The Exchange Rate: What's in It for Prices?*

BY GEORGE ALESSANDRIA AND JARCY ZEE

Large movements in the exchange rate are quite common, and they substantially alter one's purchasing power when traveling abroad. Yet these exchange rate movements tend to have a smaller impact on the price of foreign goods that are imported. Following an appreciation of the euro against the dollar, European firms selling products to American firms for import do not raise their prices by nearly as much as the prices they charge consumers in the European market. Similarly, American firms sell their products at higher prices in Europe than at home. This incomplete, or partial, pass-through of exchange rate movements to domestic import prices is important for inflation, American purchasing power, and the pattern of trade between countries. In this article, George Alessandria and Jarcy Zee discuss some of the reasons why changes in the exchange rate may not be fully passed through to import prices.

In the summer of 2008, traveling to Europe was quite expensive for Americans, while traveling to the U.S. was a bargain for Europeans. For instance, on average, a Big Mac[1] was almost 50 percent more expensive in Europe than in the U.S. ($5.31 in Europe and only $3.57 in the U.S.). Just five years earlier, the gap was much smaller: Big Macs in Europe cost only about 15 percent more than Big Macs in the U.S. ($3.05 in Europe and $2.65 in the U.S.).[2] A key component of the 35 percent increase in the price of European Big Macs relative to U.S. Big Macs was a nearly 50 percent depreciation of the U.S. dollar relative to the euro: from $1.06 per euro in January 2003 to $1.58 per euro in July 2008. As the dollar depreciated, McDonald's raised both the Big Mac's dollar price in the U.S. and the euro price in Europe, but the price increase in the U.S. was not large enough to offset the effect of a weaker dollar, making European Big Macs relatively more expensive.

The increase in the relative price of European Big Macs was typical for a broad range of goods. Over this same period, the broad basket of goods making up the European consumer price index[3] (CPI) became 45 percent more expensive relative to the broad

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[1] Big Mac™ is a registered trademark of the McDonald's Corporation.

*The views expressed here are those of the authors and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

[2] Based on Big Mac prices as of July 24, 2008, and January 16, 2003. The Big Mac index is published periodically by *The Economist* and is a useful way of comparing the price of goods in different countries. For more information about the Big Mac index, go to *http://www.economist.com/markets/bigmac/.*

[3] The consumer price index measures the price of a basket of goods that the typical consumer in a country purchases. The CPI is one of the main indicators measuring inflation.

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basket of goods making up the U.S. CPI. Just as with the Big Mac, the main source of the increase in the price of European goods in Europe relative to U.S. goods in the U.S. was the 50 percent depreciation of the U.S. dollar against the euro.[4] Only a small part of this exchange rate movement was offset by U.S. prices rising slightly faster than European prices in euros (18 percent rise in the U.S. vs. 13 percent rise in Europe).

These movements in the exchange rate have made buying all goods in the U.S. relatively inexpensive compared with buying goods in Europe, even if these goods were produced in Europe.[5] For instance, while the sticker price of an Audi A4 sold in the U.S. but produced in Germany rose 13 percent in dollars from 2003 to 2007, its sticker price in Germany when converted to dollars rose 28.5 percent as the dollar depreciated.[6] Across a broad range of imported goods, we find similar price changes in that European firms selling products to American firms for import have not raised their prices by nearly as much as the price they charge Europeans to buy their products in Europe. Similarly, American firms are selling their products to Europe for more than they sell their products at home. These pricing policies imply that U.S. consumers purchasing imports have been partially insulated from the effect of a weaker dollar.

The incomplete, or partial, pass-through of exchange rate movements to domestic import prices is important for inflation, American purchasing power, and the pattern of trade between countries. In this article, we present some evidence on the pass-through of the changes in the exchange rate to import prices in the U.S. and abroad, and we discuss some reasons why changes in the exchange rate may not fully pass through to import prices.

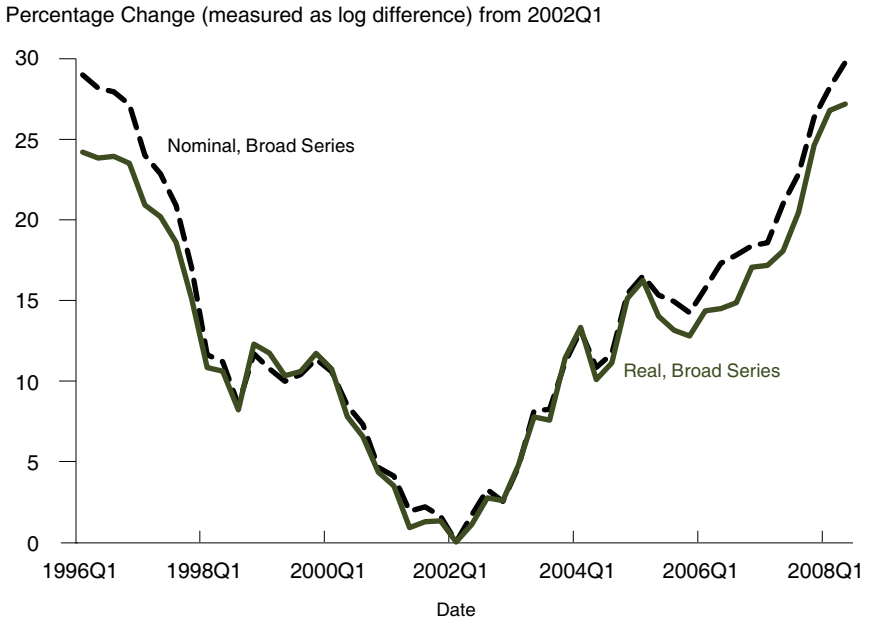
BEHAVIOR OF EXCHANGE RATES AND CONCEPT OF PASS-THROUGH

The nominal exchange rate, which measures the rate at which one country's currency can be exchanged for another country's currency, tends to experience large and sustained changes. As seen in Figure 1, the U.S. nominal exchange rate relative to the currency of its trading partners (the dashed line) fell substantially from 1996 to 2002, so that it took 29 percent fewer U.S. dollars to buy one unit of foreign currency in 2002 than in 1996. This period of U.S. dollar appreciation was followed by a period, from 2002 to 2008, when the nominal exchange rate increased 29 percent, indicating a depreciation of the U.S. dollar.

These changes in the nominal exchange rate are not offset by movements in the local prices or production costs of goods, so that there are also large and sustained changes in the relative cost of producing goods or buying goods in different countries. The real exchange rate, which measures the cost of goods sold in the

FIGURE 1

U.S. Nominal and Real Exchange Rates



[4] The relative change in price, Δq, is calculated by $\Delta q = \Delta e + \Delta p - \Delta p^*$, where Δe is the change in the nominal exchange rate, Δp is the change in the U.S. price level, and Δp^* is the change in the European price level.

[5] Since the first quarter of 2003, nominal European manufacturing costs have risen 14.5 percent in euros, while U.S. manufacturing costs have risen only 12.1 percent, measured in dollars.

[6] These price changes are based on sticker prices in the U.S. from annual issues of Ward Automotive's *Car Specifications and Prices* and pre-tax sticker prices in Germany from the European Commission's biannual car price reports in May 2003 and May 2007. In 2003, the U.S. model was an Audi A4 1.8T FrontTrak (1.8L, 170 hp), and the German model was an Audi A4 1.9 TDI (1.9L, 130 hp). In 2007, the model priced in each country was an Audi A4 2.0 TDI. Exchange rate conversions were $1.13/euro in 2003 and $1.37/euro in 2007.

U.S. relative to the rest of the world, is calculated as a ratio of foreign and domestic consumer prices measured in a common currency. Because most goods consumed are domestically produced, the real exchange rate provides a good proxy for how the relative cost of producing goods in different countries changes over time. Figure 1 demonstrates that the real exchange rate (solid line) and nominal exchange rate (dashed line) tend to move together, indicating that relative production costs are highly correlated with the nominal exchange rate.

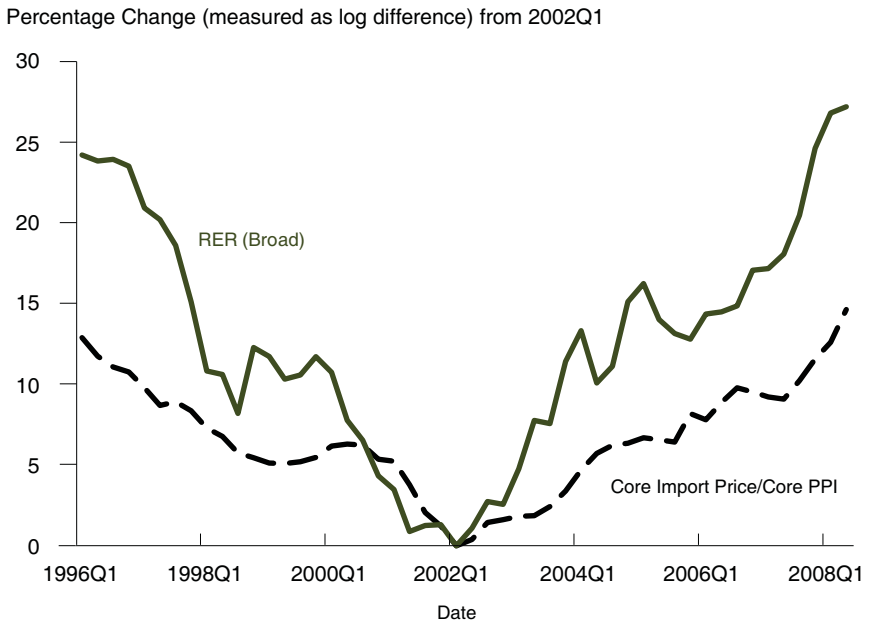
These fluctuations in the cost of producing goods in the U.S. relative to overseas markets also affect the cost of producing the goods that the U.S. imports (and exports). In response to the movements in relative costs, foreign firms alter the price they charge for their goods in the U.S. and at home. Figure 2 shows both how the relative cost of American goods fluctuates (the real exchange rate indicated by the solid green line) and how the price of imported goods relative to the price of goods produced in the U.S. changes. The two lines have a similar pattern. As the cost of producing goods overseas fell relative to the U.S. from 1996 to 2002, so did the price of goods imported to the U.S. Similarly, as the cost of producing goods overseas rose from 2002 to the present, so did the price of imported goods. The magnitudes are quite different, though. From 1996 to 2002, relative to the cost of producing and selling U.S. goods, the cost of foreign goods fell 24 percent, while the price at which Americans could import these goods fell about 13 percent. Similarly, since 2002, producing goods overseas has become about 27 percent more expensive than producing in the U.S., yet the price at which these goods are imported into the U.S. has risen only about 15 percent. Thus, import price movements tend to be smaller than movements in relative costs or exchange rates.

The extent of pass-through can be measured as the ratio of the change in the import price to the change in relative production costs. A pass-through value of 100 percent denotes complete pass-through and indicates that a 10 percent change in foreign cost results in a 10 percent change in the import price. Pass-through less than 100 percent, denoted as incomplete or partial pass-through, implies that prices are less responsive to movements in relative production costs. To measure pass-through, we could just use the nominal exchange rate as a measure of the relative change in costs. However, because the exchange rate movement may be associated with changes in the costs of producing the good, the approach we take will be conditioned on changes in costs. To control for these changes in costs, for import prices, it is common to use a measure of costs or prices in the source market. For our baseline, we take the change in price in the source country market measured in nominal terms using the destination market's currency as a measure of the change in costs and then estimate pass-through using the change in price in the destination market.

For example, suppose the ABC car company charges $10 for a car in its home market of Europe when converted to U.S. dollars and $10 for the same car in the U.S. If the company raises its price to $20 in Europe and $17 in the U.S., pass-through is 70 percent. However, the price change in Europe relative to the U.S. may result from either a change in the euro to dollar nominal exchange rate or from the cost of producing the good. Suppose initially that $1 can be exchanged for 1 euro and the car sells for 10 euros in Europe and $10

FIGURE 2

Import Prices Relative to Producer Prices



in the U.S. In the next year, suppose the U.S. dollar depreciates, so now $2 are needed to buy 1 euro. If ABC keeps its car price in Europe at 10 euros, or $20 when converted to U.S. currency at the new exchange rate, but raises its price in the U.S. to $17, we find pass-through to be 70 percent.[7] Alternatively, suppose the nominal exchange rate does not change but that the price of steel, an important input for producing cars, increases. If ABC decides to double its price in Europe to 20 euros, or $20 at a constant $1 per euro exchange rate, and raise its price to only $17 in the U.S., we will also find pass-through to be 70 percent.[8]

EVIDENCE OF INCOMPLETE PASS-THROUGH

Many studies measure pass-through in different countries, industries, and time periods. These studies also distinguish between pass-through to import prices and pass-through to the consumer price index. The focus here is on pass-through to import prices in the long run. *Empirical Estimates of Exchange Rate Pass-Through* explains the empirical framework of some of these studies. Pinelopi Goldberg and Michael Knetter survey these studies and find that pass-through to import prices is about one-half. Thus, if foreign costs rise 10 percent, the import price of foreign goods is expected to rise 5 percent. Pass-through is nearly the same following either an increase or a decrease in foreign costs.[9]

Pass-through also tends to vary by industry: It's relatively high for raw materials and energy and relatively low for manufactured goods. José Campa and Linda Goldberg estimate pass-through from a broad sample of countries in the energy industry to be about 77 percent, on average. Giovanni Olivei estimates pass-through for nonenergy industries and finds pass-through of about 39 percent for the automobile industry, in the long run.

We next turn to the recent evidence of pass-through to import

Empirical Estimates of Exchange Rate Pass-Through

Recent research has focused on understanding how pass-through has changed over time and how it differs across countries. A study by Mario Marazzi and co-authors uses disaggregated data to document a decline in exchange rate pass-through since the 1980s and to attribute it to the decrease in industry-specific changes. José Campa and Linda Goldberg study trade between the U.S. and a broader sample of countries to observe pass-through across time.

The two studies use a similar empirical framework, running a regression of changes in import prices on changes in the exchange rate and foreign costs using quarterly data:

$$\Delta p_t^j = \beta_j + \sum_{i=0}^{-4} a_i^j \Delta e_{t+i}^j + \sum_{i=0}^{-4} b_i^j \Delta w_{t+i}^j + \sum_{i=0}^{-4} c_i^j \Delta p_{t+i}^{com} + \sum_{i=0}^{-4} d_i^j \Delta gdp_{t+i}^j + v_{it}^j$$

where for country j, p_t^j is the import price, e_t^j is the exchange rate, w_t^j is foreign cost, gdp_t is real GDP and p_t^{com} is a measure of commodity prices. The regressions in the two papers differ slightly. Campa and Goldberg run their regression using quarterly data from the first quarter of 1976 to the first quarter of 2004 for 16 countries and drop the term controlling for commodity prices. Marazzi and co-authors focus on just the U.S. from the fourth quarter of 1972 to the fourth quarter of 2004, exclude the term of real GDP, and constrain the term on foreign costs measured using foreign price levels to be the same as that on the exchange rate.

Short-run pass-through is represented by the coefficient a_0^j and long-run pass-through is represented by the sum of coefficients $\sum_{i=0}^{4} a_i^j$. Campa and Goldberg find that long-run pass-through of exchange rates into manufacturing import prices is about 44 percent for the U.S. using this regression. Their micro estimates from the broad range of countries show an average exchange rate pass-through into manufacturing import prices of about 60 percent.

Marazzi and co-authors find that pass-through to import prices in the 1980s was roughly 50 percent, but it has declined to about 20 percent in the mid-1990s. Campa and Goldberg, however, find less evidence of the decline in a broader sample of countries.

[7] $ERPT = \frac{\Delta p}{\Delta e + \Delta p^*} = \frac{0.7}{1 + 0} = 0.7$, where Δp is the percent change in price, Δe is the percent change in the nominal exchange rate, and Δp^* is the percent change in the foreign price.

[8] $ERPT = \frac{\Delta p}{\Delta e + \Delta p^*} = \frac{0.7}{0 + 1} = 0.7$, where Δp is the percent change in price, Δe is the percent change in the nominal exchange rate, and Δp^* is the percent change in the foreign price.

[9] In a study of exchange rate pass-through to U.S. import prices, Giovanni Olivei finds that pass-through does not depend on the direction of the exchange rate movement in 32 out of 34 industries.

prices for manufactured goods between the U.S. and two of its major trading partners, Canada and the European Union. Together, Europe and Canada account for about 30 percent of U.S. international trade over the period 2000 to 2007. We focus on these countries not only because they are major trading partners of the U.S. but also because we have fairly accurate measures of both their production costs and U.S. import prices. There have also been some fairly large and sustained exchange rate movements that allow us to measure pass-through over long intervals.[10]

Pass-through on European goods to prices in the U.S. has been approximately 25 percent. Figure 3 presents the relative cost of manufactured goods produced in Europe to manufactured goods produced in the U.S. (solid line). As before, we split the period evenly between a large appreciation of the dollar from 1996 through the first quarter of 2002 and a large depreciation since then. In the first half of the sample, European goods became 38 percent less expensive to produce, yet the import price (the dashed line) fell only by about 10 percent, indicating that pass-through was just under 25 percent. In the second half of the sample, producing European goods became just over 60 percent more expensive, yet import prices rose only about 14.5 percent. Again pass-through was only about 25 percent.

At about 50 percent, pass-through on Canadian goods has been somewhat higher than for European goods. Figure 4 presents the cost of manufactured goods produced in Canada relative to the cost of goods manufactured in the U.S., again divided into a period of dollar appreciation followed by a period of depreciation. In the first half of the sample, Canadian goods became about 13 percent cheaper to produce than American goods, and this translated into a drop in the price of Canadian imports of just under 7 percent, for pass-through of about 52 percent. In the latter half of the sample, the situation reversed, with relative costs rising 29 percent and import prices rising about 15.5 percent. Again, pass-through was just over 50 percent.

[10] While we focus on pass-through of relative cost movements that occurred along with changes in nominal exchange rates, it is also possible to measure pass-through of relative costs when the exchange rate does not change, such as when a country follows a fixed exchange rate regime.

WHY IS PASS-THROUGH INCOMPLETE?

Fundamentally, incomplete pass-through suggests that firms are sometimes charging different prices for the same good in different countries[11] and that, over time, they are changing prices in each market by different amounts. We now discuss some of the common reasons why firms may elect to change their prices by different amounts in different countries following a change in their costs.

One common reason for incomplete pass-through, suggested by Rudiger Dornbusch, is that firms face different competitors in each market, and therefore, exchange rate movements affect the competitive environment differently across countries. For instance, most cars available in the U.S. are produced in the U.S., while most cars available in Europe are produced in Europe.

[11] The *Business Review* article by George Alessandria and Joseph Kaboski presents evidence that some of the long-run differences in prices across countries are related to differences in income.

FIGURE 3

Europe's Real Exchange Rate and Import Prices

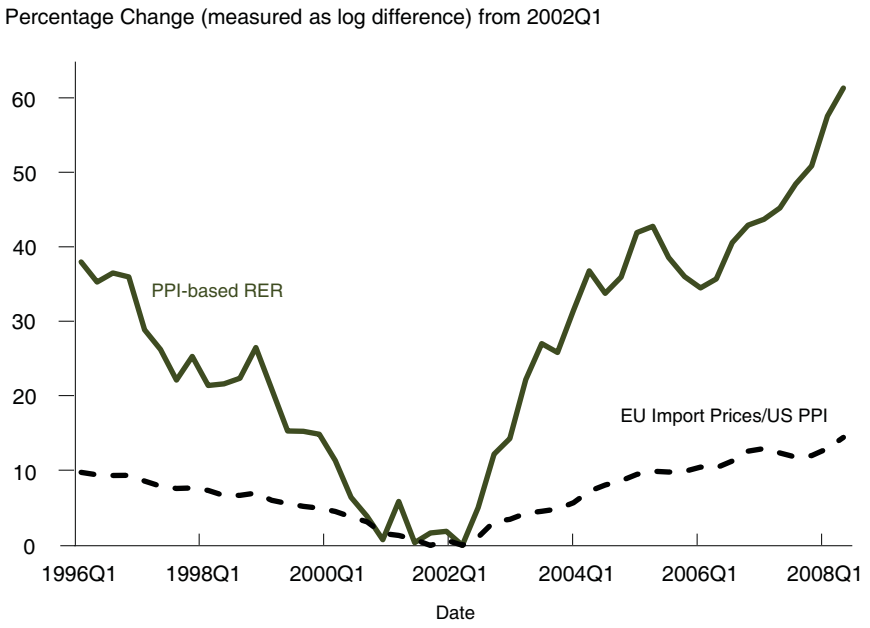
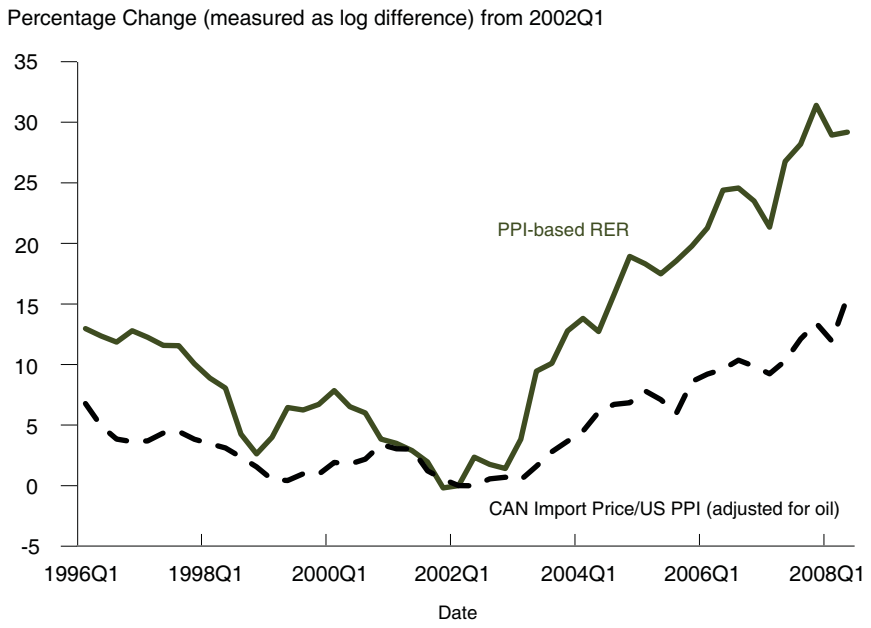


FIGURE 4

Canada's Real Exchange Rate and Import Prices



But, of course, you can find European cars in the U.S. and U.S. cars in Europe. When the euro appreciates, or becomes more valuable compared to the dollar, European carmakers will face higher relative costs. In the U.S., European carmakers may find it difficult to raise their prices, since there are many relatively low-cost U.S. cars available. In Europe, however, there are fewer relatively low-cost U.S. cars available, so European carmakers can raise their prices by more, or at least they do not have to lower prices to avoid losing customers.

Firms exporting their goods to the U.S. may also decide not to raise their prices following a depreciation of the dollar because doing so would have a negative impact on its future profits. For instance, an automaker that sells a car today also expects to sell repair services for that car in the future and increases the likelihood that the same customer will buy another car in the future. Thus, if that automaker raises its prices a lot today and sells fewer cars, it will have fewer customers (and sales and profits) in the future. A study by George Alessandria shows that firms carefully consider the effects of their price changes on both today's profits and future profits. It turns out that maximizing the sum of current and future profits may imply a relatively smaller price adjustment today in order to prevent losing customers and future sales and service.

Local inputs to production of foreign goods can also cause import prices to move by less than the exchange rate. In a 2002 article, José Campa and Linda Goldberg find that increases in the amount of imported inputs that originate from the home market, used in goods that are eventually re-exported to the home country, are associated with lower pass-through into import prices. For instance, the cost of an Airbus airplane imported to the U.S. from Europe would be expected to rise with an appreciation of the euro. However, if the airplane's engines are produced by GE in the U.S. with a relatively constant cost in dollars, the cost to Airbus of producing the airplane will not have risen by the same amount as the exchange rate. Thus, Airbus may raise its price by less than the exchange rate has appreciated. In our estimates of pass-through, these effects of inputs on prices are captured by the foreign cost, so it only shows up in an estimate of pass-through that uses the nominal exchange rate to measure costs.

Incomplete pass-through to import prices may also arise if local inputs are bundled to make final sales. For instance, a European car sold in the U.S. is bundled with some U.S. services, mainly the wholesale services in getting the car from the port of entry in the U.S. to the dealership and then the dealer's retail services. In another article (2006a), Campa and Goldberg show that these local components mostly matter for the price that the final purchaser pays. (See *Pass-Through to Consumer Prices from Exchange Rates* for more details.) However, these downstream costs can also affect import prices and pass-through. Again, consider the case of a European car manufacturer following an appreciation of the euro. In addition to raising the cost of producing European cars relative to U.S. cars, the appreciation increases the downstream costs of selling cars in Europe relative to the U.S. These differences in downstream costs imply that the price at which the carmaker sells to the dealer will be relatively more important for the final sales price, and hence sales, to consumers in

Pass-Through to Consumer Prices from Exchange Rates

The consumer price index (CPI) is a weighted average of the prices of goods, based on a standard basket of consumer goods. It is used to measure inflation. Movements in exchange rates are not only passed through to import prices; they can also be passed through to consumer prices. Thus, pass-through to consumer prices measures the sensitivity of consumer prices to changes in the exchange rate.

José Campa and Linda Goldberg study exchange rate pass-through to import and consumer prices for 21 countries. On average, pass-through to import prices is 64 percent, while pass-through to consumer prices is about 17 percent for these countries. For the U.S., consumer price pass-through is close to zero. However, consumer price pass-through is higher in more open economies, such as the Netherlands (38 percent) and Spain (36 percent). In all cases, though, consumer price pass-through is lower than import price pass-through, indicating that exchange rate movements have a smaller effect on domestic price levels than on import prices.

Consumer price pass-through tends to be lower than import price pass-through because the consumer price index includes only a small share of imported goods. Thus, holding import price pass-through constant across countries, consumer price pass-through tends to be higher in countries that purchase a high share of goods from abroad, since a larger fraction of the consumption bundle in these countries is affected by the exchange rate. However, it is also possible to measure pass-through to consumer prices of individual imported goods. For instance, in a case study of beer, Rebecca Hellerstein finds that pass-through to retail prices on imported beer is only about 11 percent. She attributes this incomplete pass-through to retail prices to three things: incomplete pass-through of import prices by the beer manufacturers; incomplete pass-through by retailers of the price charged by the beer manufacturer; and the presence of wholesale and retail distribution costs that do not change with the exchange rate.

the U.S. than to consumers in Europe. Thus, the carmaker has an incentive to raise its price by less in the U.S. than in Europe.

An alternative, less conventional view is that incomplete pass-through results primarily from difficulties in measuring prices accurately. In this view, the composition of imports may change systematically with the exchange rate. In a third article (2006b), Campa and Goldberg observe that these composition shifts can change measures of pass-through on aggregate import prices. Shifting imports toward industries with lower pass-through will cause aggregate import pass-through to decline. Likewise, a shift of imports toward industries with higher pass-through will increase pass-through of aggregate prices. Alternatively, a depreciation of the dollar may cause high-price foreign firms exporting to the U.S. to exit, or buyers may shift their purchases toward lower quality imported goods. For instance, consumers may prefer imported cars with smaller engines or cloth seats rather than leather ones. Measurement of pass-through does not adjust for these changes in the goods being imported to the U.S.

Another possibility is that companies are not accurately reporting the price of international transactions. This is thought to be particularly relevant for those international transactions that occur within divisions of a multinational company, such as when a car manufacturer ships an engine or chassis from a plant in one country to an assembly plant in the U.S. This trade between related parties is very common, accounting for about 50 percent of all imports to the U.S. These transactions are supposed to be booked at market prices, the prices at which unrelated companies would carry out transactions. However, since these prices do not affect trade flows, multinational firms may not be vigilantly updating these prices with the exchange rate or even be aware of market prices. Alternatively, multinationals may choose the price of the transactions to shift profits within the company toward divisions that are in countries with relatively low taxes. In this case, tax considerations matter more for pricing than exchange rate movements do. Indeed, Kimberly Clausing's findings are consistent with this tax-shifting story; she finds that related-party transactions involving U.S. imports are carried out at relatively high prices when the goods are imported from countries with relatively low taxes.

Research has found that each of the reasons described above generates incomplete pass-through. However, since the relevance of these explanations differs across industries and even time periods, the relative

importance of each reason relative to the others remains a question.

WHY PASS-THROUGH MATTERS

To each of us, pass-through clearly matters because it affects our purchasing power at home and when we travel overseas. At the aggregate level, pass-through matters for the conduct of monetary policy and the propagation of business cycles across countries.

Monetary policymakers concerned with the inflationary impact of exchange rate movements focus on pass-through to import prices and subsequently to consumer prices.[12] The importance of pass-through for inflation differs across countries. For instance, in a country that consumes a lot of imported goods, such as New Zealand, where imports make up nearly 40 percent of GDP, pass-through is very important for gauging the inflationary impact of exchange rate movements.[13] In the U.S., which imports only about 15 percent of GDP and has relatively low pass-through, the influence of exchange rate movements on inflation is smaller. With better measures and models of pass-through, policymakers can better forecast the inflationary impact of exchange rate movements and adjust monetary policy accordingly.[14]

Pass-through is also important for understanding the relationship between economic activity and the exchange rate. When pass-through is high, changes in the exchange rate can have a relatively large effect on trade flows and thus the trade balance, which is the difference between what a country exports and what it imports. An increase in import prices decreases imports and therefore raises net exports. This movement shifts production to domestic firms, raising demand for workers in the U.S. and lowering it for workers overseas. When pass-through is low, the effect of exchange rate movements on trade flows is much more muted.

Theoretical research, such as that of George Alessandria and that of Caroline Betts and Michael Devereux, finds that incomplete pass-through may actually contribute to larger fluctuations in international relative prices, such as the real exchange rate, over the business cycle. Suppose that the U.S. economy is booming and producing a lot of goods. To get consumers to purchase the abundantly available U.S. goods, the U.S. goods must sell for relatively low prices; so there is a tendency for the real exchange rate to depreciate. However, if pass-through is low, within countries, the price of U.S. goods will fall relatively little compared to foreign goods, and hence, purchases of domestic goods will not rise by much, requiring a much larger movement in the real exchange rate.

To each of us, pass-through clearly matters because it affects our purchasing power at home and when we travel overseas.

SUMMARY

Movements in the exchange rate substantially alter the relative cost of producing goods in different countries. However, consumers in different countries are partly insulated from these movements by the pricing behavior of producers.

Recently, the large depreciation of the dollar has made producing goods outside the U.S. relatively more expensive. This has contributed to rising prices of imported manufactured goods in the U.S. However, the price of imported manufactured goods has risen by substantially less than the cost of producing these goods and the price at which they are sold in the country where they are produced, making these goods a bargain in the U.S.

[12] See the speech by former Federal Reserve Governor Frederic S. Mishkin at the Norges Bank Conference on Monetary Policy.

[13] Import ratios are from the Organization for Economic Cooperation and Development's (OECD) Country Statistical Profiles.

[14] Joseph Gagnon and Jane Ihrig also present evidence that pass-through tends to be lower for countries with more stable inflation and hence central banks more determined to fight inflation.

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Beautiful City*

BY GERALD CARLINO

Proponents of the City Beautiful movement advocated for sizable public investments in monumental spaces, street beautification, and classical architecture. Today, economists and policymakers see the provision of consumer leisure amenities as a way to attract people and jobs to cities. But past studies have provided only indirect evidence of the importance of leisure amenities for urban growth and development. In this article, Jerry Carlino uses a new data set on the number of leisure tourist visits to metropolitan areas to examine the correlation between leisure consumption opportunities and population and employment growth in metropolitan areas during the 1990s. His study suggests that leisure amenities are important for an area's growth, even after controlling for other characteristics, such as climate or proximity to a coast.

The City Beautiful movement of the late 19th and early 20th centuries advocated city beautification as a way to improve the living conditions and civic virtues of urban dwellers. Proponents of the movement advocated for sizable public investments in monumental public spaces, street beautification, and classical architecture, with an emphasis on aesthetic and recreational values. The Benjamin Franklin Parkway in Philadelphia with its many public buildings (for example, the Philadelphia Museum of Art, the main branch of the Free Library of Philadelphia, the Franklin Institute, and the Rodin Museum) exemplifies this movement.

Today, economists and policymakers see the provision of consumer leisure amenities as a way to attract people and jobs to cities. But most amenities, such as pleasant weather or scenic views, are not standard goods that are traded in visible markets, making it difficult to quantify the contribution of a city's quality of life to its growth. Past studies have provided only indirect evidence of the importance of leisure amenities for urban growth and development.

My 2008 study with Albert Saiz makes the point that since leisure tourists are attracted by an area's special traits (such as proximity to the ocean, scenic views, historic districts, architectural beauty, and variety in cultural and recreational opportunities), the number of leisure tourist visits to a city can serve as a fairly comprehensive proxy for the quality of life the city offers. Put differently, some of the very characteristics that attract tourists to cities also attract households to cities when they choose these places as their permanent homes.[1]

Using a new data set on the number of leisure tourist visits to metropolitan areas, Albert Saiz and I looked at the correlation between

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*The views expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

[1] "City" and "metropolitan area" are used here to designate a metropolitan statistical area (MSA). In general, MSAs are statistical constructs used to represent integrated labor market areas. They typically are geographic areas combining a large population nucleus with adjacent communities that have a high degree of economic integration with the nucleus.

leisure consumption opportunities and population and employment growth in metropolitan areas during the 1990s. We found that, all else equal, during the 1990s, population growth was about 2.2 percentage points higher and employment growth 2.6 percentage points higher in a city with twice as many leisure tourists as another city. The extra growth associated with leisure amenities is not trivial when one takes into account that during the 1990s, population grew 12 percent in the typical metropolitan area in our sample, while employment grew 20 percent. Over a long period of time, even relatively small differences in growth rates translate into relatively large differences in population and employment growth. Among the forces Saiz and I considered in our study, our leisure measure was the third most important predictor of population growth in the 1990s.

Cities around the world (such as Barcelona and Bilbao; Glasgow; and Oklahoma City, Camden, and San Antonio) have used public investments in leisure spaces and city beautification in an attempt to spur economic development. My study with Saiz suggests that leisure amenities are important for an area's growth, even after controlling for an area's proximity to a coast and for its climate. This is an important finding, since if people are largely attracted by an area's natural advantages, such as coastlines or nice weather, these types of amenities are not something local policymakers can reproduce. Instead, my study with Saiz provides policymakers with evidence that spending public funds to provide public goods that are oriented toward leisure activity (such as museums, waterfront parks, and open-air shopping centers) yields a return on the investment in terms of a city's economic growth. The association between leisure amenities and growth may occur because such amenities disproportionately attract more productive workers.

WHY ARE PEOPLE AND JOBS CONCENTRATED IN CITIES?

Although metropolitan areas account for less than 20 percent of the overall territory of the U.S., they contain about 80 percent of the nation's population and almost 85 percent of its jobs. Why are people and jobs so spatially concentrated? Economists have developed the notion of agglomeration economies — that is, the benefits that firms and households receive from locating near one another — to explain this concentration. The two main types of agglomeration economies are described below.

Business Agglomeration Economies. Cities offer numerous advantages to business firms, and often, the larger the city, the greater the advantages. Agglomeration economies constitute an important source of a firm's productivity. Increases in productivity due to agglomeration economies depend not on the size of the firm itself (internal economies of scale) but rather on the size of a firm's industry in a particular city or on the size of the city itself. For example, firms in large cities are better able to find workers who possess the specific skills the firms require than if they were in much smaller places. Also, firms can reduce their costs by locating in large cities and sharing specialized inputs. For example, many firms are too small to have a full-time chief financial officer but big enough to have some of the same problems that confront larger companies. However, by locating in a large city, a small firm will be able to find a local business that provides financial managers who spend part of each week doing what CFOs are supposed to do: prepare budgets, project sales, and negotiate with banks. A similar story applies to other types of specialized business services, such as access to legal services and advertising agencies.

Consumer Agglomeration Economies. Cities also offer numerous leisure consumption opportunities to households, and the larger the city, the greater the opportunities. Large concentrations of population can provide consumers with a greater variety of goods and services. Our largest cities can support professional sports teams, theater, opera, and a symphony orchestra. If consumers prefer a large variety of goods and services and there are substantial economies of scale in providing them, economic welfare will depend on the size of the local market. For example, studies by Joel Waldfogel and by Waldfogel and Lisa George have shown that larger cities have more and better newspapers and more and better radio and television stations.

From a social point of view, larger cities make it easier for people to make wider social contacts and to have a more diverse set of friends. Along these lines, larger cities appeal to younger, more highly educated workers

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because large cities better facilitate development of professional and social connections. Dora Costa and Matthew Kahn note that power couples (both partners have bachelor's degrees) are increasingly locating in larger cities because they offer better labor-market outcomes for working couples.

It's important to recognize that an area's quality of life depends on more than the variety of goods and services that increase with city population size. People are also attracted by an area's "natural" amenities, such as its historic character, architectural variety, natural scenic beauty, nearness to the ocean, or climate. Richard Florida has also pointed out that people are paying increasing attention to the provision of public goods that are oriented toward leisure activities, such as museums, waterfront parks, open-air shopping centers, and other public spaces enjoyed by families and individuals.

But increased urbanization brings not only greater productive efficiency and greater variety of cultural and leisure activities but also costs, such as congestion, that take the form of long-distance commuting and higher housing prices. These costs eventually balance the gains from the various amenities. The higher cost of housing as cities get congested reduces households' purchasing power and limits the inflow of people.[2]

WHAT'S THE EVIDENCE?

Until recently, the vast majority of studies have looked at the relationship between business agglomeration economies and city growth. As I've pointed out in previous articles, technical improvements, especially in transportation, mean that, today, businesses are freer to locate wherever they want, and, unlike before, their choice of location will depend on where their workers choose to live.[3] This means that an area's special features, such as its quality of life, will be an important determinant of where households and, ultimately, firms locate.

Comparisons of the quality of life across cities have generated a fair amount of interest from workers, the media, and local policymakers. Since 1981, David Savageau has compiled the *Places Rated Almanac*. A "places rated" index is used to produce a ranking of cities. The index is based on nine categories of amenities: cost of living (mostly housing costs); the economy (e.g., the risk of unemployment); climate; education; health care (physicians and hospitals); transportation (e.g., airline connections); safety; recreation; and location (e.g., scenic beauty). In constructing the index, David Savageau uses his own judgment in three ways. First, he uses his own preferences to determine which items to include in each of these categories. Second, Savageau assigns points to each of the nine categories. Finally, he applies equal weights to the rankings in each of the nine categories to compute an index number reflecting the amenities offered in each city (the places rated index). As Glenn Blomquist has pointed out, "This equal weighting means that a one-position difference in climate is equally important as a one-position difference in the crime ranking." Obviously, the rankings of cities will be quite sensitive to weights assigned to the various characteristics. For example, I might put more weight on the cost of living in a city and much less weight on a city's economy. This would almost certainly result in a different ranking of cities than one produced by equally weighting the various categories of quality of life.

Beginning in the late 1970s, economists introduced a methodology for determining the value of an area's special characteristics by observing what people are willing to pay to live there in terms of higher rents and lower wages.

Beginning in the late 1970s, economists introduced a methodology for determining the value of an area's special characteristics by observing what people are willing to pay to live there in terms of higher rents and lower wages.[4] Individuals who choose to live in areas with a high quality of life are willing to move to these locations despite facing some combination of higher housing prices (or rents) and lower wages. This combination of higher housing costs

[2] See my 2005 *Business Review* article for further discussion of consumer agglomeration economies.

[3] See my 2005 *Business Review* article.

[4] See, for example, the articles by Jennifer Roback; Glenn Blomquist, Mark Berger, and John Hoehn; Joseph Gyourko and Joseph Tracy; and David Albouy. See Glenn Blomquist's 2007 article for an accessible review of the quality-of-life literature.

and lower wages is the premium, or implicit price, that people must pay to live in places with a high quality of life.

A comparison across metropolitan areas is achieved using a quality-of-life index, or QOLI. The index is constructed by first weighting each amenity an area offers by its implicit price. Next, the final index is produced by summing all amenities. Finally, the QOLI is used to rank cities by quality of life. Notice that the weights for each amenity in the index are based on preferences as expressed by thousands of consumers in local housing markets and thousands of workers in local labor markets and not on the preferences of the person constructing the index, as is the case for the *Places Rated Almanac*. Many QOLIs have been constructed for metropolitan areas in the United States, and they show that quality of life matters. There appear to be sizable differences in the quality of life across locations, and residents "pay" for these differences through some combination of higher rents and lower wages.

There are important shortcomings with the calculations of what households are willing to pay for quality of life and the associated rankings. According to the quality-of-life view, relatively higher wages are one way to compensate workers for a lack of local amenities (such as unpleasant weather, relatively high crime rates, and pollution). One advantage of the quality-of-life approach is that it uses data on individual workers and individual households (called micro data). It is easy to account for observable worker characteristics, such as education, job experience, occupation, and industry. However, an important shortcoming of this approach is that it is largely impossible to account for the many intangible characteristics of workers (motivation, dedication, creativity, and so on) that can make some workers more productive even when they are compared with other, very similar workers. If these high-productivity workers are disproportionately attracted to high-amenity cities, the higher wages reflect the relatively higher productivity of these workers and not compensation for a lack of amenities. Thus, the omission of the many intangible worker characteristics may introduce a serious bias when calculating quality-of-life rankings. For example, suppose that the hardest working and most creative software engineers are attracted to Silicon Valley in California because they are more productive there, and this greater productivity translates into higher wages. In the quality-of-life calculations, these relatively higher wages for otherwise similar software engineers give San Jose and San Francisco lower QOLIs than they probably deserve.[5] The ranking of cities reported in the article by Glenn Blomquist and co-authors supports this concern in that it ranks San Jose 88th and San Francisco 105th out of the 185 cities they considered.

An additional limitation of the quality-of-life approach is that it is virtually impossible to include in any study the vast variety of private (such as restaurants) and public leisure-oriented goods (pleasant weather) that draw people to cities. Typically, researchers have chosen the types of amenities (usually limited to environmental amenities such as weather) to include in their studies. In addition to being subjective, the set of amenities chosen will not be comprehensive.

An additional limitation of the quality-of-life approach is that it is virtually impossible to include in any study the vast variety of private and public leisure-oriented goods that draw people to cities.

Measuring Quality of Life Based on Leisure Tourism. Given the shortcomings of the quality-of-life approach, in our study, Albert Saiz and I suggest a more encompassing measure of the demand for urban amenities that stems from a revealed preference for these amenities as represented by the number of leisure tourists who visit a metropolitan area. Leisure tourists are attracted by an area's special traits, such as its restaurants and its theater but also by its unique ambiance, architectural variety, pleasant public spaces, or natural scenic beauty. We point out that the special traits that attract tourists to an area are some of the very characteristics that attract households to cities when they choose these places as their permanent homes. Since households are attracted to cities

[5] In the article by Jordan Rappaport and the one by David Albouy both authors point out that ranking cities based on the QOLI often produces rankings that are counter-intuitive. For example, in the ranking of 185 U.S. cities in the study by Glenn Blomquist and co-authors, Pueblo, Colorado, ranks first, while San Francisco ranks 105th and New York City ranks 216th. Recall that these indexes are calculated using only local wages and local rents. David Albouy goes a step further and also accounts for federal taxes paid by local residents, nonhousing costs, and nonlabor income to produce a QOLI and finds that his city rankings are much closer to people's intuitive rankings.

by many of the same traits that attract tourists, the number of leisure tourists can serve as a comprehensive measure, or proxy, for consumer amenities offered in cities. In our research, we find a positive correlation between the number of leisure tourist visits to cities and subsequent economic growth.

But why should leisure-related amenity levels be associated with economic growth? Jesse Shapiro has shown that "beautiful cities" are especially attractive to high-skill workers, who can stimulate employment and population growth. The idea is that high-skilled (highly educated) individuals are not only highly productive workers, but they also enhance the productivity of other workers they come into contact with. Along these lines, Sanghoon Lee notes that the demand for variety may increase more than proportionately with income and as high-skill individuals account for a larger share of the workforce in large cities.[6]

In our study, Saiz and I use a new data set on leisure tourist trips provided by D.K. Shifflet and Associates, a firm specializing in consulting and market research for the travel industry. The Shifflet data provide the destinations for individuals who traveled for leisure purposes.[7] The table shows the 1992 destinations of leisure tourists for selected cities. The average cities drew almost 4.5 million leisure tourists in 1992. Orlando and Las Vegas are at the top of the list, drawing 22.3 million and 18 million tourists, respectively. In our study, we excluded these two cities, since tourism in these locations is related to recreational resorts (Orlando) or the gaming industry (Las Vegas), and these activities are, at best, only weakly related to urban amenities that draw residents.[8] Many of the cities typically thought to be high-amenity locations (such as New York, San Diego, San Francisco, and Los Angeles) rank in the top 10 in terms of leisure tourist visits in 1992. Philadelphia ranked 20th overall, having almost twice as many tourists in 1992 as did a typical city. At the other extreme, Oakland, California, and Newark, New Jersey, had the fewest leisure tourists (under 100,000 in 1992).

Philadelphia ranked 20th overall, having almost twice as many tourists in 1992 as did a typical city.

Since Saiz and I use leisure tourist visits as a proxy for the quality of life offered in cities, it's important to demonstrate that leisure tourist visits are, in fact, positively correlated with many variables thought to influence the quality of life. We show that this turns out to be the case. For example, we find that leisure tourists tend to be attracted to sunnier metro areas with more colleges; lower poverty rates; lower manufacturing employment; greater average distances to hazardous sites; accessibility to the ocean, parks, and golf courses; and more historic buildings.

Next, we look at the association between leisure consumption opportunities, proxied by the number of leisure tourists, and population and employment growth in metropolitan areas during the 1990s. There is indeed a positive correlation between population growth in the 1990s and the number of leisure tourist visits to metropolitan areas in 1992 (see the figure). Of course, many other things could potentially account for this positive correlation. For example, New York City would be expected to have more tourists than, say, Philadelphia, since New York City has a much larger population base to begin with; thus, we control for city size. Since many people are attracted to coastal cities and to cities with pleasant weather, we also control for whether a city is within about 30 miles of an ocean or a Great Lake, and we also account for a city's average January temperature and for its relative humidity in July. After controlling for a city's coastal/Great Lakes proximity, its climate, and a variety of other factors that might account for the positive correlation between leisure visitors and growth (such as the previous share of the adult population with a college degree, previous average income, and so forth), Saiz and I find that population growth during the 1990s was 2.2 percentage points and employment growth was 2.6 percentage points higher in a metropolitan area with twice as many leisure visits as another metropolitan

[6] Of course, highly educated workers might move to relatively faster growing cities rather than directly affecting city growth. Studies have offered evidence that this is not the case (see, for example, the study by Jesse Shapiro).

[7] Shifflet defines travel as any overnight trip or any day trip greater than 50 miles one way. Households were asked to report on travel destinations during the last three months. Questionnaires were mailed to 180,000 households in 1992 (the year we use in our study). Returned samples were demographically re-balanced on five key measures (state of origin, age, gender, household size, and household income) to ensure that they are representative of the U.S. population. Shifflet provided leisure travel data for the top 200 tourist destinations for 1992.

[8] Albert Saiz and I show that our findings are not sensitive to the inclusion or exclusion of the Orlando and Las Vegas metropolitan areas from our sample.

TABLE

Tourist Destinations in 1992 for Selected Cities

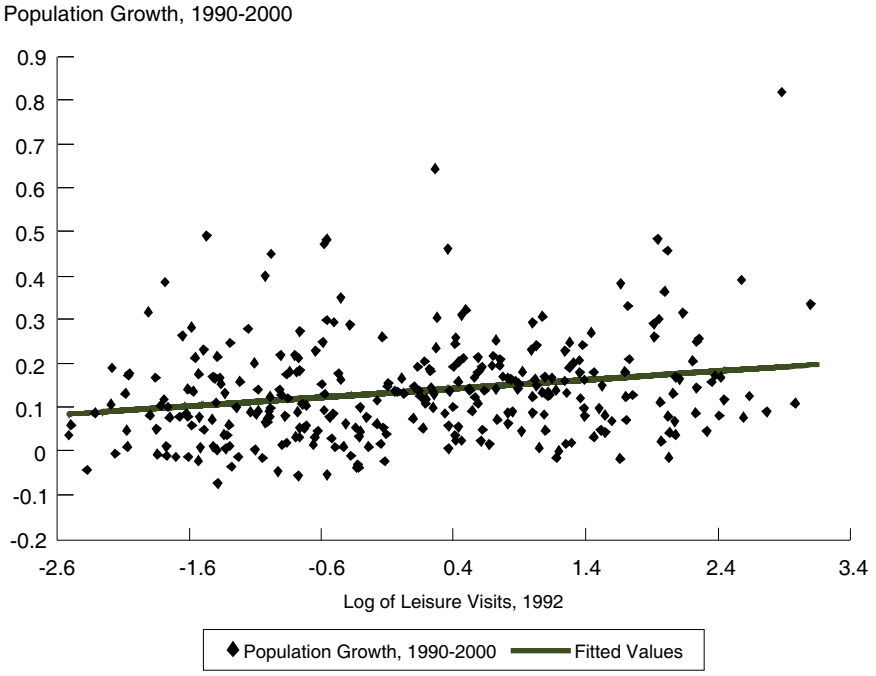
Top 20 Destinations	
Metropolitan Area	**Number of Visits in 1992 (millions)**
Orlando, FL	22.3
Las Vegas, NV-AZ	17.95
New York, NY	15.99
San Diego, CA	14.05
Los Angeles-Long Beach, CA	13.41
Atlanta, GA	13.22
Chicago, IL	11.6
Washington, DC-MD-VA-WV	11.32
San Francisco, CA	11.17
Knoxville, TN	10.83
Tampa-St. Petersburg-Clearwater, FL	10.56
St. Louis, MO-IL	10.17
Houston, TX	9.58
Columbus, OH	9.42
Nashville, TN	9.42
Norfolk-Virginia Beach-Newport News, VA-NC	9.36
San Antonio, TX	9.15
Dallas, TX	8.49
Indianapolis, IN	8.27
Philadelphia, PA-NJ	8.02
AVERAGE	**4.42**

Bottom 20 Destinations	
Metropolitan Area	**Number of Visits in 1992 (millions)**
Miami, FL	3.15
San Jose, CA	3.05
Charleston-North Charleston, SC	2.97
Toledo, OH	2.86
Fort Lauderdale, FL	2.72
Wilmington-Newark, DE-MD	2.43
Grand Rapids-Muskegon-Holland, MI	2.39
Bakersfield, CA	2.13
Allentown-Bethlehem-Easton, PA	2.08
Baton Rouge, LA	2.06
Fort Worth-Arlington, TX	2.06
Fresno, CA	2.02
Greenville-Spartanburg-Anderson, SC	1.55
Hartford, CT	1.52
Akron, OH	1.44
West Palm Beach-Boca Raton, FL	1.32
Tacoma, WA	1.14
El Paso, TX	1.11
Oakland, CA	0.96
Newark, NJ	0.66

Source: D.K. Shifflet and Associates

FIGURE

Population Growth Increases with Tourism



area.[9] Among the things we considered in our study, our leisure tourist measure was the third most important predictor of population growth in the 1990s. (The most important factor for growth is prior immigration, and the second most important factor is previous changes in local tax revenue.)

As we have seen, economists believe that more educated workers tend to be disproportionately drawn to cities offering a relatively high quality of life. Saiz and I investigate this point and find that growth in the share of highly educated workers is positively related to greater leisure tourism in cities. We also find evidence of acceleration in house-price appreciation and rent growth in metropolitan areas with more leisure tourists. Specifically, we find that a city with twice as many leisure tourists as another city has a 0.3-percentage-point increase in the growth rate of the share of the population with at least a college education. Similarly, a city with twice the level of leisure tourists as another city has about a 2-percentage-point higher house-price appreciation and a 1.3-percentage-point higher rent growth. During the 1990s, the share of the population with a college degree grew 4 percent in the typical metropolitan area in our sample, while house values grew 42 percent and rents, 31 percent. Based on these estimates, in a city with twice the previous level of leisure tourists as another city, the share of the adult population with a college education would have increased 4.3 percent instead of 4 percent during the 1990s, while housing prices would have appreciated 44 percent rather than 42 percent and rents would have grown almost 32.3 percent as opposed to 31 percent.

CONCLUSION

For some time urban economists have believed that consumption amenities, especially those geared to the enjoyment of leisure, were becoming more important in explaining urbanization and the location of individuals. Until now, urban economists were not able to provide an estimate of the importance of consumption amenities for city growth. The main benefit of my study with Albert Saiz is to provide such an estimate. Using the number of tourist visits to cities as a proxy for the amenities offered in these cities, Saiz and I found the predicted decadal population growth rate would be 2.2 percentage points higher and its

[9] No doubt tourism leads to growth, but to some extent, growth (perhaps due to agglomeration economies in production) helps finance cultural and recreational amenities and the growth of these amenities draws leisure tourists. The difficulty lies in trying to differentiate the extent to which tourism causes growth or growth causes tourism. Saiz and I use an approach (instrumental variables) that attempts to break the reverse causality of growth on tourism. We argue that historic places (such as Independence Hall in Philadelphia) cause tourism today, but tourism today is unlikely to have caused historic places. Similarly, the coastal share within a 10-km. radius (about six miles) of an MSA's boundary will cause tourism, but not vice versa. That is, historic places and access to the coast are highly correlated with tourism (and therefore serve as good instruments for tourism), but these instruments are not caused by urban growth during the period 1990-2000 we considered. We find that reverse causation does not appear to be a problem in interpreting our findings.

Another concern is that a metropolitan area that is geographically close to other population centers may disproportionately draw leisure visitors relative to the amenities they offer. For example, Philadelphia may draw relatively more leisure tourists because the city is somewhat close to New York City and to Washington, D.C. People who visit New York City or Washington, D.C. might also visit Philadelphia, even though they might not have if Philadelphia were not close to these other cities. In our research, Saiz and I controlled for the population *potential* of each city in our data set, where the population potential of a city measures how near people in all cities are to any given city. We found essentially identical results after controlling for the population potential of cities compared with the results when we did not control for population potential.

predicted decadal employment would be 2.6 percentage points higher in a city with twice the level of leisure tourists as another city.

My study with Saiz provides important implications for policymakers who want to stimulate local economic growth. First, we find that consumer leisure amenities do appear to positively enhance city population and employment growth, even after controlling for a city's natural advantages, such as its distance to a coast and its climate. This is an important finding because if people were largely attracted by an area's natural advantages, these types of amenities are not something local policymakers can reproduce. However, we find an association between growth and amenities that policymakers can affect.

Second, as policymakers think about ways to stimulate local economic growth, spending public funds on leisure and cultural activities may prove to be an avenue worth exploring. This may explain why policymakers and private investors are paying increasing attention to providing public goods oriented toward leisure, such as museums, waterfront parks, open-air shopping centers, and other public spaces enjoyed by families and individuals. Cities around the world (such as Barcelona and Bilbao; Glasgow; and Oklahoma City, Camden, and San Antonio) have used public investments in leisure spaces and city beautification as a way to spur economic growth.

An important issue is whether some types of amenities are better at stimulating growth than are other types of amenities. While using the number of tourist visits is a useful way to summarize in a single number the vast array of consumption amenities offered by cities, it does not help in addressing the question of which types of leisure amenities stimulate growth the most or if they even stimulate growth at all. That is, my research with Saiz does not allow us to tell the extent to which having, say, clean and safe streets affects city growth as opposed to the effect on growth of a city offering, say, waterfront parks, open-air shopping centers, and other public spaces. The answer to the question about which types of amenities affect growth the most awaits future research. An additional caveat is that the finding that leisure amenities are associated with higher local growth is not the same thing as recommending that cities immediately decide to fund activities that attract tourists/residents if only because the opportunity cost of appropriating such funds is the elimination of other, possibly more worthy, programs, such as building new schools. ER

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Convertible Securities and Venture Capital Finance*

BY YARON LEITNER

Venture capital financing relies heavily on convertible securities; the most common type is convertible preferred stock. Venture capital contracts also specify control rights that describe who gets to make the firm's decisions. The recent literature has provided some theoretical explanations for the use of these two features. Underlying these explanations is the idea that individuals can take actions that affect the firm's performance but that these actions cannot be specified in a contract. In this article, Yaron Leitner focuses on venture capital contracts, but the ideas presented can be applied to other contracting problems in which individuals must be given incentives to take appropriate actions.

Venture capital is a type of private equity capital typically provided to early-stage, high-potential-growth companies that are not publicly traded. By providing funds, the venture capitalist hopes to eventually generate a return through an event such as an initial public offering (IPO) or sale to another company. A contract between a venture capitalist and an entrepreneur has many special features; for example, a venture capitalist typically provides capital in stages and can abandon the venture at any time. The venture capitalist provides not only capital but also advice on how to manage the venture.[1]

Unlike debt, which characterizes most bank financing, venture capital financing relies on equity-like and convertible securities that provide the venture capitalist with a share of the profits (the upside). The most commonly used security is convertible preferred stock.[2] Convertible preferred stocks were used in 204 of the 213 real-world venture capital investment contracts analyzed by Steven Kaplan and Per Strömberg.[3] Sometimes the convertible preferred stock was used in combination with other securities, but in 170 financing rounds (almost 80 percent), convertible preferred stock was the only security used.

Real-world venture capital contracts also specify control rights that clearly describe who gets to make the firm's decisions. These control rights often depend on the firm's performance. The recent literature has provided some theoretical explanations for the extensive use of convertible preferred stocks in venture capital contracts and for the use of contingent control rights. Underlying these explanations is the idea that individuals (the entrepreneur and the venture capitalist) can take actions that affect the firm's performance but that these actions cannot be specified explicitly in a contract.

This article focuses on venture

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[1] An excellent, accessible account of what venture capitalists do can be found in the *Business Review* article by Mitchell Berlin. An account of the history of venture capital can be found in the introduction to the book by Paul Gompers and Josh Lerner.

*The views expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

[2] The government is now using this type of security to recapitalize banks under the Capital Assistance Program. For more details, see the regulatory agencies' joint press release from February 23, 2009 at http://www.federalreserve.gov/newsevents/press/bcreg/20090223a.htm.

[3] Their sample largely reflects financing rounds completed between 1996 and early 1999 (166 cases). Of the remaining cases, 34 were completed between 1992 and 1995 and 13 were completed before 1992.

capital contracts, but the ideas presented here can be applied to other contracting problems in which individuals must be given incentives to take appropriate actions.

After explaining what a convertible preferred stock is, we will describe some of the theoretical explanations and some empirical facts.

WHAT IS A CONVERTIBLE SECURITY?

In exchange for putting money into a firm, a venture capitalist usually receives convertible preferred stocks. Because these are complicated securities, I will first explain what *preferred stock* is and then explain what *convertible* preferred stock is.

Preferred stock has some features that resemble debt, but legally, it is an equity security. As with a debt contract, the company needs to make fixed payments (dividends) to the holder of the preferred security. But unlike with debt, the company can choose not to pay the dividends without being considered in default of the contract.[4] Preferred stock is called preferred because the company cannot pay dividends on its common stock unless it has paid them to preferred stockholders. Debt holders, however, must be paid before any preferred stockholder gets paid. Unlike preferred stockholders in many other settings, venture capitalists who hold preferred stock usually have voting rights. In addition, venture capitalists usually have a right of redemption, which means that they can cash out their shares at some predetermined price whenever they want to.

Convertible preferred stocks are preferred stocks that give the holder the right (or option) to convert his or her shares into a pre-specified number of shares of common stock. Venture capitalists who hold convertible stock will exercise this option only if they expect to receive more money by doing so, for example, if the stock price is very high relative to the conversion price. Thus, convertible preferred stock provides venture capitalists with some protection if the business does not do well (in this case, the fact that it is preferred allows venture capitalists to take priority over common stockholders in payments) while the conversion feature allows them to share the upside.

> Preferred stock has some features that resemble debt, but legally, it is an equity security.

A convertible bond is another example of a convertible security. This is a bond that can be converted into shares of common stock. While convertible bonds are sometimes used by other firms, they are not very common in venture capital finance.[5] (See *Who Issues Convertible Securities?*)

CONVERTIBLE SECURITIES CAN ALIGN INCENTIVES

Venture capitalists are usually very active in managing and providing advice to the firms they finance. The firm's success depends on the venture capitalist's effort as well as on the entrepreneur's. Economists use "effort" to describe actions or decisions that involve time and work but that increase the probability of higher profits. For example, in a biotechnology start-up, the entrepreneur, who has scientific skills, puts effort into developing a new drug by reading scientific material and conducting laboratory experiments, while the venture capitalist, who has managerial skills, puts effort into marketing the drug by conducting market research to find out who is likely to use it. Clearly, earnings and profits depend not only on effort but also on some other factors that are beyond the firm's control, such as overall economic conditions or what a competitor does. Nevertheless, the underlying assumption is that when one exerts more effort, the firm is more likely to generate more profits. The firm may still end up with low profits, but the chances for low profits are reduced when more effort is exerted.

Since exerting effort is costly, the entrepreneur and venture capitalist will do so only if they are provided with the right incentives. Ideally, this could be done via a contract that specifies the level of effort that each one should make and the punishment for shirking. For example, someone who does not exert the appropriate amount of effort should be paid less (or not be paid at all).

The problem with such a contract is that it is often impossible to observe or measure precisely how much effort someone exerts. For example, it may be hard to determine whether the scientist has used intelligence and creativity in developing the drug or

[4] In addition, dividends received from preferred stock have different tax implications from interest collected on debt.

[5] Convertible debt was used in only one out of the 213 cases that Kaplan and Strömberg analyzed. Convertible zero-coupon debt was used in eight cases. A zero-coupon debt is a bond that does not make periodic interest payments. It pays only the principal at the expiration date. A convertible zero-coupon debt is a zero-coupon debt that can be converted into shares of common stock.

conducted the "right" experiments. Thus, a court may not be able to enforce the ideal contract described above. However, a court may be able to enforce a contract that depends on some observable outcomes, such as earnings before interest and tax (EBIT). A contract between an entrepreneur and venture capitalist can therefore depend on EBIT, but it cannot depend on effort directly.

The issue then is how to share the project's earnings between the entrepreneur and the venture capitalist so that each one will have the incentive to put the appropriate amount of effort into the project. Intuitively, one will exert more effort when one has more at stake. If you are the sole owner of the firm and do not need to share the profits with anyone, you will exert as much effort as you can, up to the point at which the extra effort no longer increases profits (net of the cost of exerting effort). However, if you need to share the profits with someone else, you will be less willing to exert effort, and you will do so only up to the point at which the extra effort increases *your* share of the profits.

The optimal split of profits between the entrepreneur and the venture capitalist is the one that induces efforts that generate the highest total profits (net of the cost of putting forth effort). Suppose, for example, that the optimal split is 50-50; that is, the entrepreneur and the venture capitalist each have 50 percent of common stock, giving each a claim on 50 percent of the firm's profits. This is how the entrepreneur and venture capitalist would split the profits if there were no other issues involved. In other words, if providing incentives to exert effort is the only concern, we can induce the optimal level of effort by giving the entrepreneur and the venture capitalist shares of common stock according to the optimal split.

Who Issues Convertible Securities?

Thomas Noddings, Susan Christoph, and John Noddings analyzed U.S. convertible bonds and U.S. convertible preferred stocks trading in January 2000.[a] Their data do not include firms that rely on venture capital financing, since those firms are not publicly traded.

They found that companies that issue convertible bonds span a broad market spectrum from very small-cap to very large-cap firms, but the majority of issues represented micro-sized to small-sized growth companies with ratings below investment grade. A total of 311 companies had actively traded convertible bonds. Of these companies, 26 percent were in what the authors defined as the micro-cap category (market capitalization below $225 million), 32 percent were in the small-cap category (market capitalization between $225 million and $1.25 billion), 27 percent were in the medium-cap category (market capitalization ranging from $1.25 billion to $10.5 billion), and the remaining 15 percent were large-cap companies (market capitalization above $10.5 billion).[b] Only 21 percent of the firms had a Standard & Poor's bond rating of BBB and above. Noddings, Christoph, and Noddings note that the 230 small-cap and larger companies (i.e., the small, medium, and large) were among the 3,000 largest U.S. firms, and that while there was a slight overlap with the largest 3,000 firms, most of the 81 micro-cap companies came from the 1,000 firms just below the top 3,000. This gives us some idea of the fraction of public firms with actively traded convertible bonds (roughly 8 percent).

Like convertible bonds, most convertible preferred stocks were issued by small to mid-sized companies. Out of the 117 companies with actively traded convertible preferred stocks, 15 percent were in the micro-cap category (defined above), 32 percent were small cap, 39 percent were medium cap, and 14 percent were large cap. Only 13 percent had a Standard & Poor's preferred stock rating of BBB and above.

[a] The first edition of their book covers January 1998. Even though the numbers are not identical in both editions, the results are essentially the same.

[b] There are no precise definitions for small, medium, and large market cap. In addition, these definitions can change over time. I use the definitions in Noddings, Christoph, and Noddings' study.

Another issue, however, is that venture capitalists need to be compensated not only for the effort they exert but also for the money they invest in the venture. Venture capitalists will agree to invest in the firm only if they expect to make a profit; more precisely, the expected return on the investment, adjusted for risk, needs to be at least as high as what the venture capitalists could obtain by investing their money elsewhere. If the investment is very large relative to the size of the company, a venture capitalist may insist on a split of, say, 60-40, where he

or she gets 60 percent of equity instead of only 50 percent. However, compared with the optimal split of 50-50 assumed above, a 60-40 split distorts incentives, inducing the entrepreneur to exert too little effort. The use of convertible securities can help ensure that a venture capitalist gets enough cash to cover the initial investment while at the same time maintaining incentives.

The idea is as follows: Suppose that profits can be either $100 million (good state) or $40 million (bad state), and the entrepreneur can either exert effort or not. The entrepreneur's effort increases the likelihood of the good state and reduces the likelihood of the bad state. The entrepreneur will exert effort only if the payoff he receives in the good state is large enough compared to what he gets in the bad state. With a 50-50 split, the entrepreneur obtains $50 million in the good state and $20 million in the bad state, and as assumed here, this induces him to exert effort. However, we can also induce effort by giving the entrepreneur less in *both* states; for example, we can give the entrepreneur $30 million in the good state and nothing in the bad state. In this case, more is left to the venture capitalist, and the venture capitalist can cover his investment. This profit allocation can be implemented by giving the entrepreneur shares of common stock and by giving the venture capitalist shares of convertible preferred stock. The preferred stock ensures that the venture capitalist has priority in payment in the bad state (in our example, he receives everything), and the convertibility option allows the venture capitalist to share the upside. For more details, see *An Example of Venture Capital Financing* on pages 22 and 23, as well as the table on page 24.

The detailed numerical example illustrates two more things: First, the need for convertible preferred stock arises only when the required investment from the venture capitalist is large. Otherwise, the two objectives (inducing effort and allowing the venture capitalist to cover his investment) can be achieved by simply giving the venture capitalist shares of common stock, which is equivalent to simply sharing the profits of the firm. This seems consistent with the observation that "angel investors," who invest smaller amounts than venture capitalists, are more likely to obtain common stock. See, for example, the paper by Andrew Wong.[6] Second, in some cases (for example, when the required investment is very large and the entrepreneur has no funds of his own), we may not achieve the two objectives above even with convertible preferred stock. In this case, it might not be possible to finance the venture at all, or the entrepreneur might need to wait until he has amassed enough capital of his own.[7]

CONVERTIBLE PREFERRED STOCK CAN PREVENT WINDOW DRESSING

A striking feature of venture capital finance is that the venture capitalist typically infuses capital in stages, which are usually related to significant milestones in the development process. Such stages, for example, might be completion of the design, the pilot production, the first date the firm makes a profit, or the introduction of a second product. At each stage, the firm is given just enough cash to reach the next stage, and the venture capitalist retains the option to abandon the venture if performance is not satisfactory.

A striking feature of venture capital finance is that the venture capitalist typically infuses capital in stages, which are usually related to significant milestones in the development process.

The threat to abandon the venture may induce the entrepreneur to put more effort into making the venture a success. This is good, of course, but it also introduces the potential for "window dressing." The entrepreneur might manipulate short-term performance signals upward to fool the venture capitalist into continuing to finance the project. For example, the entrepreneur might engage in activities that boost short-term earnings but reduce long-term earnings. Or the entrepreneur might produce a prototype that looks functional (and so meets the requirements of the current stage) but is in fact too costly to put into mass production. Window dressing reduces the benefit of stage financing because the venture capitalist bases decisions on "noisy" or incorrect information

[6] An angel investor is a high-net-worth individual who typically invests in small private firms, on his own account. (In contrast, venture capitalists invest funds received from other individuals.) Formally, angel investors are "accredited investors," according to the SEC. The SEC rule 501 of Regulation D states that an accredited investor is an individual who has a net worth that exceeds $1 million or an expected yearly income of more than $200,000 ($300,000 including spouse).

[7] For more detailed models, read the paper by Catherine Casamatta and the paper by Rafael Repullo and Javier Suarez.

An Example of Venture Capital Financing

Dexter, a young genius, has finally decided to have his own start-up. He has an idea about how to develop a drug that allows cartoon characters to become humans and vice versa. Dexter has no cash of his own, and he hopes to raise the required investment of $45 million from his old neighbor, Mandark, who now has his own venture capital firm.

Assume that there are two states: A good state, where profits are $100 million, and a bad state, where profits are $40 million. Dexter and Mandark can either exert effort or not. Exerting effort raises the probability of the good state and lowers the probability of the bad state: If both Dexter and Mandark exert effort, the probability of each state is 50 percent. If either of them does not exert effort, the probability of the good state falls to 25 percent, and the probability of the bad state rises to 75 percent.

But Dexter and Mandark bear a cost for exerting effort. Think of this as profits each forgoes by putting effort into the venture rather than into other projects. Assume that the cost of exerting effort (per individual) is $7.5 million.

Let's suppose that Dexter and Mandark share profits between them. The question is how to design a contract between Dexter (the entrepreneur) and Mandark (the venture capitalist) so that (i) each will have the incentive to exert effort (more precisely, we want to make sure that if one exerts effort, the other one cannot gain by not exerting effort);[a] and (ii) Mandark (who supplies the funds) will at least break even.

Consider first an even split; that is, Dexter and Mandark write a contract according to which they split the profits equally, so that each one gets $20 million in the bad state and $50 million in the good state. Is this enough to induce effort? Yes. If Dexter exerts effort, Mandark cannot gain by not exerting effort. To see this, note that Mandark's expected return from exerting effort equals $(0.50\times20)+(0.50\times50)-7.5=27.5$, and his return from not exerting effort is the same $((0.75\times20)+(0.25\times50)=27.5)$. Similarly, if Mandark exerts effort, Dexter cannot gain by not exerting effort.

The problem with this split is that Mandark does not receive enough to cover his initial investment of $45 million. Knowing this, Mandark will not invest to begin with.

We might think that the solution is to give Mandark a larger share of the project's profits, so that he can cover his initial investment. The problem is that by reducing Dexter's share, we eliminate his incentives to exert effort. For example, if Mandark gets 75 percent of the profits and Dexter gets 25 percent, Dexter ends up with $10 million in the bad state and $25 million in the good state, so he has no incentive to exert effort. (If he exerts effort, he obtains $(0.50\times10)+(0.50\times25)-7.5=10$; if he does not exert effort, he obtains $(0.75\times10)+(0.25\times25)=13.75$.)

Instead, one solution is a contract that gives Dexter nothing in the bad state and $30 million in the good state, while giving Mandark $40 million in the

[a] This is what economists refer to as a Nash equilibrium.

rather than on correct information. In extreme cases, the possibility of window dressing may cause the venture capitalist to decide not to finance the venture to begin with.

In their article, Francesca Cornelli and Oved Yosha show that properly designed convertible preferred equity can overcome window dressing. How can such a security resolve the problem? Cornelli and Yosha show that the convertibility option is the answer.

Cornelli and Yosha assume that the venture capitalist must choose whether to convert his preferred stock to common stock after he sees the results of the first financing stage but before he sees final profits. This means that the decision to convert must be based on the venture's interim performance. The venture capitalist will choose to exercise the conversion options only if profits are likely to be high, based on the venture's interim performance. Window dressing, because it makes interim performance look better, increases the likelihood that the venture capitalist will convert his or her preferred stock to common stock. But conversion is a very undesirable outcome for the entrepreneur. In particular, if the conversion price is set low, the venture capitalist obtains

An Example of Venture Capital Financing...*continued*

bad state and $70 million in the good state.[b] This is feasible because Mandark expects to get $55 million, on average, which is more than his initial investment plus his effort cost.[c] It also induces both Dexter and Mandark to exert effort (as shown in possibility 3 in the table).

This last contract is more than pure profit sharing, since Dexter receives a positive share of the profits in the good state, but nothing in the bad state, even though the project generates $40 million. Such a contract can be implemented by giving Dexter shares of common stock and by giving Mandark shares of convertible preferred stock. Specifically, Dexter gets 30 shares of common stock, and Mandark gets 70 shares of convertible preferred stock that has a total promised payment of $40 million (if not converted) and that can be converted into 70 shares of common stock. If the bad state happens, Mandark will not exercise the option to convert and will obtain the promised payment of $40 million, which is everything the firm has. If instead Mandark chose to convert the preferred shares, he would obtain only 70 percent of the profits (because he has 70 shares and Dexter has 30), which is less than $40 million. In contrast, if the good state happens, Mandark will exercise the conversion option and, by doing so, obtain $70 million (since he will then own 70 percent of the firm's shares, and the firm is worth $100 million as a whole). This is clearly better than not converting and receiving $40 million instead. (The table provides a summary.)

Finally, note that if Mandark needs to invest $27.5 million or less, the two objectives (inducing effort and allowing Mandark to cover his investment) can be achieved even with an equal share (first possibility in the table). In contrast, if Mandark needs to invest more than $47.5 million, even the use of convertible preferred stock (third possibility in the table) does not achieve the two goals.

[b] This is not the only possibility. For example, giving Dexter $1 million in the low state and $31 million in the high state, while giving Mandark $39 million and $69 million, can also work.

[c] To simplify, I assumed here that the discount rate (i.e., the expected return Mandark can obtain by investing his money in other ventures with similar risk) is 0 percent. With a positive discount rate, Mandark would need to get more. For example, if the discount rate is 5 percent, Mandark would require an expected payoff of $54.75 million (= (45×1.05) + 7.5). The solution presented in this example still works in this case.

many shares of stock by choosing to convert preferred stock to common stock, and the entrepreneur ends up owning a substantially smaller portion of the venture. To prevent this from happening, the entrepreneur will not engage in window dressing in the first place.

Putting it differently, the entrepreneur faces a tradeoff: Window dressing increases the probability that the venture will continue to be financed but also increases the probability that the venture capitalist will use the conversion option to acquire a substantial portion of the firm's equity. Setting the conversion price low makes the second scenario, in which the venture capitalist uses the conversion option, very undesirable for the entrepreneur, and this induces the entrepreneur to refrain from window dressing in the first place.[8]

[8] The assumption that the venture capitalist must decide whether to exercise the conversion option *after* seeing the results of the first stage but *before* seeing the final results (i.e., before learning about the long-term performance of the venture) is crucial. Otherwise, the venture capitalist will not convert upon seeing a good interim signal and instead will wait to obtain more precise information. This is a drawback of the model because in reality convertible preferred stock typically does not have such a pre-specified deadline for conversion. The venture capitalist usually converts only upon exiting the investment, i.e., when the venture is sold to an acquirer or when the venture goes public in an initial public offering.

CONVERTIBLE SECURITIES AND EXIT DECISIONS

Now let's consider the exit decision and the contract between the venture capitalist and the entrepreneur. The exit decision refers to the terms on which the venture capitalist can cash out his or her investment, pay the investors, and move on to the next prospect. A moderately successful investment usually leads to a sale to another firm, while an exceptionally successful investment leads to an initial public offering (IPO), in which the firm issues common stock to the general public. For example, Apple, Google, Intel, Microsoft, and Yahoo, which are

TABLE

An Example of Venture Capital Financing

	Possibility 1			Possibility 2			Possibility 3		
	Good state	Bad state	On average*	Good state	Bad state	On average*	Good state	Bad state	On average*
Total profits	100	40	70	100	40	70	100	40	70
Dexter's payoff	50	20	35	25	10	17.5	30	0	15
Mandark's payoff	50	20	35	75	30	52.5	70	40	55
On average, does Mandark cover his initial investment plus the cost of effort?*	No (35 < 45 +7.5)			Yes (52.5 = 45 +7.5)			Yes (55 > 45 + 7.5)		
If Mandark exerts effort, can Dexter gain by not exerting effort?	No If Dexter exerts effort, he receives 35-7.5 = 27.5. Otherwise, he receives (0.25×50) + (0.75×20) =27.5.			Yes If Dexter exerts effort, he receives 17.5-7.5 = 10. Otherwise, he receives (0.25×25) + (0.75×10) =13.75.			No If Dexter exerts effort, he receives 15-7.5 = 7.5. Otherwise, he receives (0.25×30) + (0.75×0) =7.5.		
If Dexter exerts effort, can Mandark gain by not exerting effort?	No If Mandark exerts effort, he receives 35-7.5 = 27.5. Otherwise, he receives (0.25×50) + (0.75×20) =27.5.			No If Mandark exerts effort, he receives 52.5-7.5 = 45 Otherwise, he receives (0.25×75) + (0.75×30) =41.25.			No If Mandark exerts effort, he receives 55-7.5 = 47.5. Otherwise, he receives (0.25×70) + (0.75×40) =47.5.		
Implementation	Dexter and Mandark each get 50 shares of common stock.			Dexter gets 25 shares of common stock, and Mandark gets 75 shares of common stock.			Dexter gets 30 shares of common stock, and Mandark gets 70 shares of convertible preferred stock, which can be converted into 70 shares of common stock, and which have a total promised payment of $40 million.		

*If both Dexter and Mandark exert effort

The table illustrates three ways to split profits between Dexter (the entrepreneur) and Mandark (the venture capitalist). Total profits are either $100 million (good state) or $40 million (bad state). If both Dexter and Mandark exert effort, the probability of each state is 50 percent. If either of them does not exert effort, the probability of the good state falls to 25 percent and the probability of the bad state rises to 75 percent. The cost of effort is $7.5 million per individual. Mandark needs to cover his initial investment of $45 million plus the cost of effort. In addition, both Mandark and Dexter must be induced to exert effort. For simplicity, the discount rate is assumed to be 0 percent. The table shows that possibility 3 achieves the two goals, but possibilities 1 and 2 violate one of them. All numbers represent millions of dollars.

now publicly traded, initially received venture capital.

The two types of exit decisions create new contracting opportunities for the venture capitalist and the entrepreneur: They can now allocate profits differently, depending on whether the firm is sold to another firm or goes public. This additional flexibility can make it easier to achieve the two objectives: providing incentives to exert effort and making sure that the venture capitalist breaks even. Indeed, real world contracts often incorporate the exit decision. In many cases, the convertible preferred stock automatically converts to common stock in an IPO, but it does not automatically convert when the firm is purchased by another firm; Kaplan and Strömberg show that an automatic conversion provision was present in 95 percent of the financing rounds they studied. In almost all cases, automatic conversion was related to an IPO.[9]

Thomas Hellmann provides a model that explains this automatic conversion clause. In his model, the entrepreneur and the venture capitalist learn about the potential profitability of the venture. Then they need to make an exit decision. They can either sell the venture to an acquirer or remain independent, hoping to go public (in an IPO) later. Remaining independent is risky: The venture can succeed and obtain a high IPO price (the IPO value for existing shareholders could be $1 billion), but it can also fail and yield no profits.[10] In contrast, if the venture is sold, say, at $600 million, the venture capitalist and the entrepreneur end up with a guaranteed payoff that is high but not as high as what they would get if they remained independent and the venture turned out to be a huge success.

The two types of exit decisions have very different implications for continuing effort by the venture capitalist and the entrepreneur (i.e., the effort they need to exert after learning about the potential profitability of the venture and making an exit decision). If the venture remains independent, the entrepreneur and the venture capitalist need to exert effort in order to increase the probability of a success before going public. However, if the venture is sold, their efforts are no longer needed. Thus, a contract must provide the entrepreneur and venture capitalist with incentives to exert effort only if the venture remains independent but not if it is acquired by another firm.[11]

Remember that the contract also needs to make sure that the venture capitalist is compensated for his or her initial investment. In the example above, we showed that this can be done by giving the venture capitalist convertible preferred stock. But we also showed that when the required investment by the venture capitalist is very large, we could not achieve the two objectives simultaneously. (The problem was that if we gave the venture capitalist a big enough share of the profits to cover his investment, we hurt the entrepreneur's incentives to exert effort.) Contracting on the exit decision can help us achieve the two objectives. In particular, we can give the venture capitalist a higher share of profits only if the firm is sold to another firm (in which case the entrepreneur's effort is not important), while maintaining the optimal split of profits (inducing both to exert effort) if the venture remains independent. For example, if the firm is sold to another firm, the venture capitalist can obtain everything ($600 million), whereas if the firm remains independent, the venture capitalist and the entrepreneur can split profits equally to induce optimal effort levels.[12]

Note that in the profit allocation above, the venture capitalist receives more if the value is realized through an acquisition rather than an IPO.

A moderately successful investment usually leads to a sale to another firm, while an exceptionally successful investment leads to an initial public offering (IPO), in which the firm issues common stock to the general public.

[9] The convertible preferred shares currently being used to recapitalize banks also have a mandatory conversion feature.

[10] In the survey by William Sahlman, 34.5 percent of the capital invested resulted in a loss (11.5 percent resulted in total loss, and 23.0 percent resulted in partial loss). The data he used covered investments by 13 venture-capital partnerships in 383 companies from 1969 to 1985.

[11] Note that we are dealing here only with the efforts that must be exerted after the exit decision has been made. In his article, Hellmann also deals with the effort that must be made in the first stage before the exit decision is made.

[12] In the first numerical example in this article, there was more than one way to induce optimal levels of efforts because we could decide how to split profits in the high state as well as in the low state. Here if the venture remains independent there are also two states (failure, success), but because there are no profits if the venture fails, we can only split profits if the venture has an IPO. The only way to do it and maintain the optimal level of effort is equal shares.

He or she obtains $600 million in the first case but only $500 million (which is half of the IPO value) in the second case. This is done to increase the amount of money that the venture capitalist obtains as much as possible (so that he or she is willing to put out more money upfront) while at the same time inducing the entrepreneur and venture capitalist to exert the optimal level of effort needed for a successful IPO.[13] This allocation of profits can be achieved by giving the entrepreneur 50 shares of stock and giving the venture capitalist 50 shares of convertible preferred stock that have a total promised payment of $600 million and that can be converted into 50 shares of common stock. For this to work the convertible preferred stock must have an automatic conversion clause. Otherwise, the venture capitalist will not convert the preferred stock voluntarily when the firm makes an IPO.[14]

CONTROL RIGHTS

The discussion so far has been about cash flow rights: i.e., who has the right to obtain the venture's profits? Hellmann's model provides insights not only about cash flow rights but also about control rights; i.e., who gets to make the venture's decisions? In particular, Hellmann focuses on the exit decision, showing that the firm's performance determines who gets to make the exit decision. According to his model, the entrepreneur should obtain control when the potential profitability of the venture is high, and the venture capitalist should obtain control otherwise. This is consistent with the empirical evidence presented in the article by Kaplan and Strömberg. For example, they show that the venture capitalist may contractually obtain control from the entrepreneur when EBIT falls below a mutually agreed upon amount.[15]

Control rights are important because the entrepreneur and the venture capitalist, who hold different securities, may have different preferences regarding the exit decision to be made.

Control rights are important because the entrepreneur and the venture capitalist, who hold different securities, may have different perferences regarding the exit decision to be made. We have already seen that given the profit allocation in the previous section, the venture capitalist always prefers to sell the firm rather than have an IPO. However, this may not be the right decision from the firm's point of view (it may not be the decision that maximizes total profits). For example, if the probability of a successful IPO is 70 percent, it is better to remain independent and attempt a successful IPO because $0.7 \times \$1$ billion is greater than $600 million. The entrepreneur will be happy with this decision (as he or she receives nothing if the firm is sold, but $500 million if the IPO is successful), but the venture capitalist will not.

But this does not mean that we should give the entrepreneur full control. In particular, suppose the entrepreneur and the venture capitalist learn that the probability of a successful IPO is only 50 percent. The right decision in this case is to sell the firm because $600 million > $0.5 \times \$1$ billion. The venture capitalist gets paid $600 million and so will be happy with this decision. However, the entrepreneur will prefer to take

[13] The fact that the venture capitalist receives more in an acquisition compared to an IPO is counterfactual. However, it is not necessary for the main idea to hold. To see why, consider the case in which we don't know exactly at what price the firm will be sold, and we want the venture capitalist to obtain $300 million plus 50 percent of the remaining sale profits (so the entrepreneur gets the other half of the remaining profits). For example, if the firm is sold for $600 million, the venture capitalist gets $450 million, and the entrepreneur gets $150 million. This can be implemented by giving participating preferred stock to the venture capitalist (as explained in the next footnote) that automatically converts to common stock in an IPO. Automatic conversion is necessary because without it, the venture capitalist would get $300 million plus 50 percent of the remaining $700 million, which is more than $500 million, so he will not want to convert.

[14] If the venture capitalist converts preferred stock to common stock, he or she ends up with $500 million because the venture capitalist and the entrepreneur each have 50 shares of stock. If the venture capitalist does not convert preferred stock to common stock, he or she ends up with $600 million, but this does not implement the profit allocation wanted. In the real world, there is an extensive use of a variant of convertible preferred stock called *participating preferred*. This type of security was used in 38.5 percent of the cases in the sample of Kaplan and Strömberg. Participating preferred stock can be thought of as a position of two securities: preferred stock and straight common stock. Upon exit, the holder of the participating preferred stock (the venture capitalist) obtains the promised dividend (just like preferred equity) but also obtains dividends as if the security had been converted to common stock. The venture capitalist will never want to convert his or her security to common stock; a venture capitalist who does so gives up the preferred stock and ends up with only common stock. Automatic conversion is therefore necessary.

[15] They also showed that a state-contingent board provision (i.e., the venture capitalist gets control of the board in the bad state) was present in 18 percent of the cases in their sample and that state-contingent voting rights (i.e., the percentage of votes that investors and management have to affect corporate decisions) were present in 18 percent of all financing rounds and 25 percent of first financing rounds.

the risk of remaining independent. If they sell the firm, the entrepreneur gets nothing, whereas if they remain independent and the venture succeeds, he or she can get $500 million.

So how can we make sure that the right decision is made? In the example above, the entrepreneur should obtain control if the probability of a successful IPO is high (70 percent), and the venture capitalist should obtain control if the probability of a successful IPO is low (50 percent). More generally, the entrepreneur should obtain control if the expected proceeds from an IPO are high (either because of a high probability of success or because of a high IPO price), and the venture capitalist should obtain control if the expected proceeds from an IPO are low. In the real world, such contingent control rights can be implemented, for example, by stating in the contract that the venture capitalist obtains control if EBIT falls below some pre-specified level, which might indicate a low probability of a successful IPO.

SUMMARY

Convertible securities (in particular, convertible preferred stock) are widely used in venture capital financing. Convertible securities can help align incentives so that both the entrepreneur and the venture capitalist exert the appropriate levels of effort to ensure the business's success. Convertible securities can also prevent window dressing, so that the venture capitalist can provide financing in stages based on performance without worrying that the entrepreneur will try to make things look better than they really are.

The convertible securities used in venture capital financing have many unique features. For example, an automatic conversion when the firm makes an IPO can increase the amount of money the entrepreneur can raise from the venture capitalist without compromising the incentives necessary to put effort into the venture. We also saw that appropriately designed control rights can ensure optimal exit decisions.

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WHAT ACCOUNTS FOR THE DECLINE IN EMPLOYMENT VOLATILITY?

This study documents a general decline in the volatility of employment growth during the period 1956 to 2005 and examines its possible sources. Estimates from a state-level pooled cross-section/time-series model indicate that aggregate and state-level factors each account for an important share of the total explained variation in state-level volatility. Specifically, state-level factors have contributed as much as 16 percent, while aggregate factors are found to account for up to 46 percent of the variation. With regard to state-level factors, the share of state total employment in manufacturing and state banking deregulation each contributed significantly to fluctuations in volatility. Aggregate factors that are quantitatively important in accounting for volatility include monetary policy, the state of the national business cycle, and oil-price shocks.

Working Paper 09-9, "The Long and Large Decline in State Employment Growth Volatility," Gerald Carlino, Federal Reserve Bank of Philadelphia, Robert DeFina, Villanova University, and Keith Sill, Federal Reserve Bank of Philadelphia

AN OPTIMAL MECHANISM FOR REPORTING CONTRACTS

When contracts are unobserved, agents may have the incentive to promise the same asset to multiple counterparties and subsequently default. The author constructs an optimal mechanism that induces agents to reveal all their trades voluntarily. The mechanism allows agents to report every contract they enter, and it makes public the names of agents who have reached some prespecified position limit. In some cases, an agent's position limit must be higher than the number of contracts he enters in equilibrium. The mechanism has some features of a clearinghouse.

Working Paper 09-10, "Inducing Agents to Report Hidden Trades: A Theory of an Intermediary," Yaron Leitner, Federal Reserve Bank of Philadelphia

MEASURING NATIONAL INCOME: NEW GOODS AND INTANGIBLES

In this paper the author relates the measurement of intangibles to the project of measuring the sources of growth. He focuses on three related and difficult areas of the measurement of national income: the measurement of new goods, the deflation of intangible investment, and the divergence between the social and private valuations of intangible assets. The author argues that the economic theory and practice underlying measurement of these items is currently controversial and incomplete, and he points toward how concretely to move forward. (Revision forthcoming in *Review of Income and Wealth)*

Working Paper 09-11, "Intangible Assets and National Income Accounting: Measuring a Scientific Revolution," Leonard I. Nakamura, Federal Reserve Bank of Philadelphia

Changes in the Use of Electronic Means of Payment: 1995-2007*

BY LORETTA J. MESTER

This article updates the tables originally published in an article by Loretta Mester in the March/April 2000 *Business Review* and subsequently updated in the Second Quarter 2006 issue.

In "The Changing Nature of the Payments System: Should New Players Mean New Rules?" (*Business Review*, Federal Reserve Bank of Philadelphia, March/April 2000), I presented some data from the 1995 Federal Reserve Survey of Consumer Finances on the use of electronic banking. This survey of more than 4,000 households, which is designed to be representative of all households in the U.S., is redone every three years. Attached are updates of the statistics indicating how the usages of various means of electronic payment have changed between 1995 and 2007.

As seen in Exhibit 1 and in the accompanying charts, usage of electronic forms of payment, including ATMs, debit cards, automatic bill paying, and smart cards, has risen from about 78 percent of households in 1995 to almost 92 percent of households in 2007. Debit card use, which about doubled between 1995 and 1998, has been steadily increasing (although at a slower pace) since then and now stands at nearly 67 percent of all households. Increases were seen in all categories by age, income, and education. Use of direct deposit increased except for those over age 60. Automatic bill paying fell across all categories, but the percentage of households now using it remains double what it was in 1995. Nearly 80 percent of households have an ATM card, with the largest growth seen in those over age 60. There was little change in the percentage of households that use some type of computer software to manage their money: The percentage stood at about 19 percent in 2007. Respondents under 60 years old, those with higher income, and those with college degrees are more likely to use a computer for money management.

As seen in Exhibit 2 and the accompanying charts, households that do business with at least one financial institution continued to increase usage of automated methods of conducting this business. However, there was also an increase in the fraction of households, to almost 85 percent, reporting that one of the main ways they deal with at least one of their financial institutions is in person. There was a sizable increase in the percentage of households that use the telephone as one of the main ways of conducting business. This might reflect cell phone usage, but both voice and touchtone usage increased. Overall use of electronic means of doing business — either ATM, phone, fax, direct deposit and payment, other electronic transfer, and/or computer — continued to increase between 2004 and 2007. In 2007, about 93 percent of households used an electronic method as one of their main ways of conducting business, and differences by income, education, and age have become less pronounced. Differences in the popularity of ATM/debit card usage across age groups remain: Almost 86 percent of those under 30 years old use ATM/debit cards as one of their main ways of conducting business, while around 50 percent of those over 60 years old use them. Still, the usage by those over 60 has more than tripled since 1995.

The largest increase between 2004 and 2007 was seen in the percentage of households that use a computer, the Internet, or an online service to do business. In 2007, over 50 percent of households used these methods, up from 34 percent in 2004 and less than 4 percent in 1995. Youth, high income, and a college degree continue to be associated with a higher incidence of computer banking. While the computer remains a less popular means of doing business with financial institutions compared with other methods, its popularity is catching up to that of using mail or the phone.

Loretta J. Mester is a senior vice president and director of research at the Federal Reserve Bank of Philadelphia. This article is available free of charge at www.philadelphiafed.org/research-and-data/publications/.

* The views expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

Forthcoming as exhibit 1 in *The Statistical Abstract of the United States*, 2010.

EXHIBIT 1, PART 1

Percent of U.S. Households That Use Each Instrument: 1995, 1998, 2001, 2004, and 2007[a]

	ATM[b]					Debit Card					Smart Card[b]		
	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007	1995	1998	2001
All Households	62.5%	67.4%	69.8%	74.4%	79.7%	17.6%	33.8%	47.0%	59.3%	67.0%	1.2%	1.9%	2.9%
By Age:													
Under 30 years old	72.3%	75.6%	78.1%	83.0%	84.8%	24.4%	45.0%	60.6%	74.4%	78.3%	1.8%	2.6%	2.6%
Between 30 and 60 years old	68.6%	76.1%	76.8%	82.3%	85.9%	19.7%	38.6%	53.4%	67.6%	74.9%	1.5%	2.3%	3.3%
Over 60 years old	44.2%	41.9%	48.9%	51.6%	63.5%	9.6%	16.0%	24.6%	32.5%	43.9%	0.3%	0.5%	2.1%
By Income[c]:													
Low income	38.5%	45.9%	46.8%	53.0%	58.8%	7.0%	19.7%	29.2%	41.2%	48.1%	0.7%	1.5%	1.9%
Moderate income	61.5%	64.4%	67.4%	73.4%	78.5%	16.0%	31.6%	46.3%	57.4%	68.0%	0.6%	3.1%	3.0%
Middle income	70.9%	72.0%	75.2%	78.3%	87.5%	20.5%	36.6%	50.0%	64.3%	75.0%	1.3%	2.0%	2.4%
Upper income	77.2%	82.3%	83.7%	86.5%	91.0%	25.1%	43.8%	57.8%	69.3%	75.8%	1.8%	1.7%	3.7%
By Education													
No college degree	54.7%	60.1%	63.7%	67.4%	74.0%	14.3%	29.2%	42.3%	54.9%	63.7%	0.8%	1.8%	2.4%
College degree	80.4%	82.1%	81.6%	86.4%	90.3%	25.2%	43.1%	56.2%	67.0%	72.9%	2.1%	2.0%	3.8%

[a] The percentages reported are based on the population-weighted figures using the revised Kennickell-Woodburn consistent weights for each year. (For further discussion see the Survey of Consumer Finances codebooks at www.federalreserve.gov/pubs/oss/oss2/scfindex.html.) This exhibit reports percentages for all households.

[b] The questions on ATMs and smart cards asked whether any member of the household had an ATM card or a smart card, not whether the member used it. The other questions asked about usage. The question on smart cards was dropped after the 2001 survey.

[c] Low income is defined as less than 50 percent of the median household income; moderate income is 50 to 80 percent of the median; middle income is 80 to 120 percent of the median; and upper income is greater than 120 percent of the median. Each survey refers to income in the previous year. Median income in current dollars was $32,264 in 1994; $37,005 in 1997; $41,990 in 2000; $43,318 in 2003; and $48,201 in 2006.

Source: 1995, 1998, 2001, 2004, 2007 Survey of Consumer Finances data as of March 3, 2009, Federal Reserve System, and author's calculations.

EXHIBIT 1, PART 2

Percent of U.S. Households That Use Each Instrument: 1995, 1998, 2001, 2004, and 2007[a]

	Direct Deposit					Automatic Bill Paying					Software[b]			Any of the Methods: ATM, Debit Card, Smart Card, Direct Deposit, Automatic Bill Paying, or Software				
	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007	2001	2004	2007	1995	1998	2001	2004	2007
All Households	46.7%	60.5%	67.3%	71.2%	74.9%	21.8%	36.0%	40.3%	47.4%	45.5%	18.0%	19.3%	19.1%	77.7%	85.5%	88.9%	90.7%	91.8%
By Age:																		
Under 30 years old	31.0%	45.2%	48.8%	54.0%	61.3%	17.7%	30.5%	32.1%	36.5%	35.7%	17.0%	20.4%	21.4%	76.3%	80.2%	83.8%	87.6%	88.6%
Between 30 and 60 years old	42.8%	58.0%	64.8%	68.2%	72.6%	24.4%	38.6%	44.1%	50.3%	48.8%	22.0%	21.9%	21.6%	78.7%	87.5%	89.9%	90.9%	92.4%
Over 60 years old	63.3%	74.8%	83.2%	87.0%	86.4%	18.2%	33.0%	35.9%	46.5%	42.9%	9.0%	12.8%	12.3%	76.1%	83.7%	89.4%	92.0%	92.1%
By Income[c]:																		
Low income	32.5%	44.3%	51.9%	54.8%	60.5%	9.7%	17.1%	18.2%	24.6%	23.8%	6.1%	6.8%	7.7%	56.7%	69.3%	74.3%	78.0%	79.7%
Moderate income	42.9%	58.8%	63.1%	64.0%	68.5%	17.5%	30.5%	35.1%	40.5%	37.8%	10.7%	11.1%	10.7%	78.4%	87.2%	88.6%	88.7%	91.1%
Middle income	48.3%	66.1%	65.7%	73.2%	76.8%	23.4%	42.8%	45.1%	52.8%	50.2%	16.3%	17.8%	18.8%	85.1%	89.4%	92.5%	95.5%	96.4%
Upper income	58.3%	70.4%	80.2%	83.6%	86.6%	32.1%	49.3%	55.2%	62.4%	61.6%	29.9%	31.4%	30.5%	89.6%	94.9%	97.1%	97.5%	98.4%
By Education																		
No college degree	40.3%	54.4%	61.8%	64.3%	68.9%	18.1%	30.2%	33.7%	39.5%	38.0%	10.9%	12.4%	11.9%	71.4%	80.7%	85.1%	86.6%	88.4%
College degree	61.0%	72.6%	78.0%	83.2%	85.9%	30.1%	47.7%	53.2%	61.1%	59.3%	31.8%	31.3%	32.2%	91.8%	95.1%	96.4%	98.0%	98.2%

[a] The percentages reported are based on the population-weighted figures using the revised Kennickell-Woodburn consistent weights for each year. (For further discussion see the Survey of Consumer Finances codebooks at www.federalreserve.gov/pubs/oss/oss2/scfindex.html.) This exhibit reports percentages for all households.

[b] The question on software asked whether the respondent or spouse/partner uses any type of computer software to help in managing their money.

[c] Low income is defined as less than 50 percent of the median household income; moderate income is 50 to 80 percent of the median; middle income is 80 to 120 percent of the median; and upper income is greater than 120 percent of the median. Each survey refers to income in the previous year. Median income in current dollars was $32,264 in 1994; $37,005 in 1997; $41,990 in 2000; $43,318 in 2003; and $48,201 in 2006.

Source: 1995, 1998, 2001, 2004, 2007 Survey of Consumer Finances data as of March 3, 2009, Federal Reserve System, and author's calculations.

EXHIBIT 2, PART 1

Percent of U.S. Households with at Least One Financial Institution Using Each Method Among the Main Ways of Conducting Business with at Least One of Their Financial Institutions[a]

	In Person					Mail					ATM/Debit Card[b]				
	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007
All Households	85.5%	79.5%	77.2%	77.4%	84.9%	56.5%	54.1%	50.4%	50.5%	58.9%	33.8%	52.6%	56.7%	64.4%	73.6%
By Age:															
Under 30 years old	77.0%	73.7%	71.5%	72.9%	79.3%	58.2%	51.9%	50.5%	44.5%	52.4%	53.0%	68.8%	72.6%	79.3%	86.2%
Between 30 and 60 years old	86.8%	81.8%	78.6%	77.3%	84.8%	62.1%	60.4%	56.6%	56.8%	62.7%	37.7%	61.5%	65.0%	72.0%	82.2%
Over 60 years old	86.7%	77.2%	76.8%	79.6%	87.7%	44.0%	39.9%	36.0%	39.2%	53.5%	16.2%	22.3%	29.8%	39.9%	49.5%
By Income[c]															
Low income	81.2%	70.3%	68.2%	71.2%	80.9%	32.8%	33.4%	24.7%	28.9%	40.4%	19.6%	34.7%	35.6%	46.6%	53.9%
Moderate income	85.9%	80.4%	76.9%	75.0%	83.0%	48.5%	46.9%	42.0%	42.8%	52.5%	29.6%	47.8%	50.5%	62.3%	71.4%
Middle income	85.7%	81.4%	78.6%	77.8%	86.4%	56.9%	56.4%	58.4%	56.4%	63.0%	37.7%	54.1%	60.7%	65.9%	80.5%
Upper income	87.7%	84.1%	81.8%	81.5%	87.4%	74.3%	69.1%	64.9%	63.0%	70.9%	42.3%	65.2%	69.6%	74.4%	83.3%
By Education															
No college degree	85.8%	79.2%	75.1%	76.9%	84.0%	49.4%	48.2%	43.5%	44.3%	53.8%	27.4%	45.1%	50.1%	59.2%	69.0%
College degree	84.8%	80.2%	81.1%	78.0%	86.5%	71.2%	65.2%	63.0%	60.6%	67.7%	46.7%	66.7%	68.8%	72.9%	81.7%

[a] The percentages reported are based on the population-weighted figures using the revised Kennickell-Woodburn consistent weights for each year. (For further discussion see the Survey of Consumer Finances codebooks at www.federalreserve.gov/pubs/oss/oss2/scfindex.html.) Referring to each financial institution with which the household does business, the survey asked: "How do you mainly do business with this institution?" Respondents could list multiple methods, with the main method listed first. This exhibit reports for all households with at least one financial institution all of the methods a respondent listed for each of the household's financial institutions. Note, the percentages do not add up to 100 percent across columns, since households could list more than one method and more than one financial institution. Previous versions of this chart prior to 2006 reported for 1998 and 2001 on the main ways respondents did business with their depository financial institutions (i.e., commercial banks, trust companies, thrifts, and credit unions) rather than with any of their financial institutions.

[b] In 1995, the question did not include debit cards

[c] Low income is defined as less than 50 percent of the median household income; moderate income is 50 to 80 percent of the median; middle income is 80 to 120 percent of the median; and upper income is greater than 120 percent of the median. Each survey refers to income in the previous year. Median income in current dollars was $32,264 in 1994; $37,005 in 1997; $41,990 in 2000; $43,318 in 2003; and $48,201 in 2006.

Source: 1995, 1998, 2001, 2004, 2007 Survey of Consumer Finances data as of March 3, 2009, Federal Reserve System, and author's calculations.

EXHIBIT 2, PART 2

Percent of U.S. Households with at Least One Financial Institution Using Each Method Among the Main Ways of Conducting Business with at Least One of Their Financial Institutions[a]

	Phone					Computer					Electronic[b]				
	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007
All Households	25.7%	49.7%	48.9%	49.0%	61.8%	3.7%	6.2%	19.6%	33.7%	51.5%	56.2%	81.7%	87.0%	89.2%	93.3%
By Age:															
Under 30 years old	20.8%	45.4%	45.9%	43.2%	52.9%	5.2%	8.3%	22.9%	42.2%	61.7%	66.7%	81.0%	85.2%	89.2%	94.6%
Between 30 and 60 years old	28.1%	54.3%	52.4%	51.5%	64.8%	4.5%	7.6%	24.2%	39.9%	60.5%	59.9%	85.1%	89.4%	90.9%	95.1%
Over 60 years old	23.0%	40.6%	42.4%	46.0%	59.3%	1.2%	1.6%	7.3%	15.4%	27.4%	43.4%	73.9%	82.4%	85.4%	88.7%
By Income[c]:															
Low income	13.5%	28.8%	29.2%	30.0%	46.8%	1.3%	1.5%	4.8%	14.0%	23.9%	35.3%	65.4%	73.8%	78.7%	83.7%
Moderate income	18.6%	42.5%	42.8%	44.8%	59.6%	1.8%	2.7%	11.2%	22.5%	38.1%	48.5%	80.1%	84.2%	84.8%	92.1%
Middle income	22.6%	51.7%	51.7%	50.7%	62.8%	4.0%	4.3%	17.8%	32.5%	53.0%	59.2%	85.2%	89.7%	92.1%	96.6%
Upper income	37.9%	64.9%	61.4%	60.4%	71.2%	5.9%	11.5%	32.5%	49.5%	72.9%	70.8%	91.0%	94.5%	95.6%	98.1%
By Education															
No college degree	19.7%	41.9%	41.7%	43.4%	58.1%	2.8%	2.7%	11.3%	24.0%	39.8%	47.8%	76.5%	83.2%	85.7%	90.3%
College degree	38.1%	64.3%	61.9%	58.0%	68.2%	5.6%	12.8%	34.8%	49.4%	71.8%	73.5%	91.4%	94.0%	94.9%	98.4%

[a] The percentages reported are based on the population-weighted figures using the revised Kennickell-Woodburn consistent weights for each year. (For further discussion see the Survey of Consumer Finances codebooks at www.federalreserve.gov/pubs/oss/oss2/scfindex.html.) Referring to each financial institution with which the household does business, the survey asked: "How do you mainly do business with this institution?" Respondents could list multiple methods, with the main method listed first. This exhibit reports for all households with at least one financial institution all the methods a respondent listed for each of the household's financial institutions. Note, the percentages do not add up to 100 percent across columns, since households could list more than one method and more than one financial institution. Previous versions of this chart prior to 2006 reported for 1998 and 2001 on the main ways respondents did business with their depository financial institutions (i.e., commercial banks, trust companies, thrifts, and credit unions) rather than with any of their financial institutions.

[b] In 1995, electronic refers to ATM, phone, payroll deduction and direct deposit, electronic transfer, or computer. In 1998, 2001, 2004, and 2007, electronic refers to ATM, phone (via voice or touchtone), direct deposit, direct withdrawal/payment, other electronic transfer, computer/Internet/online service, or fax machine.

[c] Low income is defined as less than 50 percent of the median household income; moderate income is 50 to 80 percent of the median; middle income is 80 to 120 percent of the median; and upper income is greater than 120 percent of the median. Each survey refers to income in the previous year. Median income in current dollars was $32,264 in 1994; $37,005 in 1997; $41,990 in 2000; $43,318 in 2003; and $48,201 in 2006.

Source: 1995, 1998, 2001, 2004, 2007 Survey of Consumer Finances data as of March 3, 2009, Federal Reserve System, and author's calculations.

FIGURES

Figure 1.1 Exhibit 1 ATM

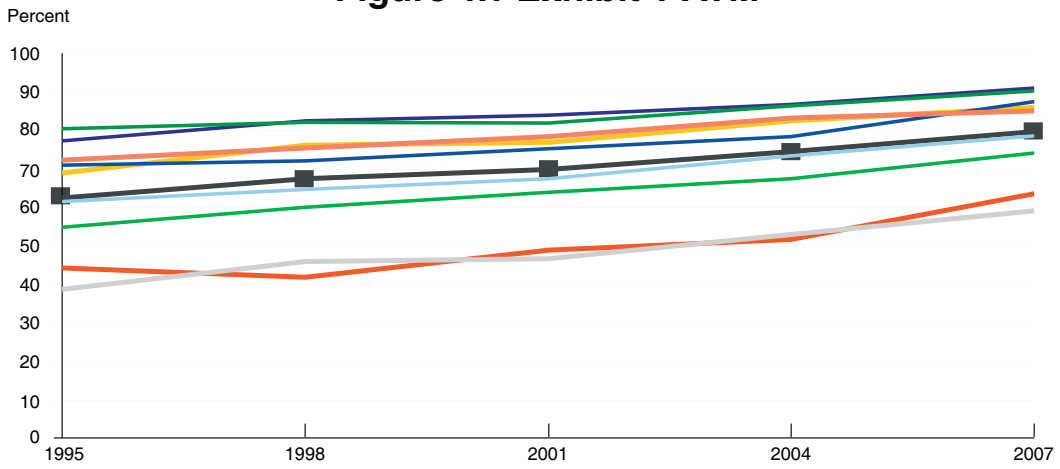


Figure 1.2 Exhibit 1 Debit Card

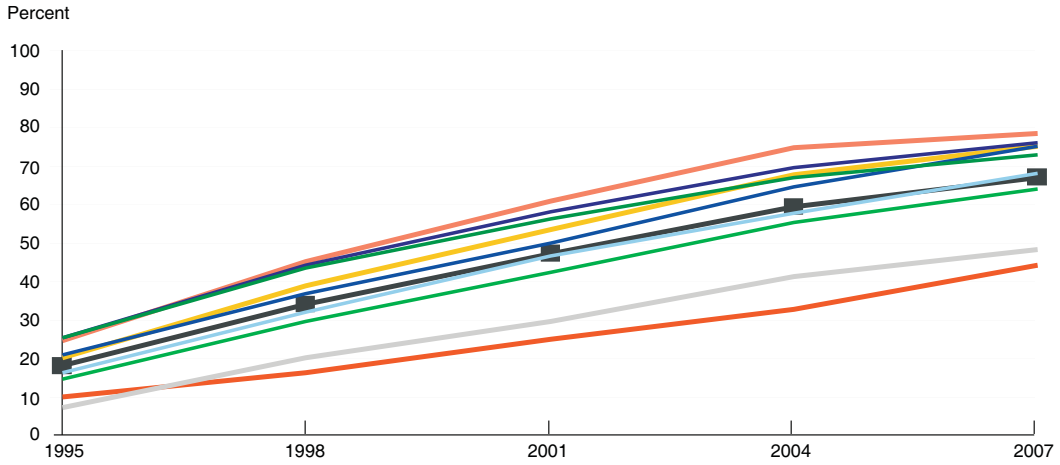
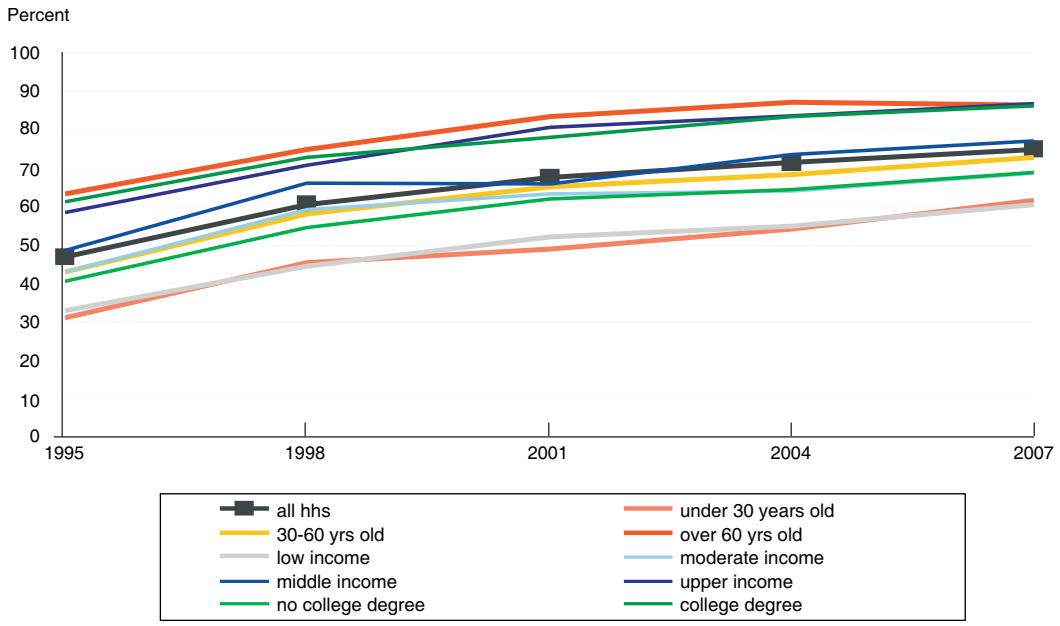


Figure 1.3 Exhibit 1 Direct Deposit



FIGURES

Figure 1.4 Exhibit 1 Automatic Bill Paying

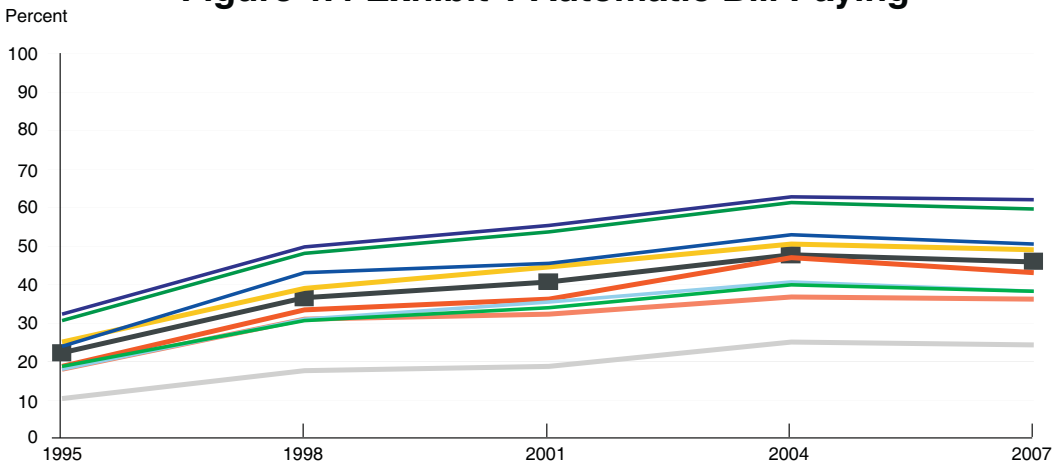


Figure 1.5 Exhibit 1 Software

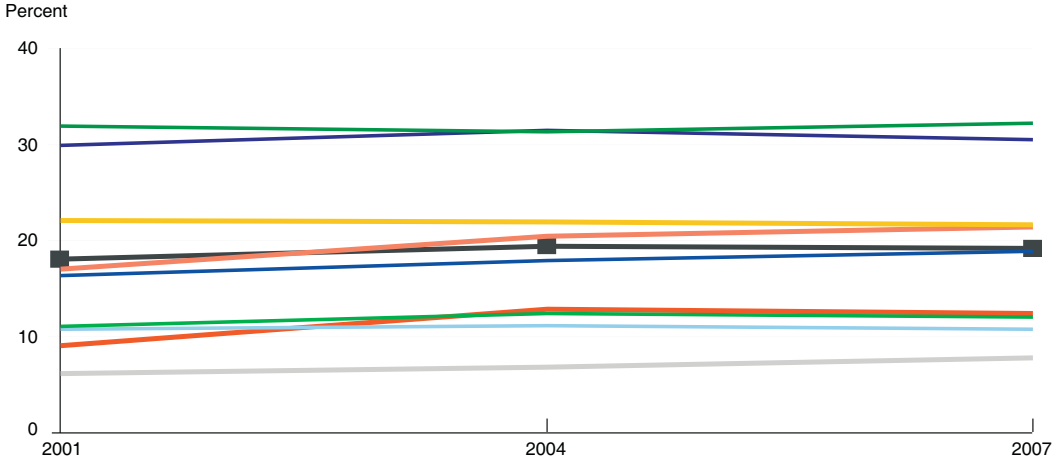
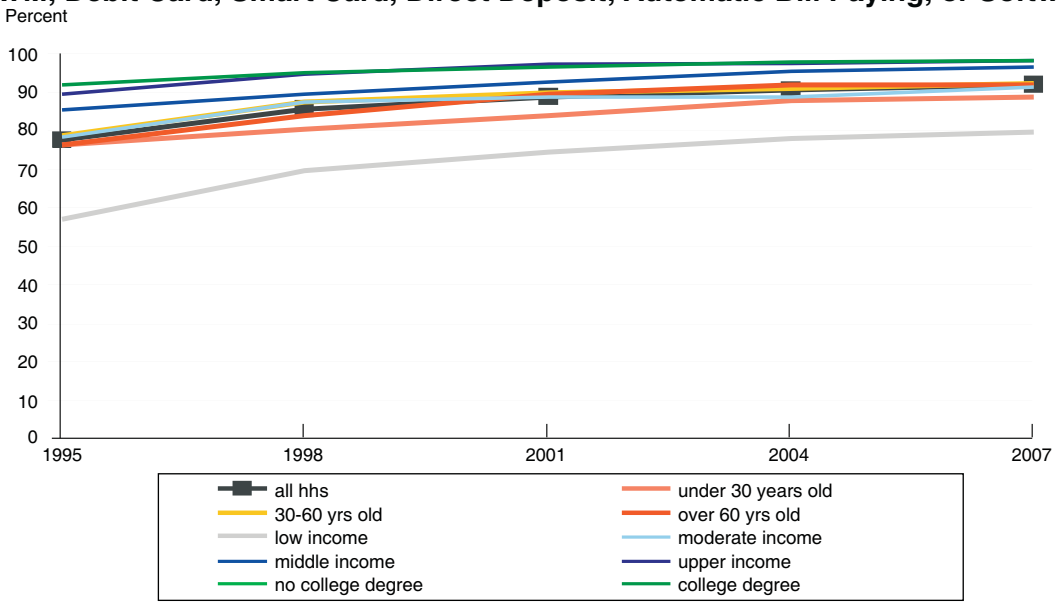


Figure 1.6 Exhibit 1 Any of the Methods

ATM, Debit Card, Smart Card, Direct Deposit, Automatic Bill Paying, or Software



FIGURES

Figure 2.1 Exhibit 2 In Person

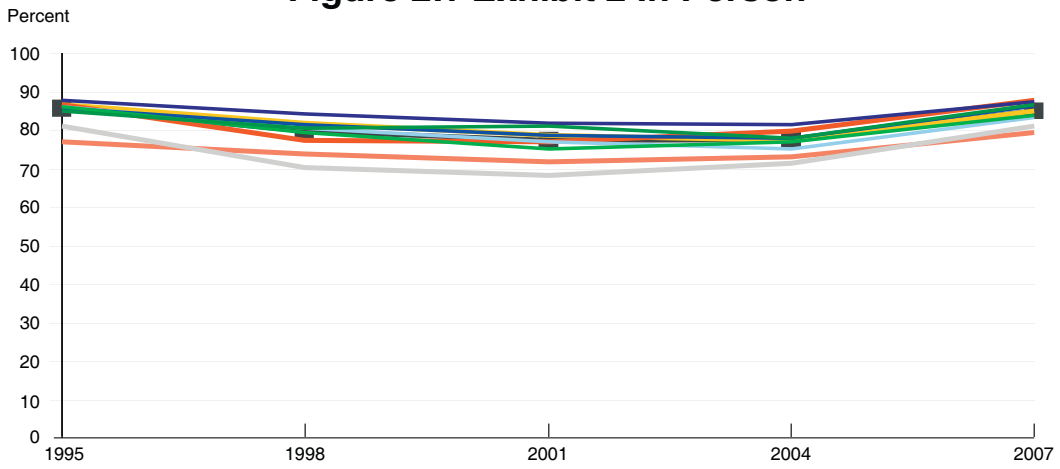


Figure 2.2 Exhibit 2 Mail

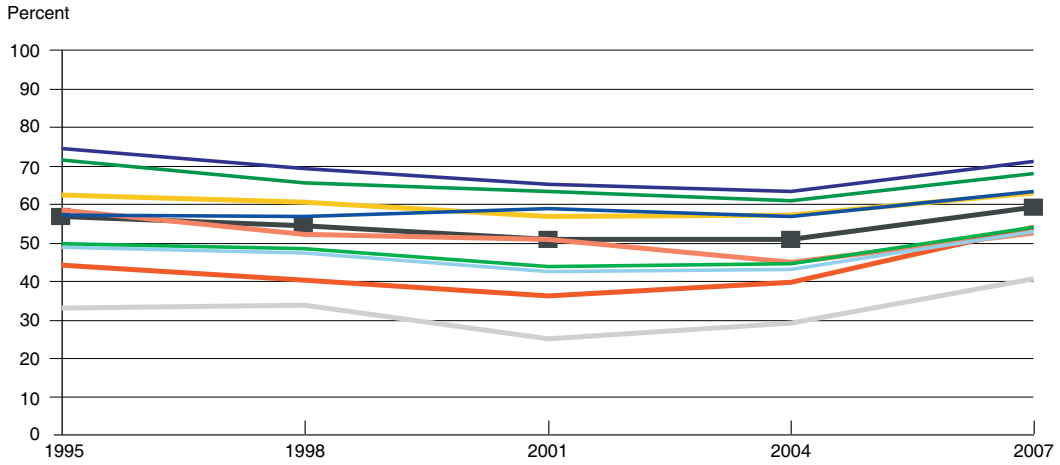
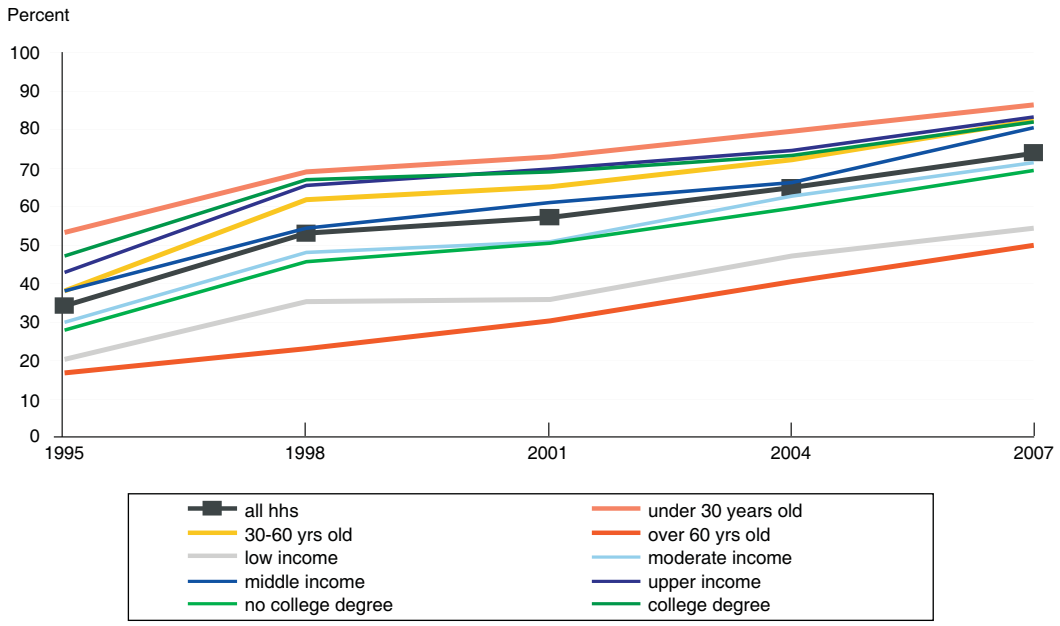


Figure 2.3 Exhibit 2 ATM/Debit



FIGURES

Figure 2.4 Exhibit 2 Phone

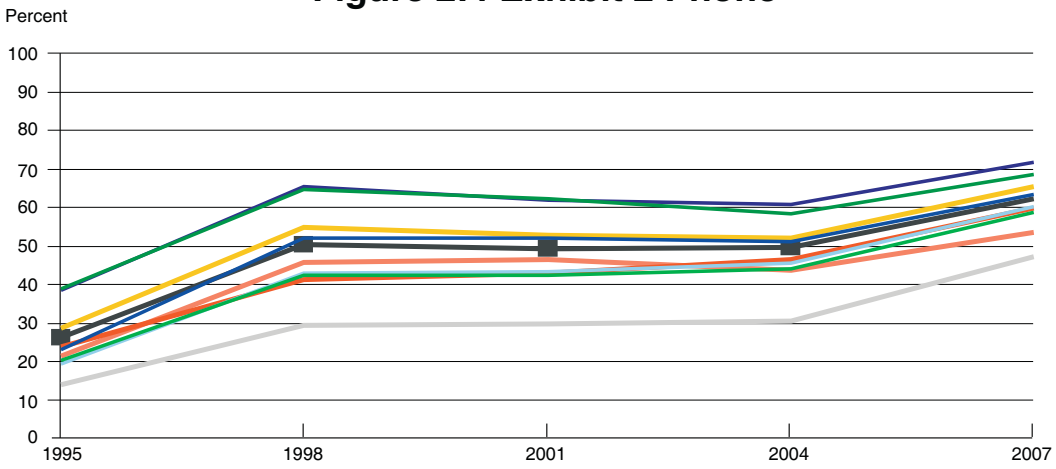


Figure 2.5 Exhibit 2 Computer

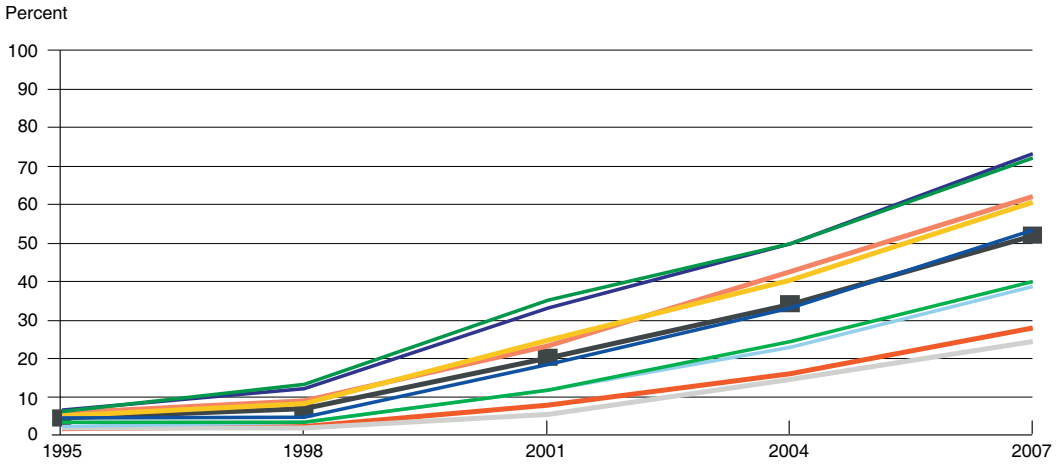


Figure 2.6 Exhibit 2 Electronic