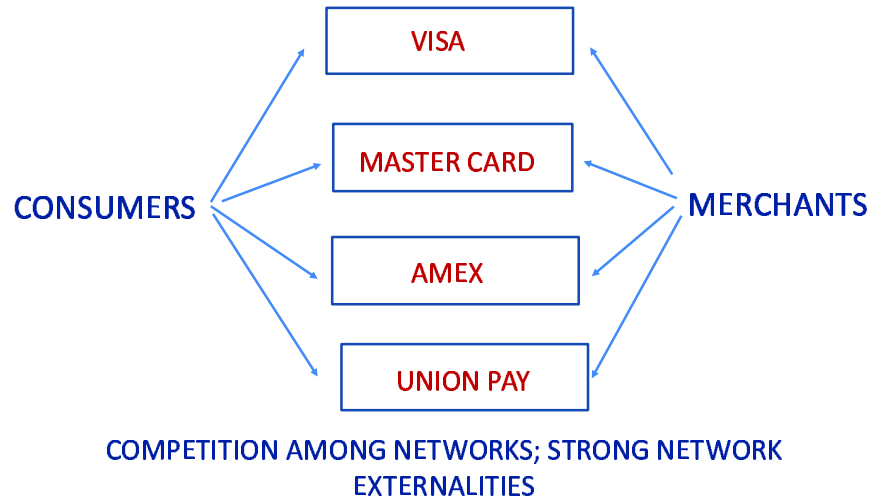
Figure 2: Mobile Payment Platforms

will respond to ride requests from both the Uber and Lyft networks, and in principle could respond to requests from a new network. Likewise, many consumers have both the Uber and Lyft apps on their phones, and switch between these platforms depending on driver availability or differences in prices.

And that brings us to one of the toughest problems for a ride-sharing platform — or almost any other two-sided platform. *How to price the two sides of the platform?* How much should riders pay to go from A to B, and how much should drivers receive (the difference going to the platform)? There is no simple answer to this question, but as we examine ride-sharing and other platforms in detail, we will see examples of pricing decisions that were far from optimal.

Figure 2 illustrates a multi-sided platform: *mobile payments*, i.e., payments that can be made with smart phone. Examples are Alipay, Weichat Pay, Samsung Pay, and Apple Pay. If you have the Apple Pay app on your phone, you can use it to make payments to merchants (e.g., in the E62 cafeteria). You would link your Apple Pay account to a credit card or to a bank account, and that account would be charged when you use the app. But note that you can also use Apple Pay to transfer money to other consumers, and merchants can use

TWO-SIDED PLATFORMS: CREDIT/CHARGE CARDS



PRICING PROBLEM COMPLICATED BY ISSUERS

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Figure 3: Credit Cards and Charge Cards

it to transfer funds to other merchants (e.g., to pay for supplies and materials). That is what makes the platform “multi-sided.” (But as of 2019, the vast majority of transactions on Apple Pay are from consumers to merchants.)

Finally, Figure 3 illustrates an important two-sided platform that we will examine in detail, namely credit and charge cards. As we will see, the network externalities are very strong. And pricing is very complicated! How much should consumers pay when they use a Visa card to buy something from a merchant, and how much should the merchant pay? These pricing decisions are made by the card networks (i.e., the Visa network decides what those prices will be). But for some of these networks pricing is made more complicated by the fact that the cards are supplied to consumers by *issuers* (e.g., a bank), rather than the network itself. We turn to credit and charge cards next.

2 Credit and Charge Cards

There are very few markets in which network externalities play a stronger role than the market for credit and charge cards. The nature of the (positive) network externality should

be easy to see: You might carry and often use a Visa card because lots of merchants accept the card, making it easy for you to make purchases. Likewise, lots of merchants accept Visa cards because such a large number of consumers have them and use them.³

This externality creates a “chicken-and-egg” problem that makes starting a new card network very difficult. Consumers will obtain and use the card of a new network only if lots of merchants accept the card, but lots of merchants will accept the card only if many consumers have them. So to start a new network, we must somehow convince *both* consumers and merchants to obtain, use, and accept the cards of that network. This is a much harder job than it would be if all we had to do was convince *either* consumers *or* merchants to adopt the card. Note the difference, for example, between card networks and computer productivity software. All Microsoft had to do was get many or most computer users to buy and use Office — not an easy job, but once enough people were using Office, the network externality would take over and more and more people would use Office. With a credit card network, we must get two completely different groups to accept and use the card, and each group will do so only if the other group does.

2.1 Charge Cards, Credit Cards, and Debit Cards

There are three major categories of cards that can be used to buy goods and services: charge cards, credit cards, and debit cards. The focus of these notes will be on charge and credit cards, but it is important to understand the differences among all three. All three are sometimes called *payment cards* because they can be used as a form of payment.

A *charge card* provides a transaction service; i.e., it allows consumers and merchants to do business with each other without the need for cash, checks, or other types of payment. An example of a charge card is the American Express card. You can use an Amex card to make purchases, but you are expected to pay your balance due at the end of each month. The very first payment cards, beginning with the Diners Club card introduced in New York

³These lecture notes provide a bare-bones introduction to card networks and how they work. For an excellent and thorough treatment, see David Evans and Richard Schmalensee, *Paying with Plastic: The Digital Revolution in Buying and Borrowing*, 2nd Ed., MIT Press, 2004.

in 1950, were all charge cards.

A *credit card* bundles two services together: the transaction service that a charge card provides, along with a credit service. Example, of course, are Visa and MasterCard. About half the people (in the U.S.) who hold one or more credit cards make use of only the transaction service — they pay their balance due in full at the end of each month. The other half of cardholders also use the credit service; they maintain a balance due, on which they pay interest each month.

A *debit card* is something in between a credit card and a charge card. It, too, provides a transaction service, in that you can use the card as a form of payment just as you would a credit or charge card. However, rather than receiving a bill at the end of the month with a balance due, as you would with a credit or charge card, every charge you make with the card is debited directly from your bank account. (Some banks will issue you a debit card that provides some credit, in that the bank will allow the account balance to go negative, and of course charge you interest accordingly.)

There are actually two different kinds of debit card transactions. An *off-line* debit transaction is signature-based, so that you would use the card the same way you would use a credit card. In the U.S., an off-line debit transaction can only be done with a card that is part of the Visa or MasterCard networks. When you make an off-line debit transaction, the merchant gets paid (and your bank account gets debited) in about two or three days.

An *on-line* debit transaction requires a PIN number. Merchants prefer on-line debit because they get paid immediately, and they also pay a much smaller discount. Thus a merchant will often suggest that you enter a PIN number.

The use of debit cards has grown extremely rapidly over the past decade, so that debit card charge volume is now close to credit card volume. This might seem surprising given that debit cards have distinct disadvantages compared to credit cards. The most important disadvantages are (1) your account is debited immediately, eliminating about a month of free credit (“float”), and (2) a mistaken, fraudulent, or otherwise disputed charge is debited from your bank account and stays debited until the dispute is resolved, unlike a credit card, for which a disputed charge is removed from your account until it is resolved. Given these

disadvantages, how can we explain the rapid growth of debit cards? First, it is much easier for students and other people without a credit history to obtain a debit card than a credit card. Second, many people fear (sometimes correctly) that with a credit card they will be unable to constrain their spending.

2.2 Open and Closed Systems

There are three important functions that must be carried out for any card systems. (1) Cards must be issued to consumers, and then cardholders must be sent monthly statements, and dealt with when disputes or other problems arise. (2) Merchants must be solicited and signed up to accept the cards, and then dealt with when problems arise. (3) All of the card transactions must be processed, and the processing must be quick. There are two fundamental types of card systems, and they differ based on how these functions are carried out.

American Express and Discover operate *closed systems*. In a closed system, the card company carries out all three functions. Thus American Express solicits and issues cards to consumers, sends its cardholders monthly statements and collects their payments, and deals with lost cards and disputed charges. American Express also signs up (“acquires”) merchants to accept the cards, helps them set up the necessary infrastructure (card readers, etc.), makes sure they are paid on time, and deals with any complaints or other issues. Finally, American Express processes all of the transactions involving its cards.

Visa and MasterCard, on the other hand, operate *open systems*. The only fundamental function that they perform is the processing of transactions (often with the help of third parties). (Visa and MasterCard also perform a secondary function of creating brand standards for their cards, advertising their networks, and doing some R&D related to card security.) Then who finds the consumers and merchants? Any bank can join the Visa or MasterCard network (or both) and issue cards. Likewise, any bank can become an “acquirer” and solicit, sign up, and service merchants.

If you carry a Visa or MasterCard credit card, your relationship is with the bank that issued you the card, and *not* with Visa or MasterCard. If you have a dispute over a charge,

Table 1: **Top U.S. Card Issuers by Purchase Volume in 2015**

Rank	Issuer	Purchase Volume (\$ Billions)	Cards (Millions)
1	American Express	678.1	37.4
2	Chase	615.2	91.8
3	Bank of America	331.2	54.6
4	Citibank	291.1	67.8
5	Capital One	249.8	89.4
6	Discover	132.3	51.3
7	U.S. Bancorp	127.1	21.5
8	Wells Fargo	125.5	23.8
9	Barclays	75.1	15.7
10	Synchrony	47.7	28.4

(Source: Nilson Report, February 2017)

you take it up with your issuer, not with Visa or MasterCard. And the particular terms for your card (annual fee, possible rebates, the interest rate on unpaid balances) is likewise determined by your issuer. And a merchant that accepts Visa and MasterCard must take up any dispute with its acquiring bank, not with the Visa or MasterCard networks. If you carry an American Express card, on the other hand, your relationship is with American Express, which settles any disputes you might have and sets the terms for your card.

There are advantages and disadvantages to each type of system. (If that were not the case, we wouldn't see two systems.) What are the advantages of an open-loop system such as MasterCard's? What are the advantages of a closed-loop system. Think about these questions, and we will discuss them in class.

Table 1 shows the top U.S. card issuers in 2010, based on annual purchase volume. In terms of the number of cards issues, Chase was number 1 by far, with 130 million cards. American Express had only issued about 50 million cards, but because an Amex cardholder typically spends much more per purchase than a Visa or MasterCard cardholder, it was first in terms of purchase volume.

2.3 Interchange and the Merchant Discount

What happens when you make a purchase with a charge card or credit card? What is the cost to the merchant (the “merchant discount”) when you use a card? The answers depend on whether the card is part of a closed or open system, and which card network it belongs to. Let’s start with Visa and MasterCard, which are among the largest networks in terms of the numbers of cardholders.⁴ Figure 4 illustrates what happens when you make a purchase.

Suppose you go to a store and use a Visa card (issued, let’s say, by Bank of America) to buy something for \$100 (A). You (or the cashier) swipe the card through the card reader, or insert the card in the chip reader. Your card number identifies the issuer of the card, so a “message” is sent to that issuer requesting authorization for the purchase (B). If your account is delinquent, the authorization will be denied, but let’s assume that your account is in good standing, in which case the authorization will be approved (C). All of this takes two or three seconds. You then leave the store with your purchase.

The store will then request payment from its acquiring bank (D). The acquiring bank will request payment from Visa (E), and Visa will request payment from the issuing bank, in this case Bank of America (F). The issuing bank will immediately pay Visa, but not the entire \$100. It will keep a fraction of the \$100 for itself, usually around 1.7% (G). That fraction is called the *interchange fee*, and the specific percentage is determined not by the issuing bank, but by the card network, in this case Visa. The interchange fee is important because it accounts for the bulk of the merchant discount, and because it is a major source of revenue for card issuers. (The other major source of revenue is the interest payments from cardholders who keep a credit balance.)

Visa will then make a payment to the acquiring bank, but it will also keep a certain percentage of the \$100 for itself (H). That percentage, usually around 0.2%, represents the fees Visa collects for processing the transaction. (The processing fee includes both a fixed

⁴On a world-wide basis, the largest network in terms of the numbers of cardholders is currently UnionPay. Given the “chicken-and-egg” problem, how did UnionPay become so big? As we will discuss in class, the Chinese government played an important role.

Credit Card Transaction

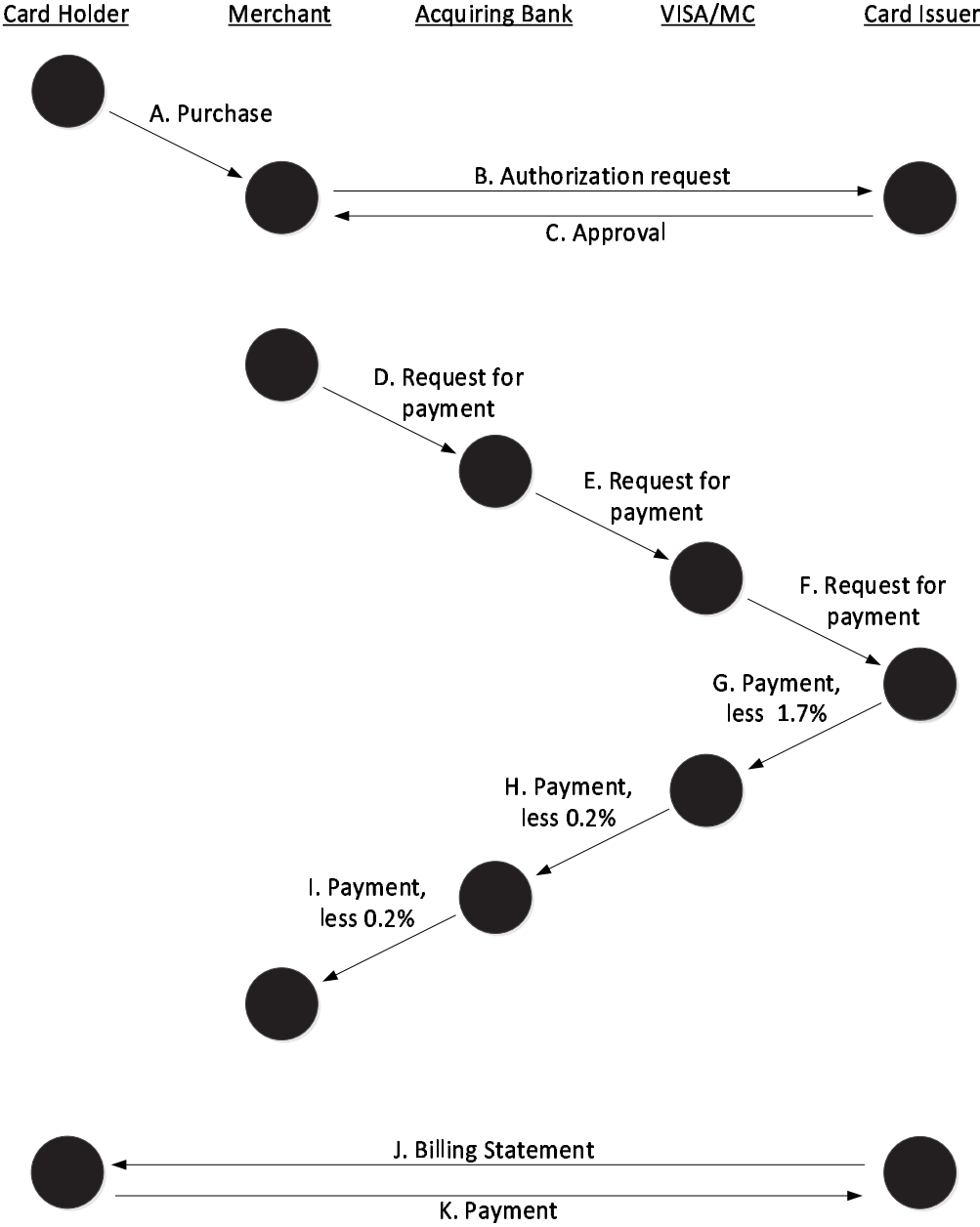


Figure 4: Visa or MasterCard Credit Card Transaction

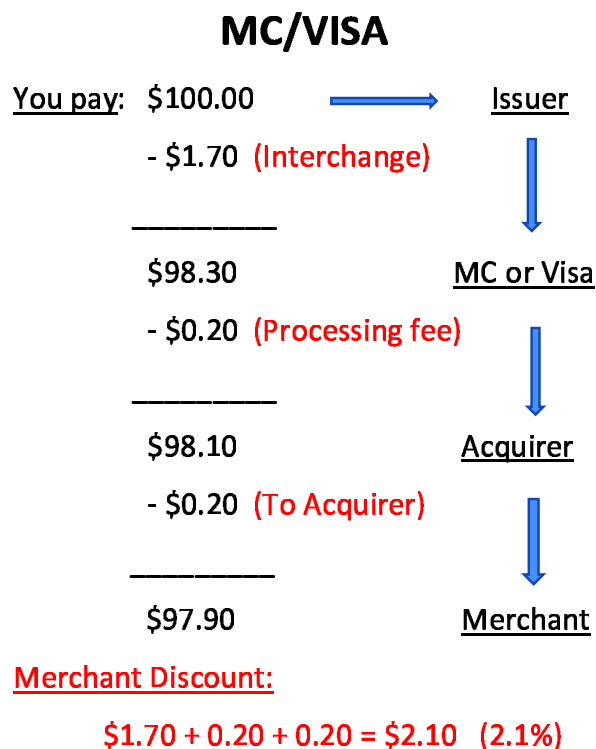


Figure 5: Merchant Discount: MC and Visa

and variable component, so 0.2% is just a rough average figure.) Lastly, the acquiring bank pays the merchant, but also withholds a certain percentage of the \$100 (usually around 0.2%) as payment for its work in servicing the merchant (I). At the end of the month you will receive a billing statement that will include the \$100 purchase (J), and to keep your account in good standing, you will make a payment to the issuer (K).

So what does the merchant get in the end? Based on the percentages shown in Figure 4, it receives $\$100.00 - \$1.70 - \$0.20 - \$0.20 = \$97.90$, i.e., the transaction costs the merchant 2.1% of the original \$100. That 2.1% is called the *merchant discount*. The calculation is summarized in Figure 5.

Suppose that you buy your \$100 item using an American Express card. Because Amex is a closed system, the process is much simpler. Once again an authorization request is made, now to Amex (the card issuer). Assuming your account is in good standing, the authorization is approved. Now the merchant's request for payment goes directly to Amex.

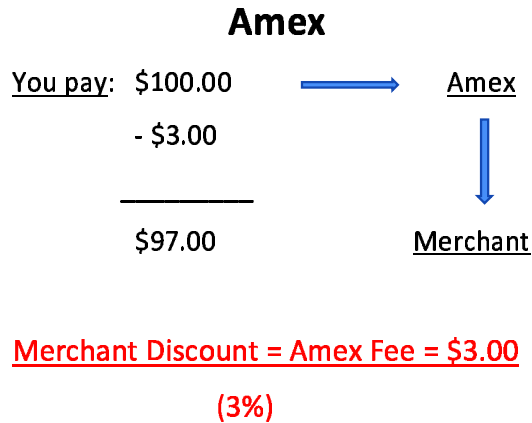


Figure 6: Merchant Discount: American Express

Amex will then pay the merchant, but retain a fee, which might be about 3%. That fee is the entire merchant discount. This is summarized in Figure 6.

2.4 Recent Litigation and Regulation

For many years, merchants have complained about the discounts that they pay when accepting a credit card, charge card, or debit card. In addition, some of the rules that the card networks have imposed on merchants and on issuing banks have been criticized as unfair and/or anticompetitive. As a result, there has been a great deal of legal and regulatory activity over the past decade or so regarding card networks. Here are some of the more important results:

- **2000:** Previously banks that issued MC cards could also issue Visa cards, and vice versa. However they were prohibited from issuing Amex or Discover cards. The DOJ sued, and MC and Visa were forced to end their issuance restrictions.⁵
- **2005:** A large group of merchants sued MC and Visa over the discount on debit card transactions, and the requirement of MC and Visa that if they accepted the network's credit card, they also had to accept the debit card, and vice versa. As a settlement

⁵For a detailed discussion of this litigation and the issues involved, see Robert S. Pindyck, "Governance, Issuance Restrictions, and Competition in Payment Card Networks," in J. Kwoka and L. White, Eds., *The Antitrust Revolution*, 6th Ed., Oxford Univ. Press.

in that suit, MC and Visa were forced to end their “Honor all Cards” rule. They also agreed to lower their off-line debit interchange rates.

- **2007:** Amex sued MC and Visa for damages resulting from past issuance restrictions. MC and Visa agreed to settle (for about \$1 billion and \$2 billion respectively).
- **2010:** The DOJ sued MC, Visa, and Amex on their “steering” rules, which prohibit a merchant from offering a discount to a customer who pays in cash rather than with a card. MC and Visa agreed to stop; Amex decided to fight this in court.
- **2011:** The Durbin Amendment to the Dodd-Frank Wall Street Reform and Consumer Protection Act gave the Federal Reserve control over interchange rates. The Fed reduced debit interchange rates further, and also considered regulating credit interchange. The Fed also issued restrictions on issuer practices.
- **2012:** MasterCard, Visa, and several major banks (including JPMorgan Chase and Bank of America) had been sued by a large group of merchants who claimed they acted anticompetitively in setting interchange rates and processing fees. In a settlement announced in July 2012, MC, Visa, and the banks agreed to pay the merchants more than \$6 billion in damages, and also agreed to reduce their processing fees.
- **2015:** EuroPay, MasterCard and Visa required merchants to upgrade to equipment that can read chip-enabled cards or else be liable for fraud and security breaches.
- **2017:** MasterCard and Visa settle for \$6.2 billion with some plaintiffs, but not all, as a result of 2012 antitrust case on interchange rates. In addition, MasterCard and Visa will have to pay penalties, determined by the court, for their business practices.
- **2018:** MasterCard and Visa must litigate or else settle with the hold-out plaintiffs, i.e., plaintiffs that did not agree to join the 2018 settlement.