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Recent Banking Sector Reforms in Japan

Hiroshi Nakaso

During the past year, in which major reforms to deal with the country's financial system problems were undertaken, the Bank of Japan focused on two tasks. The first was the establishment of a framework in which a bank failure could be handled in a flexible way with minimum negative impact on the stability of the financial system. It was thought essential to introduce a framework that could maintain the franchise value of a problem bank. This was particularly important for dealing with the failure of a bank like Long-Term Credit Bank of Japan (LTCB), which had an international presence and whose failure thus had systemic implications for the global financial system: as of the end of March 1998, LTCB had outstanding ¥51.5 trillion notional principal in derivatives transactions, which were typically cross-border. The second was to maintain the framework of capital injection using public funds. The Bank of Japan has argued that the core of Japan's financial system problems is the undercapitalization of many, if not all, Japanese banks. It was quite natural that an accelerated, accumulated charge-off of bad loans after the bursting of the bubble in the early 1990s ended up eating up the capital account of a bank. As banks' profitability and access to private capital markets were limited, public funds were almost the only source of money to immediately strengthen the capital position of viable banks.

Diet discussions produced two significant pieces of legislation: the Law Concerning Emergency Measures for the Reconstruction of the Functions of the Financial System, and the Financial Function Early Restoration Law. An outline of these laws is shown in Figure 1. The Law Concerning Emergency Measures for the Reconstruction of the Functions of the Financial System (commonly referred to as the Financial Reconstruction Law) is a useful framework within which the authorities can deal with a failed bank without necessarily finding a sound receiving bank

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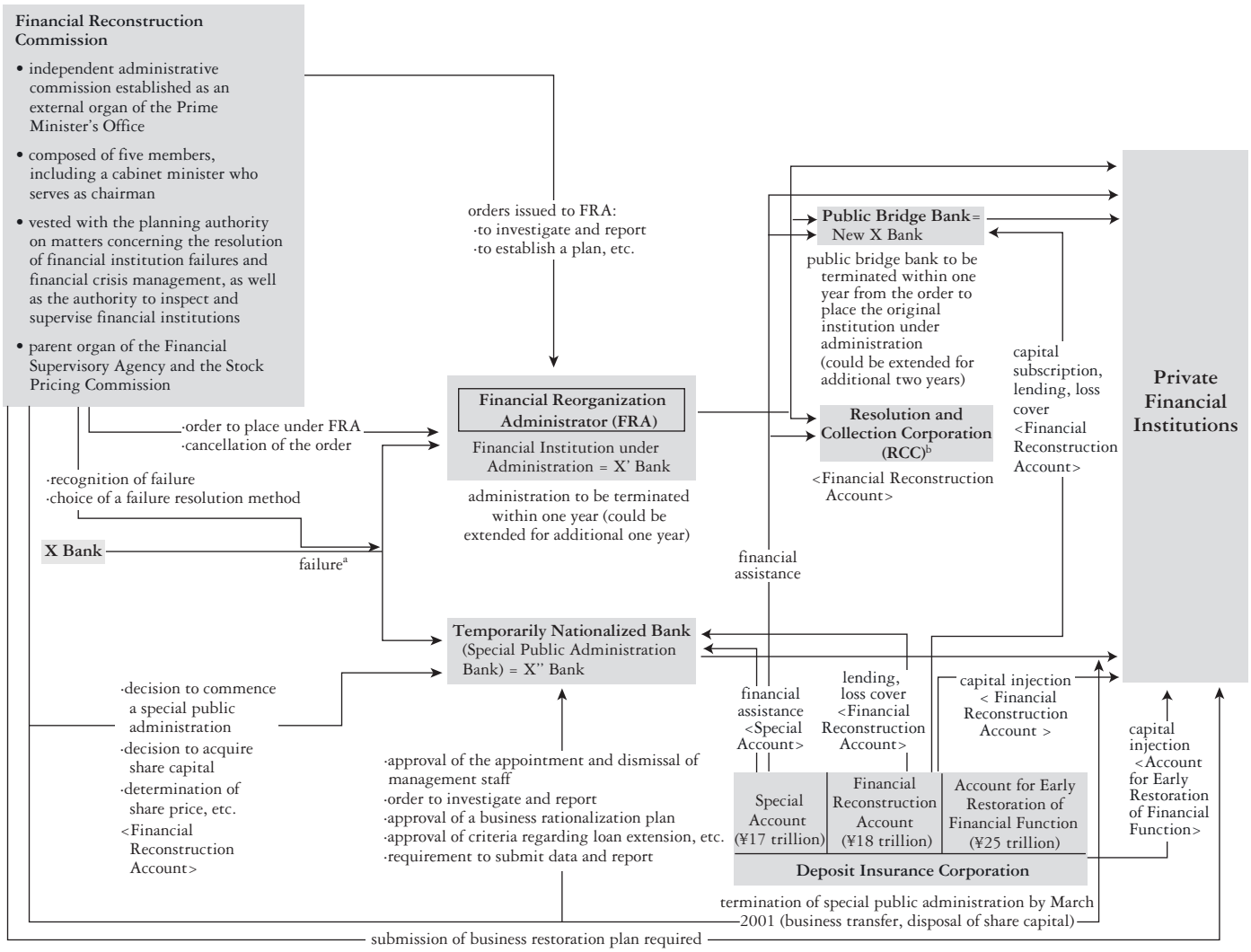
beforehand. LTCB was nationalized under the Financial Reconstruction Law. Under the framework, everything, including loss coverage and daily funding of a nationalized bank, is covered by the Deposit Insurance Corporation (DIC) in order to maintain the franchise value of the bank and to clean up its balance sheet. Throughout the temporary nationalization, until a sound receiving financial institution is found, the bank continues to provide its financial services while fully meeting its liabilities.

The new capital injection framework under the Financial Function Early Restoration Law has available ¥25 trillion of public funds. The primary objective of the capital injection was to restore confidence in Japanese banks and thus in the financial system as a whole. There may be various reasons for the lack of confidence in banks. For example, unrealized capital losses from securities holdings were not deducted from capital in calculating the capital ratio. Although this practice is justifiable as long as a bank adopts "original cost accounting standards," the figures are publicly disclosed and market players could easily calculate the "effective capital ratio" by subtracting the unrealized losses from the capital position of a bank.

Figure 1

THE FRAMEWORK OF THE FINANCIAL RECONSTRUCTION LAW AND THE FINANCIAL FUNCTION EARLY RESTORATION LAW



[a]Temporary nationalization (special public administration) can be applied to a financial institution in danger of failure.
[b]RCC is authorized to purchase assets from financial institutions under administration, bridge banks, special public administration banks, and other financial institutions.

Furthermore, charge-offs and provisioning of Japanese banks were regarded as generally insufficient. Against this background, the Financial Reconstruction Commission (FRC) decided to take these two points into account in calculating the required capital for fifteen major banks. As shown in Tables 1 and 2, the total amount of public capital injected is ¥7.5 trillion. Of this, ¥6.2 trillion is in the form of preferred stock. The unrealized capital losses for the fifteen major banks as of September 1998 stood at ¥2.7 trillion. The amount of nonperforming loans to be disposed of as of the end of March this year stands at ¥9.0 trillion. This figure is based on the new guideline established by the FRC. Specifically, loans to borrowers who are judged "close to bankruptcy"—loans almost equivalent to the so-called grade III loans have to be written down by around 70 percent. Meanwhile, the substandard portion of any loan to a "marked" borrower, which includes past-due and restructured loans, is to be written down by around 15 percent. Other loans to a marked borrower should be written down by appropriate provisioning rates based on historical losses. (Thus, grade II loans are also to be appropriately disposed of.) Given the net core operating profit of ¥2.5 trillion, the total scale of capital injection—amounting to ¥9.5 trillion, including ¥7.5 trillion of public funds—is sufficient to cover both the unrealized capital losses from securities

Table 1
AMOUNTS AND TERMS OF THE CAPITAL INJECTION

	Amounts of Public Funds to Be Injected (Billions of Yen)				
	Total	Preferred Stock	Subordinated Debt	Rate of Return[a]	Notes
Sakura	800	800	-	1.37	Preferred stock only
Dai-Ichi Kangyo	900	700	200	0.41~2.38	
Fuji	1,000	800	200	0.40~2.10	
Sumitomo	501	501	-	0.35~0.95	Preferred stock only
Sanwa	700	600	100	0.53	
Tokai	600	600	-	0.93~0.97	Preferred stock only
Asahi	500	400	100	1.15~1.48	
Daiwa	408	408	-	1.06	Preferred stock only, conversion right exercisable after three months
IBJ	600	350	250	0.43~1.40	
Mitsubishi Trust	300	200	100	0.81	
Sumitomo Trust	200	100	100	0.76	
Mitsui Trust	400	250	150	1.25	Conversion right exercisable after three months
Toyo Trust	200	200	-	1.15	Preferred stock only, conversion right exercisable after three months
Chuo Trust	150	150	-	0.90	Preferred stock only, conversion right exercisable after three months
Yokohama	200	100	100	1.13~1.89	
Total	7,459	6,159	1,300		

[a] The rate is for preferred stock. Figures are in percentages. Some banks launch different types of preferred stock.

Table 2
AMOUNTS OF CAPITAL ENHANCEMENT VERSUS ESTIMATED AMOUNTS OF NONPERFORMING LOANS (NPL) TO BE DISPOSED OF AND UNREALIZED GAINS/LOSSES FROM SECURITIES HOLDINGS
Billions of Yen

	Capital Enhancement		Net Core Operating Profit (Estimated) March 1999[a]	NPL to Be Disposed of (Estimated) March 1999	Unrealized Gains/Losses from Securities Holdings Sept. 1998
	Total	Public Funds			
Sakura	1,145	800	206	-994	-475
Dai-Ichi Kangyo	900	900	240	-970	-209
Fuji	1,217	1,000	215	-700	-588
Sumitomo	841	501	335	-1,050	46
Sanwa	880	700	305	-900	-25
Tokai	700	600	130	-560	-115
Asahi	645	500	136	-634	-158
Daiwa	460	408	53	-363	-381
IBJ	918	600	206	-900	-34
Mitsubishi Trust	300	300	213	-501	115
Sumitomo Trust	373	200	164	-395	-89
Mitsui Trust	509	400	95	-418	-362
Toyo Trust	300	200	105	-365	-144
Chuo Trust	222	150	60	-104	-185
Yokohama	200	200	75	-190	-73
Total	9,609	7,459	2,536	-9,044	-2,678

[a] Net core operating profit equals net operating profit (before transfer to general loan-loss reserves and before write-offs for trust accounts) minus profits earned from bond-related transactions.

holdings and the potential losses arising from the stricter guidelines for write-offs and provisioning. This will leave banks with sufficiently high capital ratios even after deducting unrealized losses from capital accounts, a calculation that is not required in bank financial statements under the original cost accounting standards.

Prior to capital injection, the FRC had to make sure that the banks were viable and that the investment would be fully recovered. A few cases gave rise to some uncertainties. In order to eliminate such uncertainties, the FRC required explicit plans to improve profitability that included, in some cases, withdrawal of all overseas offices. The "management improvement plan" was submitted to the FRC by each bank upon receiving capital and was made public subsequently. The FRC plans to check, on a regular basis, whether banks' actions continue to be consistent with the plans. Furthermore, for some banks, the timing for the government to acquire the right to convert preferred stock into common stock was set for a relatively short time after the injection. This suggests that the government could intervene directly in the management of these banks, should their performance prove to be less than satisfactory.

With regard to the underwriting terms of the preferred stock, three factors were assessed: a) the performance of the bank (for example, profitability, funding capacity), b) the nature of the instrument (for example, the date when conversion rights are exercisable and the minimum exercise price), and c) the management improvement plan. These factors were put into an evaluation model to calculate the appropriate cost of capital. With regard to the management improvement plan, positive factors such as restructuring, cost reduction, and corporate reorganization were reflected in the rate of return in a way that made the capital cost cheaper for those banks with more comprehensive measures. This gave an incentive to banks to positively restructure their business.

As part of their management improvement plans, banks will pursue rationalizing efforts. Table 3 shows the

Table 3
PLANNED BANK RESTRUCTURINGS

	Workforce			Personnel Expenses			Nonpersonnel Expenses, Excluding Investment in Mechanization		
	Number of Personnel at End of March 1999	Number of Personnel at End of March 2003	Percentage Change	Expenses at End of March 1999 (Billions of Yen)	Expenses at End of March 2003 (Billions of Yen)	Percentage Change	Expenses at End of March 1999 (Billions of Yen)	Expenses at End of March 2003 (Billions of Yen)	Percentage Change
Sakura	16,700	13,200	-21.0	180	152	-15.5	195	186	-4.9
Dai-Ichi Kangyo	16,130	13,200	-18.2	166	138	-16.5	166	149	-10.2
Fuji [a]	14,250	13,000	-8.8	153	138	-10.1	137	133	-3.3
Sumitomo	15,000	13,000	-13.3	156	147	-5.6	138	129	-6.5
Sanwa	13,600	11,400	-16.2	148	126	-15.4	144	141	-2.4
Tokai	11,125	9,731	-12.5	112	93	-16.9	90	83	-7.5
Asahi	12,800	11,800	-7.8	114	107	-5.9	94	93	-1.1
Daiwa	7,640	6,300	-17.5	63	52	-17.0	92	90	-2.4
IBJ	4,776	4,482	-6.2	69	68	-0.9	61	50	-18.0
Mitsubishi Trust	4,932	4,695	-4.8	68	63	-8.3	60	60	-0.4
Sumitomo Trust	5,900	5,200	-11.9	61	52	-14.8	57	54	-5.1
Mitsui Trust/ Chuo Trust [b]	9,980	8,900	-10.8	91	82	-10.4	78	72	-8.6
Toyo Trust	4,100	3,400	-17.1	42	38	-9.9	31	30	-2.3
Yokohama	5,718	4,512	-21.1	51	43	-14.9	42	40	-4.1
Total	142,651	122,820	-13.9	1,474	1,299	-11.9	1,384	1,308	-5.5

[a] Unconsolidated basis.

[b] After-merger figures are used for end of March 2003.

outline. To cut personnel expenses 12 percent by March 2003, the workforce will be reduced by 14 percent. Non-personnel expenses will also be curtailed, with the exception of investments for automation. As for overseas business, five banks, of which one is a regional bank, plan to withdraw entirely from abroad, and most other banks are closing unprofitable overseas branches or reviewing the business structure of these branches. Banks have also made the capital enhancement measure an opportunity for mergers and tie-ups. In this way, developments leading to an overall reorganization of the financial industry are currently under way.

Undoubtedly, the capital injection is an important step in the right direction. But it is not the ultimate measure to achieve the final goal of overcoming the banking problem. Further steps must be taken. Banks must remove bad loans from their balance sheets to improve their cash flow. This is an important step toward restoring their financial intermediary function, which in turn would contribute to an economic recovery. Also, further consolidation is necessary. By promoting consolidation in an effective way, the banking system will gain efficiency and profitability.

With regard to the removal of bad loans from banks' balance sheets, an important element is to provide the market with adequate infrastructure. Measures have been taken in this area. They include the creation of the RCC—the Resolution and Collection Corporation—as a result of a merger between the Resolution and Collection Bank (RCB) and the Housing Loan Administration Corporation (HLAC). A feature of the new law is that the RCC can now purchase bad loans not only from failed banks but also from solvent operating banks, helping them to remove their bad loans from their balance sheets. In addition, a legal framework for securitization of bad loans using special-purpose companies is now in place and is thus available. It is expected that banks will start to utilize these measures. An important prerequisite in this regard is that transactions are executed at market price or fair value, that is, a price that can be obtained by an objective method that effectively reflects the true value of real estate and related loans. This is a key feature for restoring business confidence in the real estate market. With regard to consolidation, we are starting to see good signs in the form of mergers and alliances in the context of capital injection, with the announcement by some banks of explicit plans. Banks are expected to identify the business areas of relative advantage from a deregulated wider choice of financial business and seek further profitability and efficiency through consolidation in the broader context of the Japanese Big Bang.

The measures taken so far are intended to restore the financial intermediary function and to reform our banking system into a sounder, more efficient, and robust financial industry. It is quite obvious that an improved financial industry will better serve the economy in the longer run. But in the meantime, the transition might exacerbate uncertainties in various parts of the economy. For example, large-scale disposal of real estate may have a negative impact on land prices. Such uncertainties in the transition process may be an argument for macroeconomic policies to support the economic recovery. Also, it will be necessary to handle the remaining problems in the banking

Table 4
BANK OF JAPAN ACCOUNTS
Billions of Yen

Assets		Liabilities and Capital Accounts	
Gold	432.8	Banknotes	51,286.6
Cash	265.3	Current deposits and other deposits	6,174.8
Commercial bills discounted	11.4	Deposits of the Japanese government	2,024.3
Loans	1,302.9	Bills sold	9,999.1
Bills purchased	5,175.3	Japanese government securities borrowed	3,898.3
Japanese government securities in custody	3,898.3	Other	686.1
Japanese government securities	49,469.5	Allowances and accrued liabilities	2,898.1
Foreign exchange	3,574.9	Capital	0.1
Loans to Deposit Insurance Corporation	6,652.7	Reserves	2,132.6
Deposits with agencies	3,354.2	Total	79,100.3
Cash collateral in exchange for Japanese government securities borrowed	4,101.2		
Other	861.4		
Total	79,100.3		

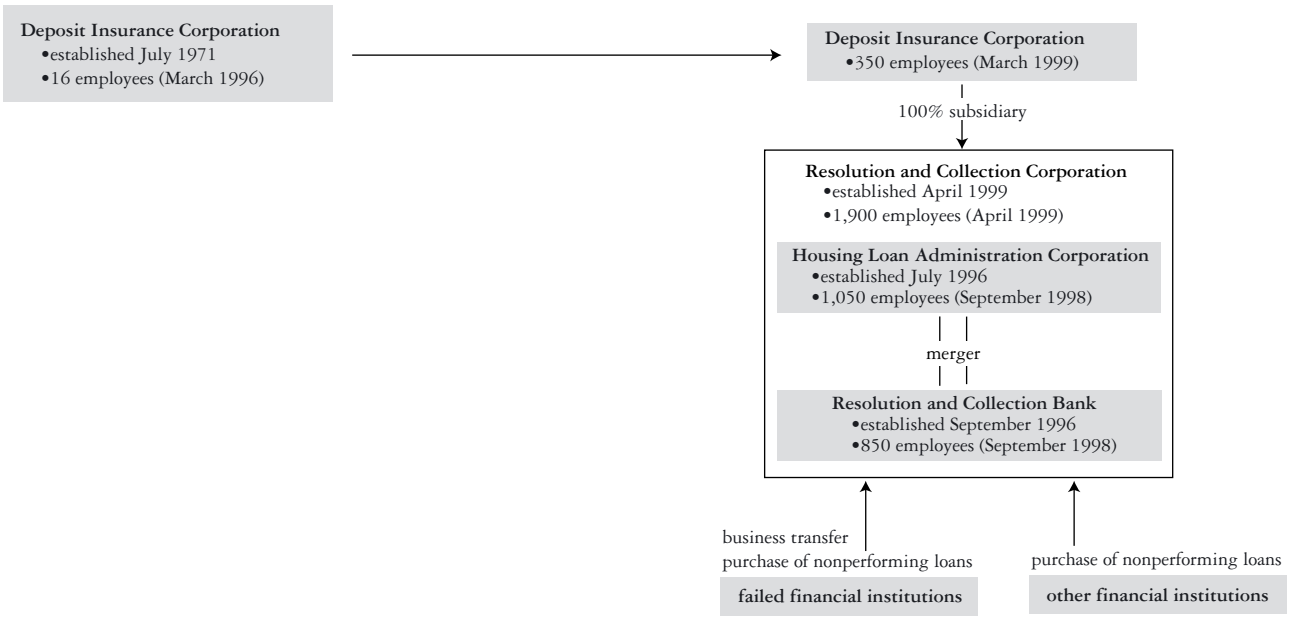
Note: Figures are as of end of March 1999.

system in a smooth way under the current safety net framework, fully acknowledging the importance of preventing any major financial disruption from materializing.

Another unique aspect of the central bank involvement in dealing with the financial instability is the lending to the DIC. Table 4 shows that the outstanding amount of such loans by the Bank of Japan stood at ¥6.7 trillion as of the end of March. Given the long-term nature of such loans, a disproportionate increase may threaten flexible monetary operation by the Bank. Against this background, the Bank has reiterated that the loans to the DIC must be of a temporary nature, or a "bridge financing," until they are replaced by loans from private financial institutions in the future. This was the case with the loan to the DIC for the purpose of capital injection. The DIC primarily carried out auctions to borrow money from private financial institutions on a government-guaranteed basis. The auctions to finance the DIC for the purpose of capital injection proved to be very successful. Foreign institutions were active participants. As a result, the DIC was able to raise ¥6.3 trillion at a cost well below the current official discount rate of 0.5 percent. The remaining ¥1.2 trillion was financed by the Bank of Japan at the official discount rate. The FRC gave assurances that the DIC would repay the loan from the Bank of Japan in four years at the latest. In addition, in order to diversify the funding instruments for the DIC, the Bank is asking the DIC to issue government-guaranteed bonds.

The safety net that has been built up over the years is quite comprehensive. Given the current status of the Japanese banking system, this is indispensable. But it has side effects too: the cost of public intervention and moral hazard, among others. These are not consistent with the principles of the Big Bang (Free, Fair, Global). That is why the safety net is designed to be a temporary framework, with all depositors and creditors fully protected in any bank failure until March 2001. There are arguments for extending this period because the banking system may continue to be fragile. But we intend to adhere to the original plan as it will encourage banks to take measures to restructure themselves into a more competitive industry in a timely manner. Depositors will naturally become more selective in choosing their banks as March 2001 approaches. This means that banks have a limited time to transform themselves into a stronger industry. Meanwhile, a study group consisting of academics, regulators, and

Figure 2
THE STRUCTURE OF JAPAN'S SAFETY NET



central bankers has been set up to design a new safety net framework that would be consistent with the more efficient and competitive financial system expected to emerge in the years beyond March 2001.

Measures taken so far will certainly contribute to the restoration of the financial system. We recognize that we have been criticized for slowness in taking action, but the problem we have been dealing with is unprecedented in terms of scale and seriousness and the instruments initially available to handle the problem were very limited. Only three years ago, the DIC had a staff of only sixteen and as little as ¥390 billion in funds. Now, as Figure 2 shows, the DIC along with the RCC has more than 2,000 staff members and ¥60 trillion of public funds available. The flexibility of the safety net has evolved significantly over the years. In fact, more than fifty institutions have already been resolved since 1992 under the deposit insurance framework. In dealing with the problem, the Bank has consistently tried its best to fulfill its responsibility to maintain financial system stability. There were painful moments, such as the loss of the ¥80 billion investment in Nippon Credit Bank and the subsequent criticism of the Bank, but it is our belief that the Bank's actions were necessary to avert a major disruption. Indeed, a systemic crisis has been successfully avoided in Japan, and we remain fully committed to our responsibility to prevent any crisis that could threaten the stability of the financial system. Hopefully, before long, our efforts to overcome the country's banking problems will represent an episode in history that we can look back on with pride and satisfaction.

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Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism

Stephen G. Cecchetti

Over the past decade, the countries of central Europe have become more alike in many ways. As the new members of the European Monetary Union (EMU) prepared for the birth of the euro on January 1, 1999, their economic policies became substantially more uniform. All eleven countries in the new euro area have virtually eliminated inflation and taken serious steps toward fiscal consolidation.[1] As their monetary and fiscal policies have adjusted to meet these common goals, the countries' business cycle fluctuations appear to have become more synchronized as well.[2] While this makes the job of the Eurosystem (the European Central Bank plus the central banks of the eleven monetary union member countries) easier, numerous difficult challenges remain. Primary among these is the making of policy in the face of the possibility that it will have differential impacts across the countries of the euro area.

The task facing the Eurosystem is even more complex than that facing countries with stable monetary regimes, where the measurement of the national and regional impact of policy has already proved to be extremely difficult. The creation of the Eurosystem constitutes a regime shift in virtually every sense of the term. The introduction of the euro seems sure to prompt adjustments in the economies of the member countries, and these adjustments will probably alter the relationship between the actions of the central bank and the real economy. That is, the monetary transmission mechanism of the countries in the euro area will change, making the job of the new European Central Bank even more difficult than it is already. But how quickly will it change, and what will it become?

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To answer these questions, we must understand the fundamental determinants of the impact of policy actions on output and inflation. For insight into these determinants, I turn to the modern views of the monetary transmission mechanism, which assign a central role to financial structure. Kashyap and Stein (1997) provide a starting point; they focus on the importance of the banking system and go on to emphasize the distributional effects of monetary policy changes. The conventional wisdom has always been that some industries are more sensitive to interest rate changes than others, and so changes in policy-controlled interest rates have differential effects across industries. The view based on financial structure both formalizes this reasoning and takes it one step further by noting that some firms are more dependent on banks for financing than others, and that this is true both across and within industries. According to this "lending view" of the transmission mechanism, monetary policy actions change the reserves available to the banking system, thereby affecting the willingness of banks to lend and, ultimately, the supply of loans. How this mechanism will affect individual firms depends on the financing methods available to them. Monetary policy has a bigger impact on firms that are reliant on banks for their financing. Furthermore, healthier banks will be able to adjust to the policy-induced reserve changes more easily than other banks will.

Is there evidence that the impact of monetary policy innovations varies across countries with the strength and scope of the banking system?

The distributional effects implied by the lending view of monetary policy transmission have clear implications for the euro area and the Eurosystem. Countries in which firms are more bank dependent and banking systems are less healthy will be more sensitive to the Eurosystem's decisions to change interest rates. This brings me to the first question I will address in this paper: Is there evidence that the impact of monetary policy innovations varies across countries with the strength and scope of the banking system?

With this in mind, I examine differences in the size, concentration, and health of national banking systems, as well as in the availability of nonbank sources of finance. I find, consistent with the most casual observation, that banking system characteristics vary dramatically across the countries of the European Union (EU). Furthermore, these differences do seem to be related to estimated differences in the impact of interest rate changes on output and inflation. Countries with many small banks, less healthy banking systems, and poorer direct capital access display a greater sensitivity to policy changes than do countries with big, healthy banks and deep, well-developed capital markets.

But this is just the first question. The more important issue facing the Eurosystem is whether the national banking systems, and the implied sensitivity of each country's real economy to monetary policy shocks, will change now that there is monetary union.

It is easy to assert that European banks will soon look like U.S. banks, exhibiting a financial structure and transmission mechanism similar to the American models. After all, the euro area does resemble the United States, at least superficially. It has a slightly larger population—292 million for the eleven members of the monetary union relative to 270 million for the United States—and nearly as high a level of GDP—$6.8 trillion compared with $8.1 trillion in 1997. The euro area also has a similar degree of openness to trade, with imports accounting for slightly more than 10 percent of GDP. These parallels, along with the fact that financial technology is easily transferable across national boundaries, have led a number of observers to conclude that the introduction of the euro may act as a catalyst, speeding the rate at which financial relationships in Europe become like those in the United States. For example, while Dornbusch, Favero, and Giavazzi (1998, pp. 48-9) do note the possibility for EU-wide asymmetries resulting from differences in financial structure, they assert that "the euro will change the way financial markets work, inducing corresponding changes in the monetary mechanism. In addition to pervasive

deregulation already under way and innovation, the introduction of the euro will revolutionize the financial structure of Europe. Europe will in a short period become more nearly like the USA." McCauley and White (1997, p. 17) suggest that there may be an acceleration in the rate at which securities replace loans on the asset side of bank balance sheets and commercial paper replaces deposits on the liability side. They point to a "dramatic potential for assets to be stripped out of the banking system" and for securities markets to absorb as much as one-third of the corporate loans now originated in European banks.[3] Overall, these commentators are speculating that the increased liquidity of European financial markets brought about by monetary union will lead to significant consolidation of banks, with mergers at both the national and the international level, as well as a direct substitution of traded equities and bonds for bank loans.

It is my main contention that the differences in financial structure across the countries of Europe are a consequence of their dissimilar legal structures.

Why should we believe that the European financial structure will quickly be transformed into one that mirrors the one in the U.S. model? Without an explanation for the evolution of these countries' national financial structures that is based on their existing differences, such claims are unconvincing. What accounts for the variation in the financial intermediation systems across countries? Traditionally, we look to taxes and regulation for an explanation, and Dornbusch, Favero, and Giavazzi (1998) as well as White (1998) do mention these. Danthine, Giavazzi, Vives, and von Thadden (1999) identify a number of barriers to change in national financial structure and note the importance of the historical path that has brought each country's banks to their current state. Danthine et al. then go on to assert that "legal differences between EU states, in particular the lack of some form of 'European corporate law,' also remain important and constitute an additional factor of market segmentation" (p. 45). Such disparities in legal structure can explain important economic patterns, and they can be maintained for long periods of time, significantly delaying the harmonization of national banking systems.[4]

It is my main contention that the differences in financial structure across the countries of Europe are a consequence of their dissimilar legal structures. My argument draws on the work of La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998), who focus on the relationship between legal structures and finance. They argue that the structure of finance in a country depends on the rights accorded shareholders and creditors by the laws of that country, as well as on the degree to which these laws are enforced. The nature of the laws is, in turn, a product of the legal tradition on which the civil codes of a country are based. La Porta et al. establish that the character of a country's financial markets depends on the country's legal structure. Putting their arguments together with the lending view of the monetary transmission mechanism leads to the possibility that it is the legal system in a country that forms the basis for the structure of financial intermediation and, hence, for the impact of monetary policy on output and prices.

Table 1 reports the empirical findings that support the basic conclusion of the paper. After classifying countries by the origin, or "family," of their legal structure, I calculate for each family the average level of an index of monetary policy's likely effectiveness (based on banking system size, concentration, and health, with a higher value implying greater effectiveness) and the estimated impact of an interest rate change on output and inflation (from a small-scale structural model). The results suggest that a country's legal structure, financial structure, and monetary transmission mechanism are interconnected. The clear pattern is that the predicted effectiveness and its measured impact vary systematically based on the origin of a country's legal system. Countries with better legal protection for shareholders and debtors (countries with a legal

Table 1
EFFECTIVENESS OF POLICY AND THE ORIGINS OF THE LEGAL SYSTEM

Legal Family	Index of Effectiveness of Monetary Policy	Impact of Policy	
		On Output	On Inflation
English	1.1	-0.45	-0.21
Scandinavian	1.8	-0.52	-0.22
French	2.1	-0.70	-0.20
German	2.4	-1.25	-0.49

Notes: The index of effectiveness of monetary policy, from Table 5, is based on financial structure variables described in the text under the heading "Likely Strength of the Transmission Mechanism," with higher values implying a larger expected impact of interest rate changes on output and prices. The impact of policy on output and inflation, from Table 6, is a measure of the maximum response, in percentage points, to an interest rate movement of 100 basis points, estimated using a small-scale structural model. Countries are classified by the origin, or family, of their legal structure, and group means are reported based on data for Ireland, the United Kingdom, and the United States (English common law); Denmark and Sweden (Scandinavian common law); Belgium, France, Italy, Portugal, and Spain (French civil law); and Germany (German civil law).

structure based on English common law) have financial structures in which the lending channel of monetary transmission is expected to be less potent; for these countries, the measured impact of an interest rate change on output and inflation is lower.

The implication is that unless the laws governing shareholder and creditor rights and the enforcement of those laws are harmonized across the members of the European Monetary Union, monetary policy will continue to have a differential impact. Put slightly differently, it is my belief that the financial structures in the countries of the euro area will not converge into one large U.S.-style system unless there are dramatic legislative changes. If such legal harmonization occurs—that is, if the civil codes protecting shareholders and creditors are made uniform across the countries that have entered the monetary union—then the regional variation in the impact of interest rate changes on output and inflation should decrease.[5] But if legal convergence does not occur, financial structure will remain heterogeneous, and so will the monetary transmission mechanism, and the job of the Eurosystem will be to construct appropriate policy that takes these asymmetries into account.[6]

The remainder of this paper provides the building blocks for this argument. In the next section, I provide a brief survey of the theories of the monetary transmission mechanism, focusing on the importance of financial structure to an understanding of monetary transmission. The following section assesses the national banking systems, including measures of overall size, concentration, health, and the relative importance of nonbank finance. Overall, this analysis allows me to evaluate the likely strength of the lending channel across countries. Subsequently, I report estimates, for a set of ten countries, of the impact of an interest rate increase on output and inflation. These estimates follow the pattern that is expected: Countries where financial structure data suggest that the lending channel should be strong exhibit more sensitivity to monetary policy movements. Following the discussion of these findings, I present the data and arguments from La Porta et al. (1997, 1998) on the relationship between legal and financial structures. This allows me to test the prediction that countries with poor shareholder and creditor protections and poor law enforcement will have less developed financial systems and greater sensitivity of output and inflation to interest rate changes. While far from being definitive, the results are consistent with my main hypothesis: Differences in legal systems give rise to variations in national financial structures, and these variations in turn lead to divergences in monetary transmission mechanisms. So long as the legal systems of the euro area countries remain distinct, the impact of interest rate changes across these countries will differ.

Unless the laws governing shareholder and creditor rights and the enforcement of those laws are harmonized across the members of the European Monetary Union, monetary policy will continue to have a differential impact.

THEORIES OF THE TRANSMISSION MECHANISM

A number of comprehensive surveys of the theories of the monetary transmission mechanism have appeared in recent

years. These include Bernanke (1993), Gertler and Gilchrist (1993), Kashyap and Stein (1994, 1997), Hubbard (1995), and my own survey, Cecchetti (1995). As a result, I will be brief.

All theories of how interest rate changes affect the real economy have a common starting point. A monetary policy action begins with a change in the level of bank reserves. For this to have any real effects at all, there must be nominal rigidities in the economy. Otherwise, a change in the nominal quantity of outside money cannot have any impact on the real interest rate. While the ability of the central bank to change the level of bank reserves is not in question, the source of the nominal rigidity that allows the change in reserves to alter short-run real rates of return has been under debate for decades. The current state of this discussion is well summarized by Christiano, Eichenbaum, and Evans (1997). They distinguish three sets of theories: one set based on sticky wages, a second set based on sticky prices, and a third set built on the idea of limited participation. The sticky wage and sticky price models, which are the most familiar, rest on the idea that there are costs to nominal price and wage changes, and so adjustments are infrequent. In limited participation models, introduced in Rotemberg (1984), individuals (households) are unable to adjust their cash balances sufficiently rapidly in response to changes in the environment—that is, households have a limited ability to participate in financial markets, and so must commit themselves to certain portfolio holdings for relatively long periods of time.[7]

The sources of nominal rigidities are relatively unimportant for the discussion of the mechanism by which interest rate changes have short-run effects on output and prices, and so I will move directly to a discussion of the current theories of the transmission mechanism.[8] Our current views are based on the work of Bernanke (1983), Bernanke and Blinder (1992), and Bernanke and Gertler (1989, 1990). These authors distinguish between the traditional money view, in which interest rate movements affect the level of investment and exchange rates directly, and the *lending view*, in which financial intermediaries play a prominent role in transmitting monetary impulses to output and prices. I will describe each of these views in turn.

The traditional view, which is largely the foundation for the textbook IS-LM model, is based on the notion that reductions in the quantity of outside money raise real rates of return. This outcome has two effects, the first directly from interest rates to investment and the second through exchange rates. An interest rate increase reduces investment, as there are fewer profitable projects available at higher required rates of return. A policy action induces a movement along a fixed marginal-efficiency-of-investment schedule. This interest rate channel will be more powerful the less substitutable outside money is for other assets. The exchange rate channel is also familiar from textbook models. Here, an interest rate increase results in a real appreciation of the domestic currency, reducing the foreign demand for domestically produced goods. Regardless of whether the transmission mechanism occurs through the interest rate channel or the exchange rate channel, there is no real need to discuss banks. In fact, there is no reason to distinguish any of the "other" assets in investors' portfolios. This is a simple two-asset model.

An important implication of this traditional model of the transmission mechanism concerns the incidence of the investment decline. Since there are no externalities or market imperfections, only the least socially productive projects, those with the lowest rates of return, go unfunded. As a result, the capital stock is marginally lower, but, given that a decline is going to occur, the allocation of the decline across sectors is socially efficient.

As most of the surveys cited earlier emphasize, the lending view has two parts, one that focuses on the impact of policy changes on borrower balance sheets and another that focuses on bank loans. In both, the effectiveness of policy depends on capital market imperfections that make it easier for some firms to obtain financing than others. Information asymmetries and moral hazard problems, together with bankruptcy laws, mean that the state of a firm's balance sheet has implications for its ability to obtain external finance.[9] By reducing expected future sales and by increasing the cost of rolling over a given level of nominal debt, policy-induced increases in interest rates (which are both real and nominal) cause a deterioration in the firm's net worth. Furthermore, there is an asymmetry

of information in that borrowers (firms) have better information about the potential profitability of investment projects than do creditors (banks). As a result, as the firm's net worth declines, the firm becomes less creditworthy because it has an increased incentive to misrepresent the riskiness of potential projects—an outcome that will lead potential lenders to increase the risk premium they require when making a loan. The asymmetry of information makes internal finance of new investment projects cheaper than external finance.

Models of monetary policy transmission based on financial structure suggest a natural place to begin looking for sources of cross-country differences in the monetary transmission mechanism.

More important for the transmission mechanism per se is that some firms are dependent on banks for finance and that monetary policy affects bank loan supply. A reduction in the quantity of reserves forces a reduction in the level of deposits, which must be matched by a fall in loans. Nevertheless, lower levels of bank loans will have an impact on the real economy only insofar as there are firms without an alternative source of investment funds.

Substantial empirical evidence supports the importance of both capital market imperfections and firm dependence on bank financing. Kashyap and Stein (1997) provide a summary of two types of studies. The first type suggests that banks rely to a large extent on reservable-deposit financing and that, for this reason, a contraction in reserves will prompt banks to contract their balance sheets, reducing the supply of loans. The second type establishes that there are a significant number of bank-dependent firms that are unable to mitigate the shortfall in bank lending with other sources of finance. Overall, recent research does imply the existence of a lending channel.[10]

Models of monetary policy transmission based on financial structure suggest a natural place to begin looking for sources of cross-country differences in the monetary transmission mechanism. The prediction is that overall, the transmission mechanism will be stronger in those countries where firms are more bank dependent, and where the banking system is less healthy and less concentrated. In the first instance, firms that have less direct access to capital markets are unable to blunt the effect of a contraction in bank loans. In the second, banks themselves have restricted access to nonreservable deposits and are forced to contract their balance sheets by more for a given change in policy. In the next section of the paper, I examine data on national financial structure and try to rank countries based on the likely strength of the transmission mechanism. To the extent that these cross-country differences are present, then the lending view implies that they will persist until the financial structures become more uniform.[11]

Likely Strength of the Transmission Mechanism

In assessing the likely impact of an interest rate change on output and prices in the various countries of the EMU, I follow the recent work of Kashyap and Stein (1997) and assemble data on the size and concentration of the banking systems, along with measures of banking system health, the importance of bank financing, and the size of firms. The indicators are chosen to conform as closely as possible to the economic quantities that the lending view suggests should be important. The balance sheets of large, healthy banks are not as sensitive to policy, because reserve contractions can be readily offset with alternative forms of finance that do not attract reserve requirements. In addition, I examine measures of the development of equity and debt markets in the EMU countries. Firms with ready capital market access, which are more likely to be found in countries with extensive secondary securities markets, will be better insulated from bank loan-supply contractions. Combining these measures, I construct an index of the probable strength of the monetary transmission mechanism.[12]

To assess the importance of small banks in a country's financial system, Table 2 reports the number of banks, the number of banks per million population, and measures of concentration for all of the EU countries plus Japan and the United States.[13] The data reveal that Austria and Finland have many more banks per capita—126 and 68 per million people, respectively—than any of the other countries. The remaining countries fall into roughly three groups: The United Kingdom, Japan, and the southern European countries of Spain, Portugal, and Greece have less than 10 banks per million; the United States and Germany have 40 or slightly more; and the remaining countries have between 13 and 25.

Turning to the concentration measures in the fourth column of the table, it is interesting to note that countries with more banks do not necessarily have less concentrated banking systems. France, for example, with 1,373 banks and just under 60 million people, has a fairly high concentration ratio: the top five French banks account for a sizable 40 percent of total banking system assets and the top ten for nearly two-thirds. Overall, Denmark and Germany have the least concentrated banking systems in Europe. By contrast, large banks clearly dominate Sweden, Finland, Belgium, the Netherlands, and Greece. The remaining countries are somewhere in between.

Table 2
SIZE AND CONCENTRATION OF THE BANKING INDUSTRY, BY COUNTRY, 1996

Country	Number of Credit Institutions	Banks per Million People	Concentration Ratios: Top Five Banks
Monetary union members			
Austria	1,019	126	48
Belgium	140	14	57
Finland	350	68	78
France	1,373	24	40
Germany	3,517	43	17
Ireland	62	18	41
Italy	937	16	25
Netherlands	172	11	79
Portugal	51	5	76
Spain	313	8	44
Members of the EU not in EMU			
Denmark	117	22	17
Greece	20	2	71
Sweden	124	14	90
United Kingdom	478	8	28
Other countries			
Japan	556	4	30
United States	10,803	40	17

Sources: See the Data Appendix.

Note: Concentration ratios are calculated as the percentage of each country's bank assets accounted for by the five largest banks.

What do these findings imply for the strength of the transmission mechanisms in the countries examined? Austria, Germany, and the United States have systems composed of a network of small banks, and so one would expect the lending channel to be relatively strong in those countries. At the other end of the spectrum, Belgium, Finland, Ireland, the Netherlands, Portugal, Sweden, and the United Kingdom all have banking industries dominated by a small number of relatively large banks, with a modest periphery of small institutions. The remaining countries—Denmark, France, Greece, Italy, and Japan—fall in a middle group.

The weaker a nation's banking system, the stronger the expected impact of policy movements. With this in mind, I have collected a set of standard gauges of banking system health—return on assets, loan loss provisions, net interest margin, and operating costs—and I have calculated a summary rating of overall system soundness (Table 3). Focusing primarily on the return on assets and the average Thomson ratings in Table 3 leads to the following rankings: Ireland, the United Kingdom, and the United States have the healthiest banks; Austria, Belgium, Germany, the Netherlands, Spain, Denmark, and Greece are second; Finland, France, Italy, Portugal, and Sweden are third; and Japan is alone at the bottom.

Finally, I turn to the availability of nonbank finance for firms in EU and other countries. The relevant data are reported in Table 4. Following Kashyap and Stein (1997) and La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997), I examine the number of publicly listed firms, the extent of secondary equity and debt markets, and the ratio of bank loans to all forms of finance. Although these are crude measures of access to external finance, they are informative. As in the case of Table 2, the countries can be divided into three groups. Austria, Ireland, Italy, Portugal, and Greece appear to have the least well developed external capital markets. They have small equity and bond markets,

Table 3
MEASURES OF BANKING INDUSTRY HEALTH, BY COUNTRY, 1996
Percent

Country	Return on Assets (1)	Loan Loss Provisions (2)	Net Interest Margin (3)	Operating Costs (4)	Average Thomson Rating (5)
Monetary union members					
Austria	0.38	0.59	1.67	2.45	2.38 (4)
Belgium	0.52	0.17	1.41	1.67	2.00 (6)
Finland	0.50	0.78	2.07	3.05	2.83 (3)
France	0.36	0.24	1.43	1.84	2.28 (16)
Germany	0.44	0.18	1.24	2.19	1.97 (19)
Ireland	1.57	0.17	3.36	3.32	1.83 (3)
Italy	0.33	0.62	2.32	3.19	2.57 (15)
Netherlands	0.75	0.26	2.06	2.48	2.10 (5)
Portugal	0.91	0.42	2.60	3.80	2.30 (5)
Spain	0.76	0.32	2.20	2.69	1.79 (11)
Members of the EU not in EMU					
Denmark	0.91	0.11	1.28	0.97	2.33 (3)
Greece	1.11	0.18	1.98	2.77	2.50 (6)
Sweden	1.28	0.25	1.90	1.77	2.50 (5)
United Kingdom	1.28	0.18	2.15	2.42	2.04 (23)
Other countries					
Japan	0.01	0.75	1.17	1.03	3.32 (44)
United States	1.42	0.10	2.68	3.51	1.73 (344)

Sources: See the Data Appendix.

Notes: Except for the Thomson ratings, all figures in the table are calculated as a percentage of total bank assets. In column 5, the number of banks rated by Thomson in each country and used to compute the average appears in parentheses.

Table 4
IMPORTANCE OF EXTERNAL AND BANK FINANCE BY COUNTRY, 1996

Country	Number of Publicly Traded Firms (1)	Publicly Traded Firms per Capita (2)	Market Capitalization as a Percentage of GDP (3)	Corporate Debt as a Percentage of GDP (4)	Bank Loans as a Percentage of All Forms of Finance (5)
Monetary union members					
Austria	106	13.15	15	46	65
Belgium	139	13.68	45	60	49
Finland	71	13.87	50	34	39
France	686	11.75	38	49	49
Germany	681	8.32	29	58	55
Ireland	76	21.59	18	13	80
Italy	217	3.78	21	37	50
Netherlands	217	13.97	96	48	53
Portugal	158	16.11	23	19	62
Spain	357	9.09	42	11	58
Members of the EU not in EMU					
Denmark	237	45.06	41	105	25
Greece	245	23.44	20	3	48
Sweden	229	25.90	99	73	32
United Kingdom	2,433	41.39	150	45	37
Other countries					
Japan	2,334	18.56	67	39	59
United States	8,479	31.94	111	64	21

Sources: See the Data Appendix.

Notes: Market capitalization is the year-end value of firms listed on major exchanges. For the United States, three exchanges are used; for Japan, eight; and for each of the remaining countries, one.

and bank loans account for a high percentage of firm financing. By contrast, Belgium, Denmark, Sweden, the United Kingdom, and the United States all have substantial secondary capital markets, and banks are a less important source of finance. The remaining six countries are somewhere in between these two groups.

Table 5 summarizes the material in Tables 2-4 and suggests the overall relative strength of monetary policy in the fourteen EU countries, Japan, and the United States. The final column, "Predicted Effectiveness of Monetary Policy," reports a measure of the effects of monetary policy on output and inflation, where higher values suggest a stronger lending channel and therefore a larger impact. Overall, the pattern is very similar to the one reported in Kashyap and Stein (1997, Table 6). Most important, the predicted effects of interest rate movements vary greatly across countries. For example, looking at the EMU countries, one would expect that a given interest rate change would have the most impact in Austria and Italy, countries in which small banks are relatively important, the banking systems are less healthy, and firms have little access to nonbank sources of finance. The opposite is true of Belgium, Ireland, and the Netherlands, where the banking systems are large and healthy and nonbank finance is readily available; in these countries, interest rate movements would be expected to have a more muted impact.[14]

Table 5
SUMMARY OF FACTORS AFFECTING THE STRENGTH OF THE MONETARY TRANSMISSION MECHANISM

Country	Importance of Small Banks (1)	Bank Health (2)	Availability of Alternative Finance (3)	Predicted Effectiveness of Monetary Policy (4)
Monetary union members				
Austria	3	2	3	2.67
Belgium	1	2	1	1.33
Finland	1	3	2	2.00
France	2	3	2	2.33
Germany	3	2	2	2.33
Ireland	1	1	3	1.67
Italy	2	3	3	2.67
Netherlands	1	2	2	1.67
Portugal	1	3	3	2.33
Spain	2	2	2	2.00
Members of the EU not in EMU				
Denmark	2	2	1	1.67
Greece	2	2	3	2.33
Sweden	1	3	1	1.67
United Kingdom	1	1	1	1.00
Other countries				
Japan	2	4	2	2.67
United States	3	1	1	1.67

Notes: Column 1 is based on Table 2; column 2, on Table 3; and column 3, on Table 4. Column 4 is an average of columns 1, 2, and 3.

The conclusions of this section could be criticized as applying only to the pre-EMU period. But will the introduction of the euro be a catalyst for the harmonization of financial structure across the EMU? I take this question up in more detail later, but at this point I will simply mention that the recent European Central Bank (1999) report *Possible Effects of EMU on the EU Banking Systems in the Medium to Long Term* provides very little evidence to suggest that an increase in either international banking competition or securitization and disintermediation will occur quickly.

Measuring the Impact of Policy on Output and Prices

Testing the proposition that the banking system's concentration, health, and importance have a material impact on the monetary transmission mechanism requires an estimate of the effects of an interest rate change on output and prices. Numerous studies report such estimates for some or all of the countries of the EU. These include Gerlach and Smets (1995), who estimate a three-variable structural vector autoregression based on long-run restrictions; de Bondt (1997), who presents estimates of the impact of policy on output and prices for Germany, France, Italy, the United Kingdom, Belgium, and the Netherlands that are based on the work of other authors; Dornbusch, Favero, and Giavazzi (1998), who report estimates of the impact of policy on output and prices derived from both small vector-autoregressive models and large structural models, for Italy, Germany, France, Spain, Sweden, and the United Kingdom; Kieler and Saarenheimo (1998), who study France, Germany, and the United Kingdom, concluding that the transmission mechanism is not significantly different across the three countries; and Vlaar and Schuberth

(1998), who examine money demand functions for fourteen EU countries; Ehrmann (1998), who estimates structural vector autoregressions for thirteen countries and finds considerable differences in the intensity of the response of output and prices to monetary shocks across countries; and Cecchetti and Rich (1999), who look at a simple two-variable system for Australia, Canada, France, Italy, Switzerland, the United Kingdom, and the United States, and find large differences in the implied impacts.

Testing the proposition that the banking system's concentration, health, and importance have a material impact on the monetary transmission mechanism requires an estimate of the effects of an interest rate change on output and prices.

Each of these studies has advantages and disadvantages. Overall, I have chosen to examine the results reported by Ehrmann (1998). The appeal of Ehrmann's approach is that it yields a series of estimates, all based on the same methodology, for nearly the full set of EU countries. Ehrmann uses techniques devised by King, Plosser, Stock, and Watson (1991). In effect, he identifies monetary shocks using a combination of long-run and short-run restrictions. The methods are described both in his paper and in Cecchetti, McConnell, and Perez Quiros (1999). For each country, the model has either four or five variables, including output, inflation, and an interest rate, and—with the exception of Germany—an exchange rate. When a fifth variable is present, it is either a second interest rate or a commodity price index.[15]

The chart plots the responses of output and inflation to an interest rate movement of 100 basis points for ten EU countries and the United States.[16] These ten countries are the ones for which Ehrmann is able to generate consistent and plausible results.[17] As is clear from these plots, the point estimates of the impulse response functions vary dramatically across countries. Looking at the impact of interest rate movements on output, note that for France and Germany, the peak impact is nearly twice what it is in the remaining European countries, and fifteen times the estimated impact in the United States. The impact of policy on inflation also varies substantially.

Table 6 reports the maximum impact of a 100-basis-point monetary contraction on output and inflation for all of the countries for which I have estimates. I also include a measure of the timing of the impact—the quarter at which the maximum effect occurs. The final column in the table presents a measure of the ratio of the average output response to the average inflation response. This measure is related to the sacrifice ratio because it is roughly the output loss for an inflation decline of 1 percentage point over a horizon of approximately three years. Unfortunately, these estimates are not terribly precise, a point that is clear from the results in Ehrmann's paper,[18] and so we should not take some of the numbers too seriously.

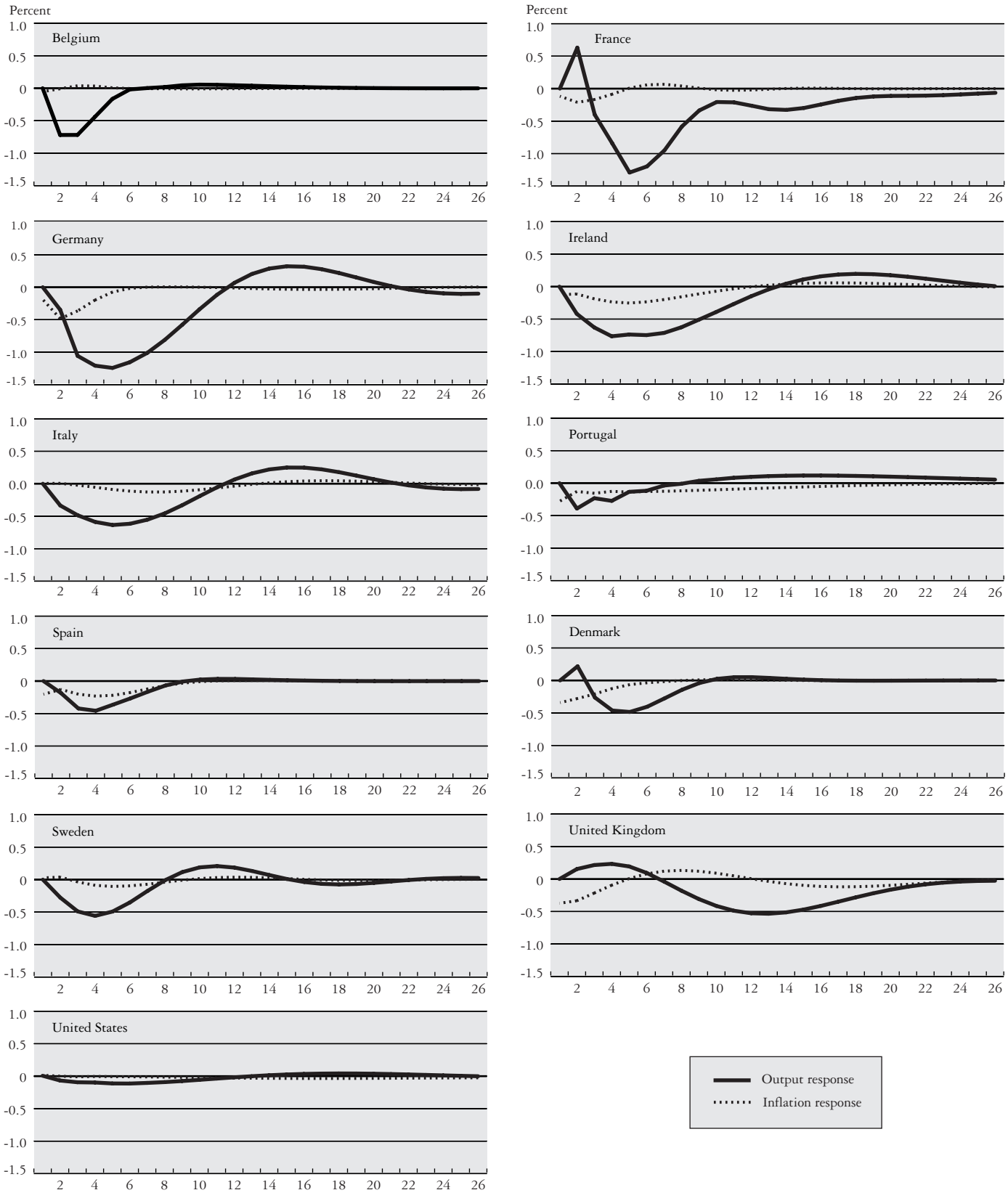
Systematic Differences in National Legal Systems

If differences in financial systems are creating the cross-sectional variation in the transmission mechanism, it is natural to look for the causes of these differences. As noted earlier, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998) have examined the relationship between a country's legal system and its financial system. The premise of their work is that investors provide capital to firms only if the investors have the ability to get their money back. For equity holders, this means that they must be able to vote out directors and managers who do not pay them. For creditors, this means that they must have the authority to repossess collateral. In addition to having nominal legal rights, these groups must also have confidence that the laws will be enforced.

La Porta et al. (1997, 1998) collect data on the legal systems in forty-nine countries. They show that all of these legal systems belong to one of four families: English common law, French civil law, Scandinavian civil law, and German civil law. With regard to shareholder rights—specifically, the ability of shareholders to vote

Reaction of Output and Inflation to an Interest Rate Increase of 100 Basis Points

Quarterly by Country



Sources: Cecchetti (1996); Cecchetti, McConnell, and Perez Quiros (1999).

Table 6
IMPACT ON OUTPUT AND INFLATION OF A 100-BASIS-POINT INCREASE IN INTEREST RATES

	Output		Inflation		
Country	Maximum Impact (1)	Quarter of Maximum Impact (2)	Maximum Impact (3)	Quarter of Maximum Impact (4)	Approximate Sacrifice Ratio (5)
Monetary union members					
Austria	—	—	—	—	—
Belgium	-0.72	2	-0.05	1	-45.29
Finland	—	—	—	—	—
France	-1.30	5	-0.21	2	-12.07
Germany	-1.21	5	-0.48	2	-5.83
Ireland	-0.76	4	-0.25	5	-3.45
Italy	-0.64	5	-0.25	9	-5.01
Netherlands	—	—	—	—	—
Portugal	-0.39	2	-0.28	1	-0.58
Spain	-0.46	4	-0.23	4	-1.34
Members of the EU not in EMU					
Denmark	-0.48	5	-0.34	1	-1.69
Greece	—	—	—	—	—
Sweden	-0.56	4	-0.11	5	-5.61
United Kingdom	-0.53	13	-0.37	1	-2.57
Other countries					
Japan	—	—	—	—	—
United States	-0.07	6	-0.017	12	-3.27

Sources: Estimates for the United States are from Cecchetti (1996); those for the remaining countries are from the estimation of Ehrmann's model in Cecchetti, McConnell, and Perez Quiros (1999).

directors out—English common law countries have the best protections and French civil law countries have the worst. The pattern is similar for creditor rights, which entail the right to reorganize or liquidate a firm. The pattern for enforcement is a bit different: Scandinavian civil law countries have the most rigorous law enforcement, while French civil law countries have the most lax.

Table 7 reproduces a portion of Table II from La Porta et al. (1997). The column labeled "Shareholder Rights" reports an index that is higher when shareholders find it less costly and difficult to vote directors out. The column labeled "Creditor Rights" reports an analogous index that is lower when creditors experience less difficulty gaining possession of property that has been used to collateralize a bond or loan. Enforcement is an assessment of countries' rigor in carrying out their laws, with a higher score implying more aggressive enforcement. Finally, the table reports the legal family from which each country's laws are derived.

Table 7
SHAREHOLDER RIGHTS, CREDITOR RIGHTS, AND ENFORCEMENT, BY COUNTRY

Country	Shareholder Rights (1)	Creditor Rights (2)	Enforcement (3)	Legal Family (4)
Monetary union members				
Austria	2	3	10.00	German
Belgium	0	2	10.00	French
Finland	2	1	10.00	Scandinavian
France	2	0	8.98	French
Germany	1	3	9.23	German
Ireland	3	1	7.80	English
Italy	0	2	8.33	French
Netherlands	2	2	10.00	French
Portugal	2	1	8.68	French
Spain	2	2	7.80	French
Members of the EU not in EMU				
Denmark	3	3	10.00	Scandinavian
Greece	1	1	6.18	French
Sweden	2	2	10.00	Scandinavian
United Kingdom	4	4	8.57	English
Other countries				
Japan	3	2	8.98	German
United States	5	1	10.00	English

Source: La Porta et al. (1997), Table II.

Using these data to examine the relationship between shareholder rights, creditor rights, and enforcement on the one hand, and the concentration of ownership and the availability of external finance on the other, La Porta et al. (1997, 1998) come to two conclusions. First, corporate ownership is more concentrated in countries where shareholders and creditors are poorly protected by both the substance of the law and its enforcement. Second, and more germane to the current discussion, countries with weaker legal rules and less rigorous law enforcement have smaller and narrower capital markets. Overall, English common law countries have the least concentration of corporate ownership and the largest and deepest capital markets. French civil law countries have the most concentrated ownership and the smallest capital markets. La Porta et al. (1997) conclude that the "differences in the nature and effectiveness of the financial systems around the world can be traced, in part, to differences in investor protection against expropriation by insiders, as reflected by legal rules and the quality of their enforcement" (p. 1131). Their findings are confirmed by the data in Table 4, which show clearly that the United States and the United Kingdom have much more extensive capital markets than France and Italy.

Relationship of the Legal Environment to the Impact of Policy

Following the demonstration in La Porta et al. (1997, 1998) that the systematic variation in systems of corporate governance and finance across countries can be tied to the differences in the countries' legal systems, I ask if the variation in the predicted strength of the lending channel and the estimated impact of interest rate movements on output and inflation can be traced to these same legal differences.[19] To address this question, I combine the data from Table 5 on the predicted strength of the lending channel of monetary transmission and from Table 6 on the size of the impact of interest rate movements on output and inflation with the measures of cross-country differences in legal organization from Table 7. In Table 8, I report the results of two straightforward exercises. The first separates the countries by the origin of their legal system and constructs group averages for the effectiveness and impact of monetary policy from column 4 of Table 5 and columns 1 and 3 of Table 6 (Table 8, top panel). The results follow the pattern predicted by the index of lending channel effectiveness as the impact of policy on output and the approximate sacrifice ratio vary systematically—and as expected—with the origin of a country's legal system.

The countries in which the lending channel is expected to be strongest have the biggest sacrifice ratios and show the largest impact of interest rate movements on output.

We can learn a bit more from the data than is recovered from the simple averages reported in the top panel of Table 8. The question of greatest interest is whether the cross-country heterogeneity in the real effects

Table 8
Testing the Relationship between Cross-Country Differences in Legal Structure and Monetary Policy Effectiveness

Legal Family	Predicted Effectiveness of Monetary Policy	Impact of Policy		Approximate Sacrifice Ratio
		On Output	On Inflation	
	Group Mean			
English	1.1	-0.45	-0.21	-3.1
Scandinavian	1.8	-0.52	-0.22	-3.7
French	2.1	-0.70	-0.20	-4.8[a]
German	2.4	-1.25	-0.49	-5.8
	Instrumental Variables Regression			
Coefficient	—	-0.46	0.05	-10.4
Standard error	—	(0.22)	(0.08)	(10.4)

Notes: "Predicted Effectiveness" is drawn from column 4 of Table 5; the "Impact of Policy," from columns 1 and 3 of Table 6. The instrumental variables regression is of columns 1 and 3 of Table 6 on column 4 of Table 5, with columns 1, 2, and 3 of Table 7 as instruments. All of the results in this table use only the eleven countries for which there are estimates in Table 6 : Ireland, the United Kingdom, and the United States (English common law); Denmark and Sweden (Scandinavian common law); Belgium, France, Italy, Portugal, and Spain (French civil law); and Germany (German civil law).

[a]Average excludes Belgium.

of monetary policy can be explained by differences in the countries' financial systems, which have their source in the strength of shareholder and creditor rights and the rigor with which these rights are enforced. We can do this without fully accounting for all of the variation in the transmission mechanism if we assume that the La Porta et al. (1997) measures are valid instruments for the financial variables in a simple regression that has the impact of policy on the left-hand side and the overall measure of the lending channel's effectiveness on the right-hand side. That is, I assume that the shareholder, creditor, and enforcement variables are exogenous, while the measure of the effectiveness of the lending channel may not be.

The results of these two-stage least squares regressions are reported in the bottom panel of Table 8. Again, we see that the countries in which the lending channel is expected to be strongest have the biggest sacrifice ratios and show the largest impact of interest rate movements on output. The latter of these relationships has a t-ratio of 2.1, and so it may even be significantly different from zero. The results for inflation are much less satisfactory: the measures of financial structure appear to be uncorrelated with the impact of policy on prices. Because of the small size of the sample (eleven countries), the estimates are all fairly imprecise, and so I treat them as being only suggestive.

Concluding Remarks

Among the many challenges facing the new Eurosystem is the possibility that the regions of the euro area will respond differently to interest rate changes. In this paper, I have suggested that differences in financial structure are a proximate cause for these national asymmetries in the monetary policy transmission mechanism. Moreover, I have proposed that these differences in financial structure are likely a result of the EU countries' diverse legal structures. The evidence, although circumstantial, is consistent with this view. Most economists believe that the monetary transmission mechanism will vary systematically across countries with differences in the size, concentration, and health of the banking system, and with differences in the availability of primary capital market financing. The countries of the EU differ quite dramatically in all of the dimensions that would seem to matter, leading to the prediction that the impact of interest rates on output and prices will not be consistent across countries. While the estimates of the impact of interest rate changes on output and inflation tend to be quite imprecise, they do differ, and in the way that is predicted by the state of the countries' financial systems. Finally, we can trace differences in financial structure, the size and scope of capital markets, and the availability of alternatives to bank financing to differences in the countries' legal structures.

What does this mean for the future of financial markets and monetary policy in the euro area? Will the European banking system become more like that of the United States? The arguments presented here suggest that unless legal structures are harmonized across Europe, financial structures will remain diverse, and so will monetary transmission mechanisms. It will not be enough to make regulatory structures more similar, since such a change will not, in and of itself, alter the structure of capital markets. In other words, I do not view regulatory competition as a force to eliminate the asymmetries in the financial intermediation systems of the EU.[20] As the European Central Bank (1999) report makes clear, this force has been very weak in the past and is expected to be weak in the future. While we may see cross-border mergers and acquisitions of financial sector firms that take advantage of the expertise of those already doing business in a region,[21] only a decision to change the existing legal structures so that shareholders and creditors in all EU countries enjoy the same rights will force the movement to a U.S.-style financial structure.

Data Appendix

The data sources for Tables 2-4 in this paper are identified below.

Table 2

Number of institutions and concentration ratios: For all countries, concentration is calculated as the assets of the top five banks as a percentage of total bank assets.

Population: International Monetary Fund, *International Financial Statistics* (January 1999), country report tables, l. 99z, midyear estimates for all countries.

Austria: Austrian National Bank web pages http://www.oenb.co.at/stat-monatsheft/tabellen/2001p.htm, Ingesamt, Hauptanstalten, for number of institutions; and http://www.oenb.co.at/stat-monatsheft/tabellen2000_5p.htm, Alle Sektoren, Summe Aktiva (Ohne Rediskonte), for total assets; Austrian National Bank, Economic Analysis Division, for assets of top five and top ten banks.

Belgium: OECD, *Bank Profitability: Financial Statements of Banks* (1998), country reports on bank balance sheets, p. 36, l. 37 (under supplementary information), for number of institutions; Bank of Belgium, Financial and Economic Statistics Division, for total assets of credit institutions and for share of top five banks.

Finland: Bank of Finland, *Financial Statistics Desk*, for all figures.

France: Bank of France, Monetary Research and Statistics Division (DESM-SASM) for all figures on credit institutions.

Germany: Deutsche Bundesbank, *Monthly Report* (May 1998), p. 16, Table IV.1, column 1, for number of institutions; Deutsche Bundesbank, Department of Controlling, Accounting and Organisation, Division C-2, for share of top five banks.

Ireland: Central Bank of Ireland, *Monetary Policy and Statistics*, for number and total assets of all credit institutions (which include licensed banks, building societies, state-sponsored financial institutions, and savings banks); IBCA BankScope database, for assets of top five banks.

Italy: Bank of Italy, Research Department, for all figures.

Netherlands: OECD, *Bank Profitability: Financial Statements of Banks* (1998), country reports on bank balance sheets, p. 192, l. 37 (under supplementary information), for number of institutions; De Nederlandsche Bank, *Annual Report* (1997), Tables 1, 2.1, and 2.2, for assets of top five banks and for total assets of monetary institutions.

Portugal: Bank of Portugal web page http://www.bportugal.pt/publish/frpublish_e.htm, Chart VIII.1 and Table VIII.2, for number of institutions and share of top five banks. OECD, *Bank Profitability: Financial Statements of Banks* (1998), country reports on bank balance sheets, p. 231, l. 25, for total assets of commercial banks.

Spain: OECD, *Bank Profitability: Financial Statements of Banks* (1998), country reports on bank balance sheets, p. 236, l. 37 (under supplementary information), for number of banks; Bank of Spain, *Statistical Bulletin* (June 1998), Tables 61.1 (p. 271), 62.1 (p. 281), 63.1 (p. 291), sum of column 1 in all tables, for total assets of banks, savings banks, and credit co-operatives; IBCA Bankscope database, for assets of top five banks.

Denmark: OECD, *Bank Profitability*: *Financial Statements of Banks* (1998), country reports on bank balance sheets, p. 64, l. 37 (under supplementary information), for number of institutions; Denmark National Bank web page http://www.nationalbanken.dk/nb/nb.nsf/alldocs/F15D9E8CF275ED1A2412565B4003E8BD5, for total assets; IBCA BankScope database, for assets of top five banks.

Greece: Hellenic Bank Association, *The Greek Banking System* (April 1998), p. 87, for number of institutions, total assets, and assets of top five banks.

Sweden: Sveriges Riksbank, *Statistical Yearbook (*1996), p. 17, Table 6, for number of banks; Sveriges Riksbank, Financial Statistics Department, for share of top five banks.

United Kingdom: British Bankers Association, *Annual Abstract of Banking Statistics* (1997), Table 1.04, for number of institutions; Bank of England, MFSD, for shares of top five banks (data relate to all banks and building societies operating in the United Kingdom and so include the business of foreign-owned affiliates in the United Kingdom).

Japan: Bank of Japan, International Department, for all figures for banks and other deposit-taking institutions, end of fiscal year 1996 (March 1997).

United States: Federal Financial Institutions Examination Council (FFIEC), Reports of Condition (call reports database), for all figures for commercial banks.

TABLE 3

Bank data: McCauley and White (1997), Table 1. Federal Reserve Bank of New York staff calculations for Austria, Belgium, Greece, Ireland, Italy, and Portugal, based on ranking of asset size from IBCA BankScope database. In each country, banks were chosen according to 1997 assets. Return on assets, loan loss provisions, net interest margin, and operating cost are drawn from IBCA BankScope database.

Thomson ratings: Thomson BankWatch database.

TABLE 4

Number of publicly traded firms and market capitalization: International Finance Corporation, *Emerging Stock Markets Factbook* (1997), pp. 17 and 23 (also available on the *Wall Street Journal* web site http://update.wsj.com/public/resources/documents/gi-tab5.htm).

Population: See sources for population data in Table 2.

Privately issued debt: Bank for International Settlements, *International Banking and Financial Market Developments* (February 1998), pp. 46-7, Tables 14 and 15, amount outstanding, December 1996 figures; sum of figures from Table 14 (international debt securities) and Table 15 (domestic debt securities).

GDP: International Monetary Fund, *International Financial Statistics* (January 1999), country report tables, l. 99b.c for all countries. Year-average exchange rates used for conversion into U.S. dollars (local currency per U.S. dollar, l. rf for all countries).

Bank loans: OECD, *Bank Profitability: Financial Statements of Banks* (1998), country reports on bank balance sheets, l. 16 on pp. 27, 35, 63, 67, 91, 115, 143, 159, 163, 167, 191, 231, 235, 251, 259, 263, 303, 307, and 315.

ENDNOTES

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1. Throughout the paper, I refer to the eleven countries of the Eurosystem but provide information on only ten. Luxembourg is not included.

2. See Angeloni and Dedola (1998).

3. Similar points are made by White (1998), who suggests that competition in banking may be about to increase in Europe, stimulated by the introduction of the euro. In addition, a recent European Central Bank (1999) study suggests that European Monetary Union may speed up the process of disintermediation and lead to a more geographically diversified and internationalized banking system.

4. For example, within the United States, more than 10 percent of firms with assets exceeding $1 million have chosen to incorporate in Delaware, a state with less than ½ of 1 percent of the country's population. Why is this? The answer can be found by considering how the development of Delaware's legal structure has differed from the development of the legal structure in other states. Originally, large firms were incorporated in New Jersey because the state, in exchange for incorporation fees and franchise taxes, had liberalized its corporation law to allow various mergers and cross-holdings that were disallowed elsewhere. State law also gave very strong power to corporations' directors (Grandy 1989). Delaware copied New Jersey's statutes and then benefited from changes made to New Jersey's law by Governor Woodrow Wilson in 1913. As this example suggests, the economic structure has its source in the legal structure.

5. I should note that firms in countries that act slowly will be put at a competitive disadvantage, and so they might pressure their governments to speed up the legal changes. The potential strength of such regulatory competition is an open issue.

6. There is an alternative. A company may move to a country where the financial system better suits its needs. The La Porta et al. measures, reported in Table 7, suggest that the United Kingdom is the best country in the European Community in which to issue both bonds and stocks, and so firms that wish to have ready access to primary capital market financing may tend to concentrate there. But for this strategy to be successful, firms would have to reincorporate *and* move assets into the alternative jurisdiction. The assets must move to provide the proper guarantees to investors. All of this seems unlikely.

7. In addition to the differences in the type of nominal rigidity, there are variations in the way in which the rigidites are modeled. These variations are more than formal; they have very different implications for the dynamic effects of nominal shocks on real variables. Different modeling strategies are based on differences in the timing of price- or wage-change decisions. There are three basic schemes used, based on Fischer (1977), Taylor (1980), and Calvo (1983), and they create very different dynamic responses of real variables to nominal shocks. Fischer, for example, assumes prices are predetermined, meaning that at some time agents set prices for some number of future periods; the level of prices set on the decision date can differ for the different periods before the next decision date. In this model, the impact of a nominal shock lasts for only as long as it takes for all price setters to have a chance to reset their price schedules. In the Taylor model, prices or wages are assumed to be fixed, meaning that their nominal value does not vary between decision dates. When prices or wages are fixed, nominal shocks die out only asymptotically. In Calvo's model, price setters change their prices according to a poison process, leading to a variety of possible dynamics.

8. Longer run considerations, such as the potential costs or benefits of modest levels of inflation, critically depend on understanding the sources of nominal rigidity. For example, Akerlof, Dickens, and Perry (1996) and Groshen and Schweitzer (1997) consider whether small positive levels of aggregate inflation can facilitate real adjustments in the presence of an aversion to nominal wage declines, suggesting that the long-run goal for inflation might be positive. But Feldstein (1996) contends that the tax distortions created by inflation reduce the level of output permanently, an argument that suggests that the optimal level of inflation may even be negative. Overall, most economists now seem to agree that inflation leads to lower levels of real output and may even retard long-run growth. See Feldstein (1999) for a summary.

9. As emphasized by Kashyap and Stein (1994), this assertion applies to both financial and nonfinancial firms.

10. This is not to say that the traditional mechanisms, operating through interest rates and exchange rates, are not present as well. Unfortunately, it has proved to be very difficult to disentangle the individual importance of the various channels of transmission.

11. It is important to note that there can be significant cyclical and secular changes in the strength of the lending channel as the health and concentration of the banking system change, and as capital markets become deeper and broader.

12. After I collected the data for this section, the European Central Bank issued its report *Possible Effects of EMU on the EU Banking Systems in the Medium to Long Term*. The appendix tables in that report contain much of the same information presented here.

13. Throughout the analysis, I omit Luxembourg.

14. A significant failing of this analysis is the assumption that these relative rankings are not changing over time. Surely, if I had chosen different dates to measure the relative health and concentration of countries' banking systems, I would have created a different set of rankings for the first two indicators. It is entirely possible that both the relative importance of small banks and the health of the banking system will become increasingly uniform across countries, leaving only differences in external finance.

15. See Appendix A in Ehrmann (1998) for additional details.

16. The results for the United States are derived from Cecchetti (1996).

17. Although he reports estimates for thirteen countries, the estimates for three of these countries appear to be difficult to interpret. In the case of Finland, for example, the impact of monetary tightening is to *increase* output, not decrease it. For Austria and the Netherlands, we have not been able to replicate the results in the current version of Ehrmann's paper.

18. Figures 1-13 in Ehrmann (1998) show that the impulse response functions are rarely significantly different from zero. The same point is made in Cecchetti (1998) and Cecchetti and Rich (1999).

19. White (1998) makes a related point when he notes that the legal, tax, regulatory, and supervisory frameworks within which financial institutions operate differ significantly across the various countries of the EU. All of these differences make direct competition more complex and less appealing. He goes on to focus on differences in the EU countries' labor laws and in the regulatory restrictions the countries place on the types of financial products that can be offered. These effects are surely complementary to the ones I address here.

20. It is also extremely unlikely that these difficulties will be overcome by the issuance of debt and equity in a jurisdiction that offers sufficient investor protections. But unless firms have assets within these jurisdictions, I do not see this as a solution.

21. Such developments would be similar to what has happened with the relaxation of interstate branching regulations in the United States, where banks in one state have purchased a bank in another state in order to obtain the legal and regulatory knowledge to do business in that state. Interstate branching has not meant opening new branches of an existing bank in another region.

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How Important Is the Stock Market Effect on Consumption?

Sydney Ludvigson and Charles Steindel

The second half of the 1990s has seen substantial changes in the wealth of American households, primarily owing to movements in the stock market. From mid-1994 to mid-1997, the aggregate value of household sector equity holdings (including those owned by nonprofits, mutual funds, and pensions and other fiduciaries) roughly doubled, for a dollar gain of about $5.2 trillion.[1] Since then, stock market values on balance have continued to rise, but there have been massive fluctuations within a wide band; the dollar value of movements within the band—from the low in October 1997 to the recent highs—has been greater than $3.0 trillion.[2]

These enormous swings in wealth no doubt have major implications for consumer spending. For this reason, the ability to measure the implications of the swings—that is, to determine their "wealth effect" on consumer resources—has grown in importance with the changing economic environment. In this article, we examine the wealth effect of stock market changes on consumption. Other things equal, an increase in the stock market makes people wealthier. In general, the wealthier people are, the more they spend. Is it possible, then, to quantify these simple truisms and come up with plausible estimates of the extent to which aggregate consumer spending in the 1990s has been supported by increased stock market wealth? Furthermore, how much would a market correction negatively affect future spending?

Our answers to these questions are a bit limited. We find, as expected, a positive connection between aggregate wealth changes and aggregate spending. Spending growth in recent years has surely been augmented by market gains, but the effect is found to be rather unstable and hard to pin down. The contemporaneous response of consumption growth to an unexpected change in wealth is uncertain and the response appears very short-lived. Therefore, we conclude

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that forecasts of future consumption growth are not typically improved by taking changes in existing wealth into account.

In the past, uncertainty about both the long-run (or trend) effect of wealth on consumption and the contemporaneous effect was of modest importance. However, in the current economy—where aggregate wealth fluctuations can be very large relative to household income, spending, and GDP—we find that the uncertainty about the size of the wealth effect also adds a considerable amount of uncertainty to one's ability to understand trends in consumer spending, over and above the difficulty of understanding the forces behind market movements.

In the next section, we briefly review changes in household sector spending, saving, and wealth, and highlight the central importance of stock market fluctuations to cyclical movements in the household balance sheet. We then turn to econometric analysis to measure the effect of a change in wealth on consumer spending. We find that a traditional specification of the consumption function gives a fairly erratic estimate of the wealth effect and may even suggest that the effect was rather small in recent years. By refining the specification and estimation of the consumption equation to reflect more rigorously current econometric concerns, we narrow the estimate somewhat, but are still left with some instability in our result. Using a more up-to-date methodology, we first establish that consumption and wealth, along with labor income, share a common trend. When asset values or labor income rises, consumption tends to rise as well, and we assess the magnitude of this boost to consumption by estimating the parameters of the shared trend—the marginal propensities to consume out of wealth and labor income. Our results suggest that these propensities are somewhat unstable over the postwar period. Nevertheless, we conclude that a dollar increase in wealth likely leads to a three-to-four-cent increase in consumption in today's economy, consistent with widely held beliefs about the long-run impact of wealth on consumption.

Finally, we analyze the short-run effects of wealth on consumption by investigating the dynamic response of consumption growth to a change in wealth and by testing the predictive power of wealth for changes in consumer spending. We find that changes in wealth are not correlated with the next quarter's consumption growth and do not help predict the growth in out-of-sample forecasts. The reason for this is not that wealth has no impact on consumption; rather, the response of consumption growth to an unanticipated change in wealth is largely contemporaneous. Controlling for lagged consumption, changes in the growth rate of wealth provide little additional information about the future path of consumption growth.

The Basics of Household Wealth Accumulation and Saving

In the aggregate, household wealth accumulation reflects two factors: saving from current income and changes in the valuation of previously owned wealth. The second factor completely dominates changes in aggregate wealth in the short and intermediate terms. In turn, changes in the valuation of existing assets are dominated by fluctuations in the stock market. These points are illustrated in Chart 1. The top panel shows, since fourth-quarter 1952, the cumulated

In the aggregate, household wealth accumulation reflects two factors: saving from current income and changes in the valuation of previously owned wealth.

value of increases in household wealth and the cumulated value of household capital gains on the stock market (capital gains are measured as the increase in the value of holdings less cumulated purchases of stock; all series are measured in chain-weighted 1992 dollars). The similarity of the two lines over short time periods is striking. The bottom panel plots the correlation between the changes in the two series over intervals from one to forty quarters, and again shows the overwhelming importance of gains and losses in the stock market in explaining movements in aggregate wealth at anything up to the longest frequencies.

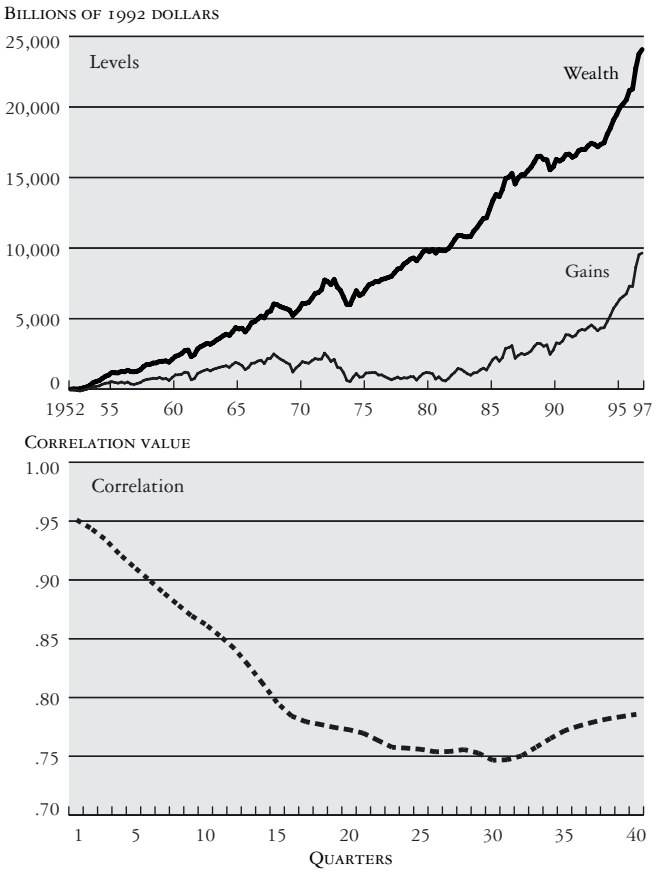
It is clear, then, that in the short run, changes in the pace of wealth accumulation owe little to changes in saving (and other things equal, changes in spending).

However, we are concerned with the opposite issue: the linkage from changes in wealth accumulation to changes in saving and spending.

One way to look at the possible influence of wealth accumulation on saving is shown in Chart 2, which plots the ratio of wealth to disposable income against the personal saving rate. Over the last few years, the wealth-to-disposable-income ratio has increased markedly while the personal saving rate has plunged. The argument for a strong wealth effect is that this increase in the ratio of wealth to disposable income, primarily because of the rise in the stock market, has boosted consumer spending and has reduced saving (both relative to income).

Chart 1

GROWTH IN WEALTH AND CUMULATED STOCK MARKET GAINS

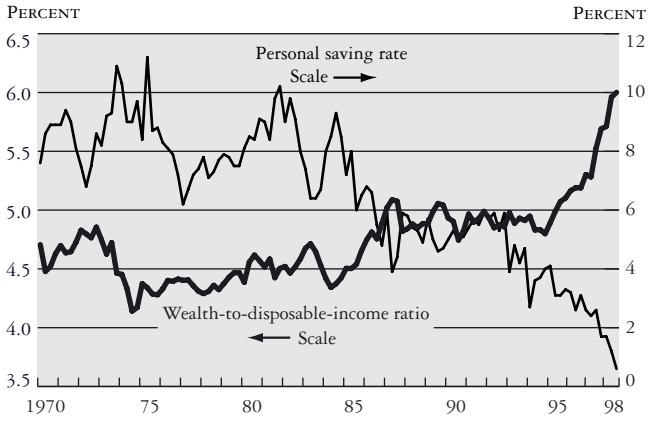


Sources: Board of Governors of the Federal Reserve System; authors' calculations.

Notes: The top panel shows the difference between wealth and the fourth-quarter 1952 level of wealth plotted against the cumulated gains at that point in time. The bottom panel shows the correlation between differences in wealth and differences in cumulated gains over "N" quarters.

Chart 2

WEALTH-TO-DISPOSABLE-INCOME RATIO AND PERSONAL SAVING RATE



Sources: U.S. Department of Commerce, Bureau of Economic Analysis; Board of Governors of the Federal Reserve System; authors' calculations.

However, a simple observation of Chart 2 is not sufficient to establish a well-defined and measured wealth effect. At the most obvious level, the chart shows periods when saving rate moves seem to parallel moves in the wealth-to-disposable-income ratio—for instance, both were increasing in the years around 1980. The seemingly strong negative connection in recent years may be a coincidence. It is helpful to recall that saving is the difference between income and spending. If we are interested in the link between wealth and consumption, it makes more sense to look at consumption directly. Accordingly, we will now turn to a statistical examination of the wealth-spending link.

THE STOCK MARKET AND THE CONSUMER: GENERAL CONSIDERATIONS AND PRELIMINARY EVIDENCE

Traditionally, the wealth effect has been measured by estimating aggregate time-series regressions of the form

$$C_t = a + bW_t + cYP_t + e_t, \quad (1)$$

where C is consumer spending during a period; YP is a measure of permanent income (usually a distributed lag on realized after-tax income); W is consumer net worth, as measured at the beginning of the period; and e_t is an error term capturing other factors that influence consumption.

Derivations of such equations from the underlying theory of consumer behavior may be found in Modigliani

and Tarantelli (1975), Modigliani and Steindel (1977), and Steindel (1977, 1981). The estimated coefficient, b, on wealth, is described as the marginal propensity to consume out of wealth and is interpreted as the increase in consumer spending associated with an increase in wealth. A widespread empirical practice is to separate wealth into different categories, with stock market wealth usually being one of them. A coefficient on stock market wealth different from other types is merely viewed as an artifact of heterogeneity of consumers; stock market wealth owners may be systematically older or younger than other wealth owners or have other characteristics that lead to a different aggregate propensity to consume out of this form of wealth. A common assumption is that b is on the order of .05 or perhaps a bit smaller; in other words, roughly five cents of each dollar of an increase in wealth is spent soon after it is earned. While this amount seems small, when we are looking at trillion-dollar gains in wealth from the stock market, a five-cent increase in spending per dollar of gain adds up to real money.

A common assumption is that . . . roughly five cents of each dollar of an increase in wealth is spent soon after it is earned. While this amount seems small, when we are looking at trillion-dollar gains in wealth from the stock market, a five-cent increase in spending per dollar of gain adds up to real money.

The perspective of modern dynamic economics is to be quite dubious about the value of estimations such as equation 1, especially using aggregate time-series data. There are questions about the appropriate estimation technique, given the possible presence of aggregation and simultaneity bias, and the use of largely untested simplifying assumptions to derive the estimating equation from the theory. Furthermore, because traditional specifications and estimation techniques basically assume that consumers are in a steady state, they do not explicitly take into account the adjustment of consumer behavior to new conditions. Formally taking into account the adjustment process to a new equilibrium implies very different ways to specify and estimate the relationship between changes in wealth and changes in consumption. This issue has been addressed in the literature at least going back to Hall (1978).

Despite the valid criticisms of formulations such as equation 1, we establish an initial reference point by estimating this type of model. Equations of this sort have been very influential in the literature on economic policy (see, for instance, Modigliani [1971]) and continue to be common in forecasting exercises.[3] Table 1 shows estimates of this traditional type of model. The regressions relate consumer spending to disposable personal income and wealth, with wealth split into two components: stock market holdings and other. Four lags of each of the right-hand-side variables are included in order to capture the adjustment process of consumer spending to changes in fundamentals. Details about the data are provided in Appendix A. The estimation of the model includes a correction for first-order autocorrelation in the error process.

Column 1 shows the coefficients for the equation estimated over the 1953-97 period. The estimates include the sum of the lag coefficients on each of the right-hand-side variables along with the standard errors. These results are more or less consistent with traditional views of consumer behavior: the sum of the lag coefficients on income is roughly .7; the sum of the coefficients on stock market wealth is .04 and, on other forms of wealth, about the same. Each sum is more than twice as great as its computed standard error, which is normally interpreted as meaning that the sum is statistically greater than zero. The estimated coefficient of serial correlation, while substantial, appears to be less than one, suggesting that the model is a valid statistical construct.

The superficial view would be that the equation in column 1 supports traditional opinions of the stock market's impact on consumption. However, the estimated stock market effect appears to be rather sensitive to the period of estimation. Reestimating the equation over three different

periods (columns 2, 3, and 4 of Table 1) suggests that the stock market effect was larger in the late 1970s and early 1980s than either before or after.

Admittedly, columns 2-4 work hard to show this instability. If we divide the sample into three fourteen-year periods (columns 5-7) rather than picking 1975 and 1985 as the break points, the coefficient estimates look more stable, though their standard errors vary. However, Chart 3 reinforces the view of a shifting model. It shows the estimated sum of the lag coefficients, along with one-standard-deviation error bands, of the wealth and income terms from regressions of the form in Table 1 estimated over ten-year periods. In particular, the remarkable thing about the middle panel is not so much the observation that such a parameter changes over time, but that the change from year to year in the estimated effect looks rather large—ten-year regressions estimated ending in two consecutive years will have 80 percent of their observations in common.[4] The chart also shows that the point estimate of the sum of the lag coefficients on the stock market for the most recent ten-year period is near zero. If all pre-1988 data were destroyed, we would be hard pressed to conclude that there is a link between the stock market and consumer spending, based on this model and estimation technique.

It is clear that the estimated marginal propensity to consume from stock market wealth is not particularly stable. Of course, it is no great surprise to find uncertainty of this type about a behavioral parameter. The likelihood ratio test statistics reported in Table 1 suggest that we can reject the null hypothesis of a stable structure over the three subsamples in the two parts of the table. In principle, we might try to determine more precisely the break points in the structure of the regression. However, if there is a violation of any of the classical assumptions needed to apply such tests for an equation estimated by ordinary least squares (OLS)—possibilities we discuss further in the next section—the tests of the stability of equation 1 will also be invalid.

Setting aside these concerns, we find that for the purpose of policy analysis, the conventional consumption function estimates produce two important but rather conflicting results. With some trivial exceptions, we consistently come up with estimates of the stock market wealth effect (and the non-stock-market wealth effect) in the range of small positive values to .1—certainly in line with traditional views. Nonetheless, awareness that this propensity can vary in this range makes the wealth effect a very shaky reed to lean on when the aggregate value of the stock market has shown that it can fluctuate by more than $3 trillion in brief amounts of time. Applying a range of uncertainty about the size of the marginal propensity of only .02 (generally equal to a two-standard-deviation error band for most of our estimates) to such a swing in wealth

Table 1
ORDINARY LEAST SQUARES ESTIMATION OF TRADITIONAL LIFE-CYCLE MODEL

Model: $C_t = \sum_{i=0}^{3} \delta_i Y_{t-i} + \sum_{i=0}^{3} \xi_i SW_{t-i} + \sum_{i=0}^{3} \mu_i NW_{t-i} + e_t$

	Estimation Period						
	1	2	3	4	5	6	7
Independent Variable	1953:1-1997:4	1953:1-1975:4	1976:1-1985:4	1986:1-1997:4	1953:1-1967:4	1968:1-1982:4	1983:1-1997:4
Income (*Y*)	0.731	0.711	0.568	1.015	0.684	0.832	0.822
	(0.067)	(0.059)	(0.195)	(0.077)	(0.091)	(0.141)	(0.074)
Stock market wealth (*SW*)	0.040	0.026	0.106	0.021	0.030	0.023	0.042
	(0.009)	(0.010)	(0.041)	(0.011)	(0.018)	(0.019)	(0.010)
Non-stock-market wealth (*NW*)	0.038	0.043	0.069	-0.027	0.049	0.012	0.016
	(0.017)	(0.015)	(0.048)	(0.017)	(0.020)	(0.036)	(0.018)
Serial correlation coefficient	0.937	0.781	0.937	0.755	0.800	0.886	0.809
	(0.030)	(0.090)	(0.069)	(0.097)	(0.094)	(0.069)	(0.091)
Standard error of regression	70.7	59.8	86.7	65.7	41.4	84.7	76.2
Sum of squared residuals of regression	830835	279012	202961	150994	78739	336836	272807
Likelihood ratio test:							
Statistic			48.690			33.668	
Probability			0.0045			0.1436	

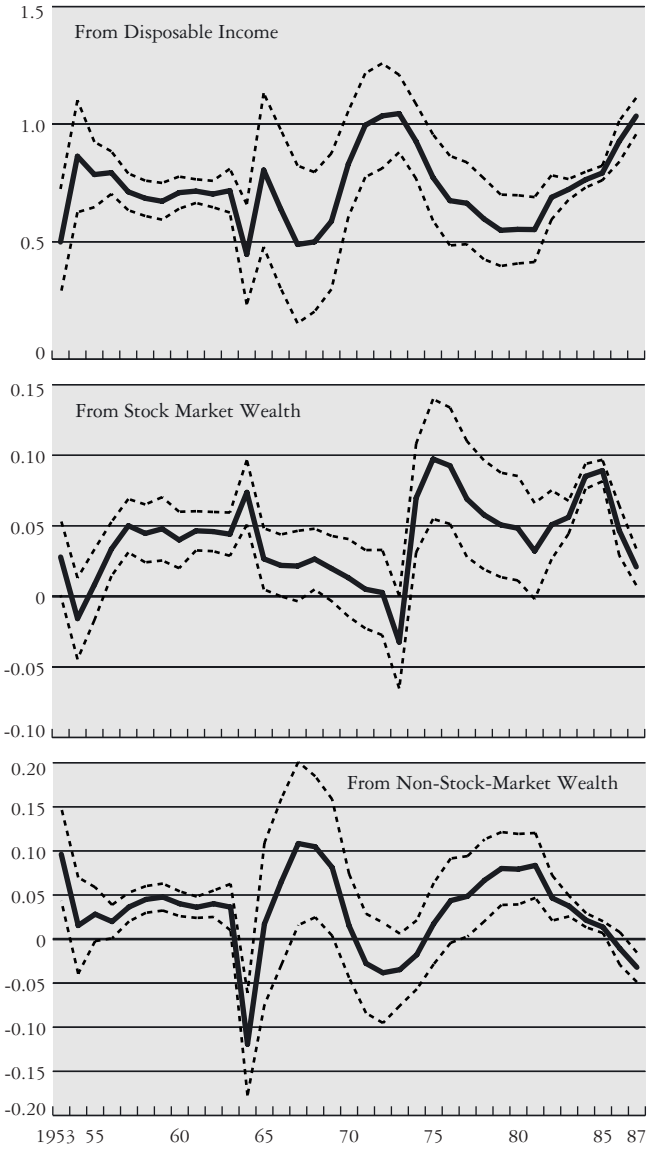
Source: Authors' calculations.

Notes: All data are real per capita. Standard errors are in parentheses.

adds $60 billion (about ¾ of 1 percentage point of aggregate GDP) to our uncertainty about the basic forces affecting consumer spending. Table 1 suggests that the range of uncertainty about the wealth propensity should also take into account the different point estimates, which make the range greater than .02. As an extreme example of our uncertainty about the recent scope of the wealth effect, Table 2 presents a range of estimates of the effect of the 1994-97 stock market rise on the 1997 level of consumer spending. These estimates are taken by applying the propensity to consume from stock market wealth determined from columns 1, 3, and 4 of Table 1 to the rise in the aggregate real value of household sector stock market wealth in this period. The estimated range of the effect of the 1994-97 market rise on 1997 spending spans more than 350 billion chain-weighted 1992 dollars. Alternatively, we can argue that the 1994-97 market increase boosted 1997 spending somewhere between 1¾ and 9 percent. Even the smallest effect can account for the 1.5-percentage-point drop in the personal saving rate over that period. However, the range of the estimates is clearly very disquieting. We now turn to more modern statistical techniques to obtain a more precise handle on the wealth effect.

Chart 3

MARGINAL PROPENSITY TO CONSUME



Source: Authors' calculations.

Notes: The panels depict rolling regressions over ten-year samples. The years represent the starting date of each regression. The dashed lines indicate one-standard-deviation error bands.

Table 2
ESTIMATED IMPACT OF 1994-97 STOCK MARKET RISE ON 1997 CONSUMER SPENDING

Propensity to Consume	Dollar Impact of Wealth Increase on Real Spending	Percentage of 1997 Consumer Spending
0.040 (1953:1-1997:4)	$166 billion	3.4
0.106 (1976:1-1985:4)	$439 billion	8.9
0.021 (1986:1-1997:4)	$87 billion	1.8

Sources: U.S. Department of Commerce, Bureau of Economic Analysis; authors' calculations.

Note: The increase in real household sector stock market holdings, measured from second-quarter 1994 to second-quarter 1997, is $4,141 billion.

THE WEALTH EFFECT ON CONSUMPTION: UPDATED STATISTICAL APPROACHES

This section employs updated empirical techniques to investigate the relationship between consumption and wealth. We begin by estimating the marginal propensity to consume out of wealth with more modern econometric procedures. With estimates of the marginal propensity to consume out of wealth in hand, we move on to analyze the response, over time, of consumption growth to a wealth shock, and to test whether accounting for movements in

wealth is likely to improve our forecasts of consumption growth one or more quarters ahead.

Long-Run Relationships: The Marginal Propensity to Consume out of Wealth

The empirical procedure above provides a descriptive summary of the relationship between aggregate consumption and wealth. Studying those results is useful because it furnishes a basis for comparison with earlier work in the traditional life-cycle consumption literature. That empirical methodology is still widely used today. Nevertheless, econometric theory points to a number of potential pitfalls with the traditional approach to estimating the effect of wealth on consumption.

Much recent theoretical research on the consumer has focused on the behavior of a representative individual who is forward looking but faces a risky stream of labor income. Among the most prominent of these paradigms is the permanent income hypothesis.

One potential pitfall concerns the failure to account for the time-series properties of C, W, and Y. At the least, each of these variables likely contains a trend component that is random and therefore not known in advance (a stochastic trend). The conventional analysis performed above does not take into account the econometric implications of this type of nonstationarity. A second problem pertains to the correlation between consumption and current wealth. We seek to identify the effect of an increase in wealth on consumption. Yet the econometric techniques employed above ignore the possibility that the estimated consumption-wealth correlation reflects, at least partially, the effect of an increase in consumption on wealth.[5] We refer to this "reverse causality" as endogeneity bias. Failure to address either problem could skew statistical inference and lead to inconsistent estimates of how much an increase in wealth influences consumption. We now present an alternate empirical approach and discuss how it can address both difficulties.

We begin by laying some theoretical groundwork. Our purpose is solely to provide intuition and motivation for the statistical analysis that follows; the empirical approach we take is not conditional on any particular theory of consumption and will be robust to a variety of departures from the framework presented next. We discuss this further below.

Much recent theoretical research on the consumer has focused on the behavior of a representative individual who is forward looking but faces a risky stream of labor income. Among the most prominent of these paradigms is the *permanent income hypothesis*. According to this theory, consumption of nondurable goods and services is chosen to match permanent income, defined as the annuity value of human and nonhuman wealth. The model implies that consumption responds to any unpredictable change in permanent income, but very little to transitory fluctuations in income. Additionally, there are no lags in the adjustment of consumption to an unexpected change in permanent income. This assumption implies that next period's *change* (or growth) in consumption should be unforecastable given information today.

The permanent income hypothesis also implies that there is a linear relationship between aggregate consumption, C_t, aggregate labor income, Y_t, and aggregate nonhuman (financial) wealth, W_t:[6]

$$C_t = \alpha + \beta W_t + \delta Y_t + u_t, \tag{2}$$

where the error term, u_t, is a discounted value of expected future (demeaned) income increases. Specifically, u_t takes the form:

$$u_t = \sum_{i=1}^{\infty} \rho^i (E_t \Delta Y_{t+i} - \mu), \tag{3}$$

where E_t is the expectation operator conditional on information available at time t, μ is the mean change in labor income, and ρ is a positive constant less than one.[7]

Equation 2 shows how modern-day consumer theory naturally implies a linear relationship between aggregate

consumption, aggregate net wealth, and aggregate labor income, much the same as in the traditional life-cycle literature with the error term given a specific interpretation. The parameters β and δ give the effect of a one-dollar increase in wealth and labor income on consumer expenditure, and can be interpreted as "marginal propensities to consume" out of wealth and income, respectively.[8]

Of course, theoretical justification is not a prerequisite for estimating a linear relationship among three variables. Nevertheless, it is helpful to have a reasonable framework with which to motivate and interpret empirical findings. Indeed, as discussed below, we find that the permanent income hypothesis—while not exactly correct—provides a reasonable approximation of much of the dynamic behavior of consumption, labor income, and wealth in U.S. time-series data. We now describe our approach to estimating the marginal propensity to consume out of wealth and labor income.

Our goal is to estimate the parameters β and δ. We begin by noting that the appropriate estimation technique will depend on the trend characteristics of the variables in equation 2. It is now widely recognized that each variable in that equation follows a stochastic trend, a fact we document in Appendix B. These trend characteristics of C, Y, and W can be described more precisely by noting that each variable appears to be nonstationary and to contain a unit root. (We refer to variables that contain a unit root as first-order integrated, or $I(1)$.) By contrast, the error term in equation 2, u_t, consists of a discounted sum of expected future *changes* in labor income. If the level of labor income is $I(1)$, the first difference of labor income will be stationary, or $I(0)$. Since u_t is simply the discounted value of these first differences, it follows that u_t will also be stationary. If consumption, labor income, and wealth are individually trending but the error term is stationary, the three variables in equation 2 must share a common trend (a unit root) while deviating from each other in the short run. In that case, we say that the variables are *cointegrated*, and the vector $\{1, -\beta, -\delta\}$ is the cointegrating vector. Appendix B presents evidence in support of the hypothesis that C, Y, and W—as measured by aggregate time-series data—are in fact cointegrated, which implies that the error term, u_t, is stationary.

Why is cointegration important? Notice that the error term, u_t, in equation 2 will typically be both serially correlated and correlated with the regressors W_t and Y_t. In ordinary empirical applications, the effects of serial correlation are usually straightforward to address, but correlation between the error term and the regressors (regressor endogeneity) is, in practice, a much more intractable problem that can lead to inconsistent parameter estimates. By contrast, applications involving cointegrated variables have an important and unusual property: OLS estimates of cointegrating parameters (for example, of β and δ) are robust to the presence of regressor endogeneity.

We find that the permanent income hypothesis—while not exactly correct—provides a reasonable approximation of much of the dynamic behavior of consumption, labor income, and wealth in U.S. time-series data.

To understand this result intuitively, notice that, if u_t is stationary but W_t and Y_t are individually trending, there may be some transitory correlation between W_t and u_t, or between Y_t and u_t, but the long-run correlation must be zero since trending variables must eventually diverge from stationary ones. Thus, we can exploit this property of cointegrated systems to obtain accurate estimates of β and δ using single equation estimation techniques (for example, OLS estimation) despite the fact that the regressors may be correlated with the error term.

A related implication of cointegration is that the empirical approach we employ will be robust to a variety of departures from the theory presented above. Consistent estimates of the parameters can be obtained *even if* there exist omitted explanatory variables (not accounted for by the

simple permanent income hypothesis) that are correlated with wealth and labor income. As long as the variables in equation 2 share a common stochastic trend, we can consistently estimate the parameters of that trend, circumventing many of the problems associated with identifying the influence of a change in wealth on consumption, such as how to adjust for the endogenous response of wealth to changes in economic activity or to unexpected shifts in the rate of return on financial assets.[9]

The empirical procedure discussed above relies on the presence of a single common stochastic trend—or cointegrating relationship—linking consumption, labor income, and net wealth. Consequently, the first step of our analysis is to verify that this proposition is supported in our data. As documented in Appendix B, the evidence suggests that there is a single cointegrating relationship among these variables, and we can therefore proceed to estimate the parameters of the cointegrating vector, that is, the marginal propensities β and δ.

Standard OLS estimation will produce consistent point estimates of the parameters β and δ (as long as the three variables in equation 2 are cointegrated). Nevertheless, it is important to recognize that statistical inference about the relationship among stochastically trending variables cannot be carried out using conventional standard errors. Some correction to the conventional OLS estimation method is necessary. Our approach is to use the dynamic OLS procedure of Stock and Watson (1993), which specifies a single equation taking the form

$$(4)\qquad C_t = \alpha + \beta W_t + \delta Y_t + \sum_{i=-k}^{k} \beta_i \Delta W_{t+i} + \sum_{i=-k}^{k} \delta_i \Delta Y_{t+i} + u_t^*,$$

where Δ is the first difference operator and u_t^* is related to u_t such that $u_t^* = u_t - \sum_{i=-k}^{k} \beta_i \Delta w_{t+i} - \sum_{i=-k}^{k} \delta_i \Delta Y_{t+i}$.

Equation 4 is estimated by OLS, but leads and lags of the first difference of the right-hand-side variables are included to eliminate the effects of regressor endogeneity on the distribution of the least squares estimator. (We also make a correction for serial correlation of the residuals.) The coefficients on the level of wealth and labor income, β and δ, provide consistent point estimates of the marginal propensities to consume, and the corrected *t*-statistics we report can be compared with the standard *t* tables.

At first glance, equation 4 appears very similar to the traditional equation 1; both specifications include some combination of current and lagged levels of wealth and income as regressors and, in principle, the parameters β in equation 4 and *b* in equation 1 measure the same economic concept: the effect of a dollar increase in wealth on consumption. On closer inspection, however, it is clear that there are some important differences between these specifications. Unlike equation 1, equation 4 contains leads, in addition to lags, of the right-hand-side variables. The estimate of *b* from equation 1 is the sum of the coefficients on the current level and lags of the level of wealth, in order to capture the long-run impact of wealth when there are adjustment lags. By contrast, the estimate of β in equation 4 is just the coefficient on the current level of wealth, and leads and lags of the first difference are included simply to eliminate the effects of regressor endogeneity on the distribution of the least squares estimator. Similarly, equation 1 proxies for permanent income by using several lags of current income, whereas equation 4 splits permanent labor income into current labor income, which appears as a regressor, and the present discounted value of expected future labor income increases, which is subsumed in the residual term, u_t. The error term in equation 4 is specifically related to the consumer spending decision and is not assumed orthogonal to the regressors. By contrast, the error term in equation 1 is an empirical "add-on," assumed to be orthogonal to the regressors.[10]

At an intuitive level, equation 4 is specified to estimate only the trend relationship linking consumption, labor income, and wealth. By contrast, equation 1, as estimated in Table 1, implicitly models both the long-run parameters and the adjustment process of consumer spending to disturbances from the equilibrium path. It is reasonable to suppose that a procedure—such as the estimation of equation 4—that separates these

two steps will produce firmer estimates of the trend component.

Before estimating equation 4, we deal with three additional specification issues that arise from the nature of the data on consumption, income, and wealth. First, note that theory typically does not rationalize distinct roles for stock market and non-stock-market wealth; total net worth enters the relationship in equation 4. Accordingly, we focus our analysis on what follows on total net worth, rather than breaking it out into stock market and non-stock-market wealth. As explained above, however, we note that quarterly fluctuations in net worth are largely driven by fluctuations in stock market wealth.

Second, standard theories of consumer behavior that imply a trend relationship linking *C*, *Y*, and *W*, as in equation 2, are applicable to the *flow* of consumption. Thus, durable goods expenditures should not be included in our measure of consumption since they represent replacements and additions to the asset stock, rather than the service flow from the existing stock. In what follows, we present estimates of the marginal propensities using personal consumption expenditures on nondurables and services (excluding shoes and clothing) as our expenditure measure, and we refer to this measure simply as consumption.[11] This consumption series is scaled up so that its sample mean matches the sample mean of total consumption expenditure, allowing a rough comparison of the size of the propensities to consume out of wealth and income estimated from these data with the size of the propensities computed from the total consumer spending series used in the first section of this article. Later, we discuss the application of these techniques to durables expenditure and how the dynamic relationship between these expenditures and wealth differs from that between wealth and the other components of consumer spending.

A final consideration is whether to express the variables in levels or in logs. In the specification above, the variables are defined in levels because we wish to estimate the effect of a *dollar* increase in wealth on consumption. Nevertheless, aggregate time-series data on consumption, wealth, and labor income appear to be closer to linear in logs than linear in levels, so heteroskedasticity is potentially important if the regression is carried out in levels. Our solution is to use the dynamic OLS procedure above with variables expressed in logs and then to back out the implied level response using the most recent values of the consumption-income and consumption-wealth ratios. Throughout this article, we use lowercase letters to denote log variables.

Table 3 reports the results from estimating equation 4 in logs for $k = 3$.[12] Estimates are presented for the full sample period and for the sample divided into thirds. Estimated parameters are denoted with a "hat"; parameters with an l subscript give the point estimates for the log response; the implied level propensities are reported in the columns labeled "Level."

As Table 3 shows, over the full sample period the marginal propensity to consume out of wealth, β, is estimated to be about .046, while the marginal propensity to consume out of labor income, δ, is estimated to be about 0.72. These parameters are strongly significant according to the corrected *t*-statistics reported in parentheses.

Dividing the sample into thirds reveals some instability in these coefficients, echoing the findings in the first part of this article. In particular, the marginal propensity to consume out of wealth drops from about .07 in the first subperiod to somewhere between 0.025 and 0.03 in

Table 3
DYNAMIC ORDINARY LEAST SQUARES ESTIMATES OF MARGINAL PROPENSITY TO CONSUME OUT OF WEALTH AND LABOR INCOME

Model: $$c_t = \alpha + \beta_l w_t + \delta_l y_t + \sum_{i=-3}^{3} \beta_{l,i} \Delta w_{t+i} + \sum_{i=-3}^{3} \delta_{l,i} \Delta y_{t+i} + u^*_{l,t}$$

	MPC out of Wealth		MPC out of Labor Income	
Sample Period	Log	Level	Log	Level
1953:1-1997:1	0.291*	0.046	0.605*	0.718
	(8.10)		(18.09)	
1953:1-1967:4	0.380*	0.072	0.500*	0.615
	(3.78)		(5.20)	
1968:1-1982:4	0.155	0.031	0.729*	0.861
	(1.58)		(11.32)	
1983:1-1997:1	0.151*	0.024	0.764*	0.907
	(3.69)		(12.13)	

Source: Authors' calculations.

Notes: Lowercase letters denote log values. "MPC" is the marginal propensity to consume. The sample period denotes the range of data after data points for leads and lags are removed. The *t*-statistics reported in parentheses are corrected nonparametrically for the effect of serial correlation.

*Significant at the 5 percent level or better.

the last two subperiods, while the marginal propensity to consume out of labor income rises from about .62 in the first subperiod to about .91 in the last two subperiods. Nonetheless, most of this instability appears to be concentrated in the early subsample, and we found that removing the post–Korean War period (by starting the sample in the first quarter of 1957 rather than in 1953) eliminated some of this instability, at least for some dynamic OLS specifications. For the post-1957 sample, the implied estimates of the marginal propensity to consume out of wealth, β, and the marginal propensity to consume out of labor income, δ, were found to be 0.04 and 0.72, respectively.

In summary, the dynamic OLS procedure employed above suggests that the estimates of the cointegrating parameters vary somewhat over time but are less unstable than those produced by the traditional methodology in the first part of this article. Moreover, much of this instability appears to be rooted in the early part of our sample. On the whole, the findings suggest that—in today's economy—a one-dollar increase in wealth typically leads to a three-to-four-cent trend increase in consumer expenditure.

The dynamic OLS estimates of β and δ can be viewed as describing some trend relationship linking consumption, labor income, and wealth. These estimates do not tell us about the nature of short-run deviations from the trend relationship, or about the impact of quarterly fluctuations in the growth rate of wealth or labor income on future consumption growth. Such short-term dynamics are of interest, and an important property of cointegrated variables is that the cointegrating parameters may be estimated in a first-stage regression, as above, and then treated as known when estimating parameters associated with short-term dynamics (Stock 1987). We now examine the short-term relationship linking consumption, labor income, and wealth, taking into account their common trend.

Short-Run Dynamics

We specify a model of short-run dynamics that imposes our estimated long-term trend relationship while at the same time making allowances for the possibility of serially correlated but temporary divergences from this trend. This model takes the form

$$\Delta x_t = \mu + \alpha(c_{t-1} - \hat{\beta}_l w_{t-1} - \hat{\delta}_l y_{t-1}) + \sum_{j=1}^{k} \Gamma_j \Delta x_{t-j} + e_t, \quad (5)$$

where Δx_t is the vector of log first differences, $(\Delta c_t, \Delta w_t, \Delta y_t)'$, and the parameters $\hat{\beta}_l$, $\hat{\delta}_l$, are the previously estimated cointegrating coefficients for c_t, w_t, and y_t. The parameters μ, α, and Γ govern the short-term dynamics—that is, the relationship of consumption, wealth, and labor income growth as well as the lags of these variables and the trend deviation in the second term.[13] Note that the parameters in this second term are the estimated coefficients from our dynamic OLS procedure.

Equation 5 is a vector autoregression (VAR) in log first differences, with the added restriction that the (log) levels of the variables share a common trend, so that last period's deviation from trend, given by $(c_{t-1} - \hat{\beta}_l w_{t-1} - \hat{\delta}_l y_{t-1})$, is allowed to influence the current period growth of at least some of the variables. This specification is referred to as an error-correction representation, and the variable $(c_{t-1} - \hat{\beta}_l w_{t-1} - \hat{\delta}_l y_{t-1})$ as the error-correction term, since the equation takes into account any "correction" arising from last period's deviation, or error, in the trend relationship. For any set of cointegrated variables, there is an error-correction representation, and this representation is the appropriate VAR for describing short-term dynamics among the variables in that set. An unrestricted VAR in first differences is appropriate when the variables involved are individually trending but do not have a common trend.

Table 4 summarizes the dynamic behavior of the restricted VAR in equation 5. All variables are expressed as log differences; estimates of the parameters in the error-correction term are obtained from the full post–Korean War sample using the dynamic OLS procedure discussed earlier. Results are reported for a two-lag version of the model, in accordance with findings from Akaike and Schwartz tests for lag length.

The results that appear in Table 4 are organized into three columns. For each dependent variable Δc_t, Δw_t, and Δy_t, the coefficient on the error-correction term is presented; *p*-values from the *F*-test statistic for the joint marginal significance of the block of lags of each variable and for the error-correction term are also presented in the table.

Three points about Table 4 are worth noting. First, the *F*-test statistics show that lagged consumption growth predicts labor income growth at the 5 percent level and growth in household net worth at the 10 percent level, but neither of the income or wealth variables predicts consumption growth. This finding is consistent with forward-looking behavior, suggesting that some consumers have information about their future asset and labor income that is not captured by lags of these variables, and that they respond to this information by changing consumption today. It also implies that an important part of the noncontemporaneous correlation between consumption and predictable changes in household net wealth and labor income simply reflects the fact that consumption tends to anticipate an increase in these variables, rather than the other way around.[14]

Second, the *F*-tests in Table 4 reveal that lags of consumption growth enter significantly in the equation for consumption growth. The correlation of consumption growth with its own lags may be the result of some adjustment delay in consumption and represents a statistical rejection of the permanent income model, which implies that the growth in consumption should be unforecastable. Nevertheless, it is clear that fluctuations in wealth do not help predict future changes in the growth of consumption once we control for lagged consumption growth.

Table 4
ESTIMATES FROM A RESTRICTED VECTOR AUTOREGRESSION

	Equation		
	Δc_t	Δw_t	Δy_t
Joint significance of			
$\Delta c_{t-i,\, i=1\ldots2}$	0.04	0.08	0.04
$\Delta y_{t-i,\, i=1\ldots2}$	0.18	0.08	0.95
$\Delta w_{t-i,\, i=1\ldots2}$	0.61	0.08	0.39
Coefficient on error-correction term			
$c_{t-1} - \hat{\beta}_1 w_{t-1} - \hat{\delta}_1 y_{t-1}$	-0.001	0.476	0.113
(*p*-value)	(0.99)	(0.00)	(0.13)
Adjusted R^2	0.11	0.14	0.05

Source: Authors' calculations.

Notes: The table reports *p*-values from the *F*-test statistic for the joint marginal significance of the block of lags in the row for the equation with the dependent variable reported in the column. The sample period is first-quarter 1953 to fourth-quarter 1997.

A remaining feature of the data is that the error-correction term is significantly correlated with next period's household net worth. This finding is not predicted by the simple model discussed above. Lettau and Ludvigson (1999) develop an alternative model of forward-looking consumption behavior that allows for time-varying returns, which can account for such a correlation.[15]

We now move on to study the dynamic response of consumption growth to a wealth shock in order to investigate the length of time over which a change in wealth typically influences consumption growth. As a preliminary step, it is necessary to make an assumption about the timing of events, and we show the response of consumption growth to a one-standard-deviation wealth shock under two such assumptions. In the first, we assume that consumption growth may not respond to wealth within the quarter but may respond with a lag. In the second, we assume that consumption may respond to a wealth shock within the quarter. Chart 4 shows these responses for consumption growth, Δc_t. Each panel also shows two-standard-deviation error bands of these responses (dashed lines).

As the top panel shows, when we force consumption to respond with a one-period lag, a one-standard-deviation shock to the growth of wealth has virtually no impact on consumption growth at any horizon; the standard error bands are sufficiently wide that the response cannot be considered more than noise.

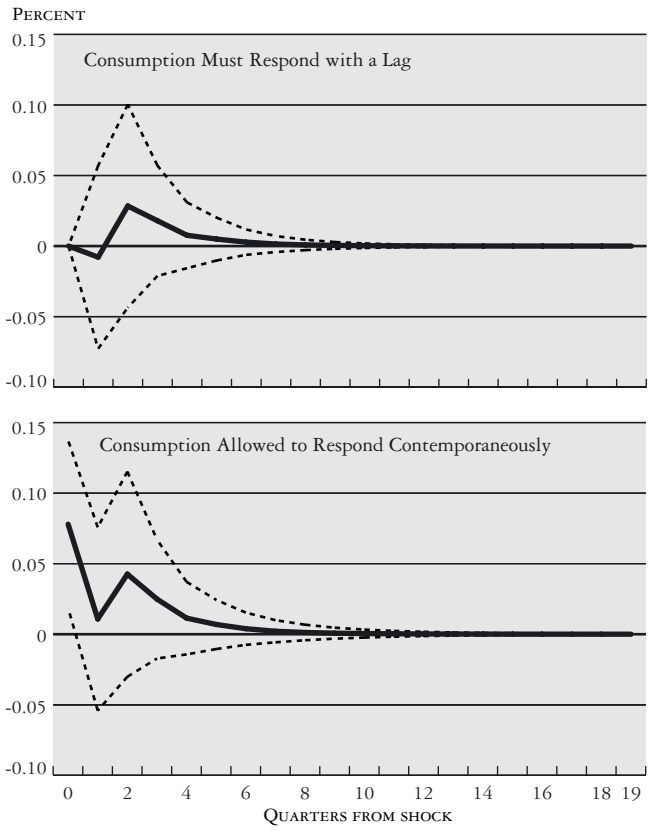
By contrast, the bottom panel shows the response of consumption growth to a wealth shock when we allow the former to respond contemporaneously. In this case, growth in consumption shoots up on impact, but the duration of the response is extremely short, so that by the end of the impact quarter, the effects of the shock

are statistically negligible. This explains why wealth has virtually no impact on consumption when we force it to respond with a lag of one quarter.[16]

The results in the bottom panel of Chart 4 allow us to estimate the impact of stock market moves on near-term trends in consumption. The panel shows the effect of a one-standard-deviation move in wealth growth on consumption growth. A one-standard-deviation move in wealth is about 1.5 percent. The point estimate of the contemporaneous or "impact" effect on consumer spending growth (actually, the effect in the quarter directly following the increase in wealth) of this move is about .07 percent, implying an elasticity of consumption growth to wealth growth of about .05. A $3.5 trillion short-term movement in the stock market (comparable to those we have recently seen) equals about 10 percent of household wealth. If such a move occurred and the level of wealth then held steady (not the case recently), we estimate that there would be a .5 percent impact on consumer spending growth (2 percent at an annual rate) the next quarter. This point estimate of the impact effect is certainly interesting, but is not overwhelming in importance. Nevertheless, the great imprecision of the estimate (the two-standard-deviation error bands stretch from a negligible effect to a 1 percent effect) implies that the impact effect is quite uncertain.

Chart 4

RESPONSE OF CONSUMPTION GROWTH TO A WEALTH SHOCK, RESTRICTED VECTOR AUTOREGRESSION



Source: Authors' calculations.

Notes: The estimation period is first-quarter 1953 to fourth-quarter 1997. The response in the top panel is produced from a vector autoregression (VAR) for the log difference in consumption growth, labor income growth, and net worth growth, in that order. The response in the bottom panel is produced from a VAR for the same variables when consumption growth is ordered last. Both VARs impose the error-correction term. The solid lines show the response to a one-standard-deviation shock in the growth of net wealth; the dashed lines indicate two-standard-deviation error bands.

What do these responses suggest for the effect of wealth changes on the *level* of consumption? Chart 4 shows that the comovement between consumption growth and an unpredictable change in wealth growth is largely contemporaneous; there do not appear to be important lagged effects in this relationship. Accordingly, when a positive wealth shock hits the economy, by the end of the impact quarter there is no further impetus from this shock to the *growth* of consumption. These responses imply that the level of consumption rises quickly to a new, permanently higher pace.

While many of the results discussed above are roughly consistent with the predictions of the permanent income hypothesis, it is clear that the permanent income interpretation is not quite right, since we know from Table 4 that consumption growth is correlated with its own lags. Serial correlation in consumption growth may be caused by any number of theoretical departures from the permanent income hypothesis, all of which can be described loosely by the umbrella term "adjustment lags." Whatever the underlying reason for these adjustment lags, however, it appears that controlling for lags of consumption growth by itself is sufficient to account for the lags. As the bottom panel of Chart 4 illustrates, once we control for lags of consumption growth, there are no meaningful lags in the adjustment of consumption to a wealth shock.

Are changes in wealth helpful in forecasting consumption growth? Put another way, should a permanent change in wealth cause us to alter our prediction of consumption growth one or more quarters ahead? We can answer this question explicitly by testing whether the specification in equation 5 improves one-quarter-ahead forecasts of consumption growth. We use a simple univariate process as a benchmark model and compare the forecasting performance of the univariate model with that of the equation 5 specification (see box).

Exploring a variety of univariate processes reveals that the log difference in consumption can be well described by a first-order autoregressive process—although a process in which the growth of consumption is unforecastable (the log of consumption is a random walk) is not a bad approximation. The best fitting univariate processes for Δw_t and Δy_t, respectively, are a first-order moving-average process and a first-order autoregressive process. We use these univariate models below.

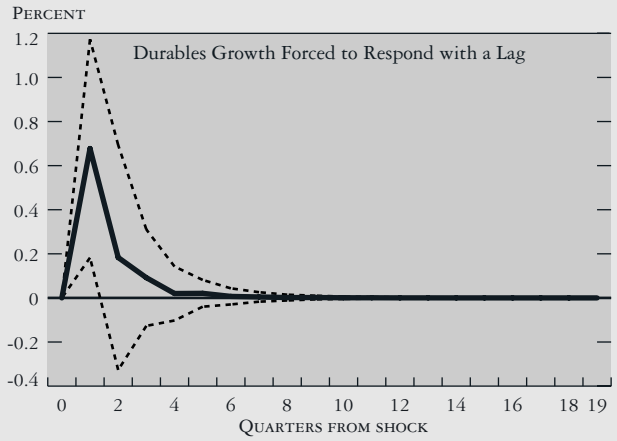
We make a series of one-quarter-ahead forecasts and begin by estimating each model on an initial sample period. We then make a one-quarter-ahead, out-of-sample forecast and use recursive estimation to reestimate the model, adding one quarter at a time and calculating a series of one-quarter-ahead forecasts. Forecasts are evaluated by

What about Durables?

The results above tell us about the dynamic relationship between nondurables and services consumption and wealth. Can we characterize the short-term relationship between wealth and durables expenditure? If evidence supported the hypothesis that durables expenditure, wealth, and labor income are cointegrated, the same techniques used previously could be employed to estimate the short-term dynamics using a restricted vector autoregression (VAR) specification such as equation 5. However, the assumption of cointegration is not warranted (either empirically or theoretically) for these variables. Thus, we investigate the short-run dynamics of an unrestricted VAR in log first differences for durables expenditure, wealth, and labor income.

The chart shows the response of real durables expenditure growth to a one-standard-deviation increase in the rate of growth of net worth. Compared with the response of the scaled nondurables measure reported in the text, this response is larger in magnitude and somewhat more persistent. One quarter after the shock, durables growth increases by about 60 basis points, and the impetus to durables spending growth from this shock remains statistically positive for more than one quarter. Nevertheless, the effect on durables spending growth is only slightly more persistent than that for the nondurables measure used in the text, becoming statistically negligible by the beginning of the second quarter after a shock. By contrast, the pattern of responses for *total* consumption (not shown) is very similar to those for the scaled nondurables consumption measure, reflecting the fact that durables expenditures represent only about 12 percent of personal consumption expenditures.

Response of Durables Growth to a Wealth Shock, Unrestricted Vector Autoregression



Source: Authors' calculations.

Notes: The estimation period is first-quarter 1953 to fourth-quarter 1997. The response is produced from an unrestricted vector autoregression for the log difference in durables expenditure growth, labor income growth, and net worth growth, in that order. The solid line shows the response to a one-standard-deviation shock in the growth of net wealth; the dashed lines indicate two-standard-deviation error bands.

computing the root-mean-squared error from the set of one-quarter-ahead forecasts.

Table 5 reviews the out-of-sample forecasting performance of the restricted VAR model relative to the univariate process for each forecasted variable. Several evaluation periods are considered. First, we use a relatively long, but recent, horizon—the first quarter of 1990 to the fourth quarter of 1997. We then analyze forecast performance over four shorter, nonoverlapping horizons spanning the first quarter of 1984 to the fourth quarter of 1997. For each forecasted variable and each evaluation period, the table reports the ratio of the root-mean-squared error obtained from the univariate model to that of the restricted VAR model (equation 5). A number less than one indicates that the one-quarter-ahead forecast accuracy of the univariate process is superior to that of the VAR model.

The main features of the results may be summarized as follows. There is no evidence that the restricted VAR model consistently improves forecasts of consumption growth relative to a simple univariate process. Indeed, in four of the five evaluation periods we consider, the restricted VAR model is outperformed by a first-order autoregressive process for consumption growth. For the remaining evaluation period (the first quarter of 1987 to the fourth quarter of 1989), the two specifications perform equally well. The superiority of the autoregressive process in forecasting consumption growth is not large in magnitude. Nevertheless, the finding that the restricted VAR model often delivers less accurate forecasts than a simple univariate model underscores the fact that quarterly fluctuations in wealth have virtually no marginal impact on future consumption growth.

These features of the results are particularly pronounced for the most recent evaluation period—the first quarter of 1994 to the fourth quarter of 1997. During this period, using the univariate model instead of a VAR model would have consistently improved forecasts of consumption growth. And, although we do not report these results in Table 5, it is worth noting that even a process in which the growth of consumption is unforecastable (the log of consumption is a random walk) would have improved one-quarter-ahead forecasts of consumption growth during this period, relative to the VAR specification.

By contrast, the VAR model appears to improve forecasts of labor income growth relative to a first-order autoregressive process for that variable: the forecasting error of the restricted VAR model for labor income growth is lower in three of the five evaluation periods we consider.

In summary, the one-quarter-ahead forecast evaluations presented in Table 5, the responses plotted in Chart 4, and the dynamic estimates displayed in Table 4 all tell the same story: Controlling for lags of consumption growth, the dynamic adjustment of consumption to an unpredictable change in wealth is largely contemporaneous, as shown by the response of consumption growth to a wealth shock in

Table 5
ONE-QUARTER-AHEAD FORECASTING PERFORMANCE OF THE VECTOR AUTOREGRESSION MODEL RELATIVE TO A UNIVARIATE MODEL

Forecasted Variable	1990:1-1997:4	1984:1-1986:4	1987:1-1989:4	1990:1-1993:4	1994:1-1997:4
Consumption growth (Δc_t)[a]	0.987	0.929	1.001	0.990	0.967
Income growth (Δy_t)[b]	1.019	1.056	0.970	0.997	1.097
Wealth growth (Δw_t)[c]	0.850	1.116	1.136	0.865	0.834

Source: Authors' calculations.

Notes: Δc_t denotes the log difference in real per capita nondurables and services consumption, excluding shoes and clothing; Δy_t denotes the log difference in real per capita after-tax labor income; Δw_t denotes the log difference in real per capita wealth. The table reports forecast evaluation statistics for predicting the variable named in the row. Each figure is the ratio of the root-mean-squared forecasting error for a univariate model relative to that of the vector autoregression (VAR); an entry of less than one indicates that the univariate model in the numerator has superior forecasting ability. Out-of-sample evaluation periods are identified in the column headings; the initial estimation period begins with the first quarter of 1953 and ends with the quarter immediately preceding the first quarter of the evaluation period.

[a] The VAR for $\Delta c_t, \Delta y_t, \Delta w_t$ is restricted (cointegration imposed); the univariate process for Δc_t is a first-order autoregressive process.

[b] The VAR for $\Delta c_t, \Delta y_t, \Delta w_t$ is restricted; the univariate process for Δy_t is a first-order autoregressive process.

[c] The VAR for $\Delta c_t, \Delta y_t, \Delta w_t$ is restricted; the univariate process for Δw_t is a first-order moving-average process.

Chart 4. Two implications of this finding are that lagged growth rates of wealth have virtually no marginal impact on current consumption growth in the restricted VAR and that a simple univariate process forecasts consumption growth as well as or better than a VAR specification, which includes wealth and labor income.

Conclusion

The question of how a large movement in financial wealth would affect consumer expenditure has become more pressing as fears rise that substantial market swings will cause consumer spending—and hence aggregate demand—to fluctuate sharply. In the extreme, some commentators have suggested that a prolonged downturn in stock prices could so depress consumer spending as to result in a recession (for example, see *Economist* [1998]).

How important is the stock market effect on consumption? Our results suggest that this question may be difficult to answer partly because the trend relationship linking consumption, wealth, and labor income exhibits some instability. An important objective for future research is to investigate formally the sources and precise timing of this instability in the long-run wealth effect. Nevertheless, using a reasonable estimate of the prevailing trend relationship between wealth and consumption, we also find that the answer to this question depends on whether one is asking about today or tomorrow. Movements in the stock market today appear to influence today's consumption growth, not tomorrow's. Thus, changes in wealth in this quarter do not portend significant changes in consumption one or more quarters later. When uncertainty about the trend and impact relationship is added to the difficulties associated with wealth-based forecasts of the next quarter's consumption growth, it appears that we have a way to go before we can make inferences about movements in consumption based on movements in the stock market.

Appendix A: Data

We provide a description of the data used in our empirical analysis.

Consumption

Consumption is measured as either total personal consumption expenditure or expenditure on nondurables and services, excluding shoes and clothing. The quarterly data are seasonally adjusted at annual rates, in billions of chain-weighted 1992 dollars. Our source is the U.S. Department of Commerce, Bureau of Economic Analysis.

After-Tax Labor Income

Labor income is defined as wages and salaries + transfer payments + other labor income - personal contributions for social insurance - taxes. Taxes are defined as [wages and salaries/ (wages and salaries + proprietors' income with IVA and Ccadj + rental income + personal dividends + personal interest income)] × personal tax and nontax payments, where IVA is inventory valuation and Ccadj is capital consumption adjustments. The quarterly data are in current dollars. Our source is the Bureau of Economic Analysis.

Population

A measure of population is created by dividing real total disposable income by real per capita disposable income. Our source is the Bureau of Economic Analysis.

Wealth

Total wealth is household net wealth in billions of current dollars. Stock market wealth includes direct household holdings, mutual fund holdings, holdings of private and public pension plans, personal trusts, and insurance companies. Our source is the Board of Governors of the Federal Reserve System.

Price Deflator

The nominal after-tax labor income and wealth data are deflated by the personal consumption expenditure chain-type price deflator (1992=100), seasonally adjusted. Our source is the Bureau of Economic Analysis.

APPENDIX B: TESTS FOR STOCHASTIC TRENDS

This appendix describes our procedures for testing for cointegration and the results of those tests. The results for log variables are presented; results for levels of variables are very similar and are available on request. We use two types of tests: residual-based tests (designed to distinguish a system without cointegration from a system with at least one cointegrating relationship), and tests for cointegrating rank (designed to estimate the number of cointegrating relationships).

The former requires that each individual variable pass a unit-root test and is conditional on this pretesting procedure. Table B1 presents Dickey-Fuller tests for the presence of a unit root in c, y, and w over several autoregressive structures. The procedure tests the null hypothesis of a unit root against the alternative hypothesis that the series is stationary around a trend. The test statistics fall within the 95 percent confidence region and are therefore consistent with the hypothesis of a unit root in those series.

Table B2 reports statistics corresponding to the Phillips and Ouliaris (1990) residual-based cointegration tests. These tests are designed to distinguish a system without cointegration from a system with at least one cointegrating relationship. The approach applies the augmented Dickey-Fuller unit-root test to the residuals of equation 2. Table B2 shows both the Dickey-Fuller t-statistic and the relevant 5 and 10 percent critical values.[17] The hypothesis of no cointegration is rejected at the 5 percent level by the augmented Dickey-Fuller test with one or two lags, but is not rejected by the test with three or four lags. We applied the data-dependent procedure suggested in Campbell and Perron (1991) for choosing the appropriate lag length in an augmented Dickey-Fuller test. This procedure suggested that the appropriate lag length was one, implying that test results favoring cointegration should be accepted.[18]

Next, we consider testing procedures suggested by Johansen (1988, 1991) that allow the researcher to estimate the number of cointegrating relationships. This procedure

Table B2
PHILLIPS-OULIARIS TESTS FOR COINTEGRATION USING LOGS

Dickey-Fuller t-Statistic				Critical Values	
Lag=1	Lag=2	Lag=3	Lag=4	5 Percent Level	10 Percent Level
-4.29	-4.20	-3.75	-3.59	-3.80	-3.52

Source: Authors' calculations.

Notes: The Dickey-Fuller test statistic has been applied to the fitted residuals from the cointegrating regression of consumption on labor income and wealth. Critical values assume trending series. We use the log of consumption for nondurables and services, excluding shoes and clothing, as the dependent variable.

Table B1
DICKEY-FULLER TESTS FOR UNIT ROOTS

	Dickey-Fuller t-Statistic				Critical Values	
	Lag=1	Lag=2	Lag=3	Lag=4	5 Percent Level	10 Percent Level
Log (total wealth[a])	-2.460	-3.067	-2.894	-3.100	3.44	3.14
Log (labor income[a])	-0.624	-0.794	-0.829	-0.810	3.44	3.14
Log (consumption, excluding shoes and clothing[a])	-0.363	-0.812	-0.944	-1.280	3.44	3.14

Source: Authors' calculations.

[a]Values are in real per capita terms. The model includes a time trend.

presumes a p-dimensional vector autoregressive model with k lags, where p corresponds to the number of stochastic variables among which the investigator wishes to test for cointegration. For our application, $p = 3$. The Johansen procedure provides two ways of checking for cointegration. First, under the null hypothesis, H_0, that there are exactly r cointegrating relationships, the "Trace" statistic supplies a likelihood ratio test of H_0 against the alternative, H_A, that there are p cointegrating relationships, where p is the total number of variables in the model. Second, an "L-max" statistic is formed to test the null hypothesis of r cointegrating relationships against the alternative of $r+1$ cointegrating relationships. Both of these tests for cointegration depend on the number of lags assumed in the vector error-correction structure. Table B3 presents the results obtained under a number of lag assumptions. The same effective sample (first-quarter 1954 to fourth-quarter 1997) was used to estimate the model under each lag assumption.

The critical values obtained using the Johansen approach also depend on the trend characteristics of the data. We present results for tests that allow for linear trends in the data, but we assume that the cointegrating relationship has only a constant. See Johansen (1988, 1991) for a more detailed discussion of these trend assumptions.[19] The table also reports the 90 percent critical values for these statistics.[20]

The Johansen "L-max" test results establish strong evidence of a single cointegrating relationship among the variables in equation 2. We can reject the null hypothesis of no cointegration in favor of a single cointegrating vector, and we cannot reject the null hypothesis of one cointegrating relationship against the alternative of two or three relationships across a range of trend and lag specifications. This result is also robust to every lag specification we consider. While the evidence in favor of cointegration is somewhat weaker according to the "Trace" statistic (for some of the lag specifications, we cannot reject the null of no cointegration against the alternative of three cointegrating relationships), we also cannot reject the null of one cointegrating relationship against the alternative of three.

Table B3
JOHANSEN COINTEGRATION TEST: I(1) ANALYSIS WITH A LINEAR TREND IN THE DATA AND A CONSTANT IN THE COINTEGRATING RELATIONSHIP

Lag in VAR model=1

L-max		Trace		
Test Statistic	90 Percent CV	Test Statistic	90 Percent CV	$H_0 = r$
19.25	13.39	26.38	26.70	0
6.14	10.60	7.13	13.31	1
0.99	2.71	0.99	2.71	2

Lag in VAR model=2

L-max		Trace		
Test Statistic	90 Percent CV	Test Statistic	90 Percent CV	$H_0 = r$
21.99	13.39	27.46	26.70	0
4.52	10.60	5.47	13.31	1
0.96	2.71	0.96	2.71	2

Lag in VAR model=3

L-max		Trace		
Test Statistic	90 Percent CV	Test Statistic	90 Percent CV	$H_0 = r$
16.68	13.39	22.03	26.70	0
4.55	10.60	5.35	13.31	1
0.81	2.71	0.81	2.71	2

Lag in VAR model=4

L-max		Trace		
Test Statistic	90 Percent CV	Test Statistic	90 Percent CV	$H_0 = r$
16.35	13.39	22.14	26.70	0
4.85	10.60	5.79	13.31	1
0.94	2.71	0.94	2.71	2

Source: Authors' calculations.

Notes: The sample period is first-quarter 1954 to fourth-quarter 1997. Endogenous variables are the log of total wealth, the log of labor income, and the log of nondurables and services, excluding shoes and clothing. The columns labeled "Test Statistic" give the test statistic for the corresponding test above; the columns labeled "90 Percent CV" give the 90 percent confidence level for the statistics.

ENDNOTES

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1. Tracy, Schneider, and Chan (1999) discuss changes in household balance sheets and the distribution of household stock holdings.

2. A good rule of thumb is that a one-point movement in the Dow Jones Industrial Average changes household sector wealth by $1 billion to $2 billion. The Dow gained 1,400 points from the beginning to the end of 1997, while the aggregate gain in household equity holdings during the year was about $2.5 trillion. The Dow's low in the period since mid-1997 was 7,161 and its high through early 1999 was above 10,000—a swing of more than 3,000 points. This swing would correspond to a change in household wealth of substantially more than $3.0 trillion.

3. Other, more recent applications of this type of estimation equation appear in Mosser (1992), Laurence H. Meyer & Associates (1994), and Poterba and Samwick (1995). Starr-McCluer (1998) examines the wealth effect using survey data.

4. Formal statistical tests of the year-to-year stability of this parameter have not been conducted. Nevertheless, the charted standard error bands give some indication of the size of the year-to-year changes relative to the statistical uncertainty of the parameter estimate.

5. Of course, this problem has been well understood for a very long time. For instance, Mishkin (1976, 1977) addressed it in a traditional life-cycle model.

6. See Galí (1990). Galí extends the infinite horizon version of the permanent income hypothesis to allow for finite horizons. Other works attempting to combine the traditional life-cycle/permanent income views with modern time-series econometrics are Blinder and Deaton (1985) and Campbell and Mankiw (1989).

7. Galí (1990) shows that ρ is a function of a constant discount rate, a constant probability of dying, and a constant rate of geometric decay in labor income growth over the lifetime.

8. Several papers have empirically tested and analyzed the permanent income hypothesis by using a single right-hand-side variable such as personal disposable income or gross national product (for example, Campbell [1987] and Cochrane [1994]). However, neither of these single measures is appropriate for our investigation because we want to estimate the marginal propensities to consume from assets and labor income separately.

9. Our empirical approach is also robust to the possibility that consumers may have more information than the econometrician. All of the expressions that contain expectations conditional on a specific information set can be left undefined in the error term, implying that we need not make any assumption about what information consumers have in implementing our empirical procedure.

10. There are other, more subtle differences: as we explain below, consumption is defined differently in the two specifications, and equation 1 assumes a first-order autocorrelation structure for the error term requiring nonlinear estimation, while equation 4 makes a nonparametric correction for generalized serial correlation. There is also a distinction between the overall income measure used in equation 1 and the labor income measure used in equation 4. See Modigliani and Tarantelli (1975), Modigliani and Steindel (1977), and Steindel (1977, 1981) for discussions of the conceptual issues involved in using a total income measure in a traditional life-cycle/permanent income consumption model including wealth.

11. Much of the traditional literature on the life cycle also drew the same distinction between durables spending and other consumer outlays. We used total spending in Table 1 because much of the recent discussion of the wealth effect focuses on the decline in the personal saving rate. Personal saving is the difference between disposable income and all consumer outlays, including durables.

12. The results are not sensitive to choosing different values for k.

13. Klitgaard (1999) uses a similar methodology to estimate the long-run and short-run relationships of Japanese export prices to the yen exchange rate. When interest rates are not fixed but instead are time-varying, an extension of the simple model presented above implies that the *ex ante* real interest rate should be included as an additional regressor in the consumption growth equation. As is now well known, however, expected real interest rates have little impact on consumption growth. The inclusion of estimates of real interest rates in our analysis did not alter our conclusions.

14. Campbell and Mankiw (1989) document a similar result for labor income: lagged growth in nondurables and services spending is a strong forecaster of disposable personal income growth.

15. The error-correction term does not enter significantly into the equation for income growth. This latter result is inconsistent with the theory presented above since the error-correction term (equal to u_t in equation 2) comprises expected future income increases. A close

Note 15 continued
examination of the labor income data reveals why: the measure of labor income we used includes transfers, the growth of which exhibits little persistence. The inclusion of transfers in labor income significantly decreases the persistence of labor income growth. Since this measure of labor income is largely unforecastable, it is uncorrelated with the lagged error-correction term. Results (not reported) show that when we use an alternate measure of labor income that excludes transfers, the error-correction term is a strong predictor of labor income growth, consistent with the theory. Nonetheless, our conclusions for consumption were not affected by our choice of labor income variable.

16. It is interesting to note that the response of wealth to its own innovation (not shown) suggests that the log of wealth is close to a random walk. This implies that the wealth shock to which consumption is responding may be viewed as a permanent increase in the level of wealth, or at least as having important permanent components.

17. Phillips and Ouliaris (1990) tabulate critical values for the augmented Dickey-Fuller *t*-test applied to residuals of a cointegrating equation with up to five variables.

18. An earlier version of this paper (Ludvigson and Steindel 1998) reported much less evidence in favor of cointegration because of an error in constructing the income data.

19. In choosing the appropriate trend model for our data, we were guided by both theoretical considerations and statistical criteria. Theoretical considerations implied that the long-run equilibrium relationship linking consumption, labor income, and wealth does not have deterministic trends (see equation 2), although each individual data series may have deterministic trends. Moreover, statistical criteria suggested that modeling a trend in the cointegrating relationship was not appropriate: the normalized cointegrating equation under this assumption did not correspond to any reasonable hypothesis about the long-run relationship among these variables. For example, with trends specified in the cointegrating relationship, the parameters of the cointegrating vector were often negative, an outcome at odds with any sensible model of consumer behavior.

20. The critical values are based on calculations made by Johansen and Nielsen (1993).

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Banks' Payments-Driven Revenues

Lawrence J. Radecki

Although banks' lending activities draw the attention of supervisors, lawmakers, researchers, and the press, a very substantial and growing portion of the industry's total revenue is received in the form of fee income. The amount of fee, or noninterest, income earned by the banking sector suggests that the significance of payments services has been understated or overlooked. A lack of good information about the payments area may partly explain the failure to gauge the size of this business line correctly. In reports to supervisory agencies, banking organizations provide data relating primarily to their safety and soundness. By the design of the reports, banks transmit information on profitability, capital, and the size and condition of the loan portfolio. Limited information can be extracted from regulatory reports on individual business lines; in fact, these reports imply that banks receive just 7 percent of their net revenue from payments services.

A narrow definition of payments, or transactions, services may also contribute to a poor appreciation of this banking function. While checking accounts are universally recognized as a payments service, credit cards, corporate trust accounts, and securities processing should also be treated as parts of a bank's payments business. The common but limited definition of the payments area reflects the tight focus of banking research on lending and deposit taking. In theoretical studies, economists explain the prominence of commercial banks in the financial sector in terms of these two functions. First, by developing their skills in screening applicants, monitoring borrowers, and obtaining repayment, commercial banks became the dominant lender to relatively small-sized borrowers. Second, because investors demand protection against the risk that they may need liquidity earlier than anticipated, bank deposits are a special and highly useful financial instrument. While insightful, neither rationale explains why

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commercial banks provide payments services on a large scale, or why they perform payments services together with deposit taking and information-intensive lending.[1]

The purpose of this article is to develop a clearer picture of the importance of payments services to the banking industry. This goal is served by taking a broad view of the payments business and analyzing information provided by large bank holding companies (BHCs) in their annual reports. BHCs have made concerted efforts to improve their financial disclosures. They now furnish material on sources of noninterest income and the amounts earned that is much more detailed than the information filed in regular reports to supervisors. This information is used to estimate the size of the payments area.

In the first section of the article, we clarify our definition of the payments area. In the second section, we review aggregate data on noninterest revenue. We also examine the categories of noninterest income used in supervisory reporting to better understand what each category captures. In the third section, we classify and measure sources of payments-driven revenue. Information appearing in the annual reports of BHCs is employed to estimate the amounts that payments services contribute to the industry's revenue stream. Our estimates show that aggregate payments-driven revenue is considerably larger than commonly appreciated and that the production and distribution of payments services form one of the core activities of commercial banking. In the last section, we explore how the greater than expected importance of payments services might affect the identification and measurement of the banking sector's output and theories of the fundamental nature of commercial banking.

Definition of Payments Services

In order to analyze banks' sources of revenue and to establish the importance of revenue derived from transactions services, we take a broad view of the payments business. At its core are those services that everyone is most familiar with: the safekeeping, administering, reporting on, and transferring of money held in a deposit account. It should be emphasized that this definition implies that all of the customer support and transfer capabilities furnished to a transactions account owner are considered part of the service. In other words, payments services involve many more bank activities than just the actual transfer of currency or federal funds to execute a Fedwire instruction, to clear and settle a personal check, or to meet a cash withdrawal at the teller window. In the future, the definition of payments services will probably need to be expanded to include new systems that are currently under development or going through market tests. These new systems include multipurpose stored-value cards and electronic forms of currency and checks for use over the Internet.

Also considered to be in the payments area are transactions services performed outside a deposit account relationship. These payments services fall into two basic categories: securities-handling and credit cards. Banks furnish a set of securities handling services to their corporate and institutional customers, including pension funds, mutual funds, and endowments. These services involve safekeeping, administering, and reporting on financial and real assets held in a trust department account and transferring ownership and settling trades of such assets. Additional services are performed on behalf of an issuer of debt or equity securities. Because of the essential similarities to deposit account services, we consider these trust department services as part of the payments business. Likewise, because of the essential similarities to payments initiated electronically from a deposit account, credit card transactions must be counted among the payments services that banks perform for retail customers. In effect, we include in payments services the transfer of money held in a deposit account, the transfer of money and assets held in a custodial account, and the transfer of money in accord with the terms of a credit agreement.

Payments Services versus Liquidity Services

Setting the boundaries of the payments area broadly requires that we make a clear distinction between liquidity services and payments services. Because liquidity and payments services are related and complementary, for the most part people do not think of them as separate services. In order to distinguish payments from liquidity services, we compare a short-term time deposit with a transaction account, which is any deposit account featuring check

writing or other capabilities to move funds deposited in the account. To highlight the difference between these two types of deposits, we employ a standard definition of liquidity: the ability to convert an asset into the medium of exchange speedily, with little uncertainty of value and with low transaction costs, even if the dollar amount involved is relatively small.

By this definition, a small-denomination time deposit with a very short maturity (as short as seven days) provides a retail customer with near-perfect liquidity. This bank deposit can be converted into currency with no uncertainty of value and no transaction fee assessed to the customer. If the depositor cannot wait until maturity, the withdrawal can be made immediately by incurring a negligible interest penalty. Because a bank incurs costs by producing liabilities with near-perfect liquidity, a customer normally earns an interest rate somewhat below wholesale money market interest rates (for example, the one-month Treasury bill rate). While liquidity is an extremely desirable feature of an asset, producing liquidity in today's highly advanced U.S. financial system is not that costly. Judging by the expense ratio of a general-purpose money market mutual fund, it costs a financial intermediary about 30 basis points (net of regulatory burden) to create liabilities of near-perfect liquidity out of various short-term wholesale financial instruments—the "raw material" out of which shares in a money fund are produced.

Payments services involve many more bank activities than just the actual transfer of currency or federal funds to execute a Fedwire instruction, to clear and settle a personal check, or to meet a cash withdrawal at the teller window.

What distinguishes a deposit in a transactions account from a short-term time deposit is payment capabilities. A deposit in a transaction account is indeed more liquid than a seven-day or one-month time deposit, but the difference is slight—there is little gain with regard to certainty of value, transaction cost, or conversion speed. The notable feature of a transaction account is the array of methods that a customer can employ to move funds into or out of the account. These transactions can be conducted in many different ways: by using personnel at a branch office, by writing a personal check, by initiating a transaction electronically from a remote location, or by preauthorizing a debit or credit by a third party. In other words, banks provide an account owner with the means to conduct transactions virtually anywhere at any time. Deposits and transfers can even be made automatically.

While banks have worked hard to execute transactions efficiently and have employed sophisticated equipment extensively, payments services continue to be costly to produce. Consider the average cost of a transaction (or service request related to a transaction account) reported by banks: at the automated teller machine (ATM), $0.27; by telephone, $0.54; and with the help of branch personnel, $1.07. By contrast, the customary practice among banks is to waive explicit account maintenance and activity fees if a customer meets a minimum balance requirement. This pricing policy fosters a perception that payments services are inexpensive to produce.

Liquidity and Convenience

Because of the complementary nature of liquidity and payments services, it could be argued that these two bank services cannot be distinguished conceptually. And if separating payments features from liquidity is problematic, developing an estimate of banks' payments-related revenues—the main purpose of this article—may not be feasible. According to this way of thinking, a better approach to analyzing the revenues generated by banks' business lines would be to focus only on the provision of liquidity services, broadly defined to encompass accessibility to deposited funds. Under this approach, the liquidity of a particular type of deposit is a function not only of its certainty of value, the cost of converting the deposit into the medium of exchange, and the speed of converting, but also of the convenience provided to the account holder.

Applying this definition, we see that the various types of accounts fall along a spectrum of liquidity. For example, three-month time deposits are more liquid than one-year time deposits because of shorter maturity. And a transaction account is more liquid than a time account because a checkable deposit is more readily available to the account owner: funds on deposit can be conveniently accessed by writing a check, by using an ATM, or by paying at the point of sale with a debit card. But if convenience augments liquidity in this way, payment capabilities are precisely what give a transaction account additional liquidity. Thus, payments services are distinguishable from credit services, and the remaining issue is whether to recognize payments services as a component of liquidity services or as a separate service.

Data Sources

Our starting point for assessing the importance of the payments business is information on noninterest income conveyed through regulatory reporting. The supervisory agencies collect data from BHCs through Consolidated Financial Statements for Bank Holding Companies (FR Y-9C), which are filed quarterly with the Federal Reserve System. According to these reports, the twenty-five largest BHCs earned a combined total of $62.4 billion of noninterest income in 1996. (See the appendix for a list of the top twenty-five bank holding companies.[2])

Besides reporting the total amount earned, a BHC records the composition of its noninterest income by following a schedule of six categories:[3]

1. Service charges on deposit accounts in domestic offices
2. Income from fiduciary (trust department) activities
3. Trading revenue
4. Net gains from foreign currency transactions conducted outside the trading account
5. Other fee income
6. All other noninterest income.[4]

For the twenty-five largest BHCs, Table 1 shows the breakdown of noninterest income for these six components. Out of total noninterest income, only $9.5 billion was collected from fees on deposit accounts in domestic offices. At first glance, it appears that the largest BHCs derive just 15.3 percent of noninterest income—and a mere 6.8 percent of operating revenue (the sum of net interest income and noninterest income, less loan loss provisions)—from payments services. On closer inspection, however, we find that the amount recorded in the first category understates payment-related revenues.

Table 1
COMPOSITION OF OPERATING REVENUE FOR THE TWENTY-FIVE LARGEST BANK HOLDING COMPANIES DURING 1996

Category of Income	Combined Totals (Billions of Dollars)	Combined Totals as a Percentage of Operating Revenue	Combined Totals as a Percentage of Assets
Total noninterest income	62.4	44.5	2.32
Service charges on deposit accounts (in domestic offices)	9.5 (15.3 percent of total noninterest income)	6.8	0.36
Income from fiduciary activities	10.2	7.3	0.38
Trading revenue	7.9	5.6	0.30
Other foreign currency gains	-0.08	-0.06	-0.003
Other fee income	23.8	17.0	0.89
All other noninterest income	10.9	7.8	0.41
Gross interest earned	181.2	129.3	6.75
Gross interest paid	94.2	67.2	3.51
Net interest income: gross interest earned - gross interest paid	87.0	62.0	3.24
Provisions for loan losses	9.2	6.5	0.34
Net-net interest income: net interest income - provisions for loan losses	77.8	55.5	2.90
Operating revenue: total noninterest income + net-net interest income	140.2	100.0	5.22
Memo: Total assets	2,686.0	—	—

Source: Consolidated Financial Statements for Bank Holding Companies.

Additional Revenue from Payments Services

According to the instructions to the filers of the Y-9C report, "deposit account fees" captures only those maintenance and activity fees that a bank collects directly from an owner of a deposit account at the same bank. But a bank can receive remuneration for payments services in ways that cause the associated revenues to appear in other categories of income:

- *Some fees triggered by deposit account activity are not reported in the category "deposit account fees."* Although banks are correctly following the instructions for filling out the schedule for noninterest income, some activity fees wind up in the "other fee" category. Such "misclassifications" can occur when someone other than the account holder actually pays the activity fee or when an institution other than the one providing the customer's deposit account collects the activity fee.

- *Some payments services are performed outside a deposit account relationship.* Some payments services are linked to a credit card account or a trust account instead of a deposit account; or, in some cases, the payments service is separate from any account held at the bank. Thus, banks do not report these revenues as deposit account fees.

- *Compensation for payments services takes the form of net interest income instead of noninterest income.* Banks receive a portion of their payments-related revenue as foregone interest on deposits or extra interest on loans, rather than as a fee, commission, or other charge to the customer. This revenue would never appear on a schedule reporting noninterest income.

In sum, the figures collected quarterly for revenue earned through fees on deposit accounts are potentially misleading. On the surface, the schedule for noninterest income developed by supervisory agencies implies that this category represents the bulk of payments-driven revenue. But the Y-9C report delineates this category too narrowly to capture all noninterest income earned from payments services, and by definition it does not capture remuneration in the form of interest income.

Bank Holding Company Annual Reports

To measure the amount of payments-driven revenue earned by the largest BHCs, we rely on information disclosed in their annual reports. During the past several years, BHCs have taken significant steps to improve their financial disclosures.[5] Their efforts have been made in concert with initiatives by the Securities and Exchange Commission, the Financial Accounting Standards Board, the Federal Reserve System, and other entities, both public and private, to promote advances in accounting, reporting, and disclosure practices. Consequently, BHCs are providing more meaningful information on sources of noninterest revenue as well as off-balance-sheet activities, risk measurement and management methods, and results by line of business.

Particularly valuable to this study is detailed information on the business activities that bring in noninterest income and the amounts earned. For example, the BankAmerica Corporation shows figures on twenty categories of noninterest income in its annual report and thereby names

Table 2
Disclosure of Sources of Noninterest Income: BankAmerica Corporation

Category of Noninterest Income	Amount Earned in 1996 (Millions of Dollars)
Deposit account fees	
Retail	1,057
Commercial	342
Credit card fees	
Membership	29
Other	326
Trust fees	
Corporate and employee benefit	18
Personal and other	211
Other fees and commissions	
Loan fees and charges	336
Income from credit card securitizations	28
Off-balance-sheet credit-related instrument fees	345
Financial services fees	216
Mutual fund and annuity commissions	100
Other	358
Trading income	
Interest rate exposures	56
Foreign exchange exposures	316
Debt instruments	258
Other noninterest income	
Venture capital activities	427
Net gain on sale of loans, premises, and equipment, and certain other assets	197
Net gain on sale of subsidiaries and operations	180
Gain on issuance of subsidiary's stock	147
Other	404
Total noninterest income as defined in the Y-9C report	5,351
Memo:	
Net gain on available-for-sale securities	61
Total noninterest income as shown in the annual report	5,412

Source: BankAmerica Corporation, *1996 Annual Report*.

a source for 86 percent of its total noninterest income of $5.4 billion (Table 2). Similarly, the Chase Manhattan Corporation shows figures for twenty-one categories and names a source for 88 percent of its $7.5 billion of noninterest income (Table 3). Both firms supplement quantitative disclosures with definitions and other qualitative information. The combination of data and supporting material makes it possible to estimate the amounts of payments-related revenue included in the categories "fiduciary fees," "other fee income," and "all other noninterest income."[6]

In preparing a disclosure, each BHC chooses categories that correspond to its main sources of noninterest income. In addition, each BHC exercises its own judgment to determine the types of information and level of detail that would help shareholders, analysts, and others interested in understanding the performance of the company and its strategy. Because each BHC has a different mix of business lines and makes an independent judgment regarding what is genuinely useful, the formats of the disclosures are not uniform across BHCs. Consequently, disclosures of noninterest income are not strictly comparable across the industry, which introduces some additional imprecision to our estimates.

Furthermore, because each BHC is free to set its own income categories, we encounter an additional complication. The categories of noninterest income appearing in an annual report do not necessarily bear a direct correspondence to categories defined by the Y-9C report. In several cases, a category used by a BHC spans more than one category in the Y-9C report. Nevertheless, we believe that sufficient information can be extracted from annual reports to serve the purpose of this study.

Table 3
DISCLOSURE OF SOURCES OF NONINTEREST INCOME: CHASE MANHATTAN CORPORATION

Category of Noninterest Income	Amount Earned in 1996 (Millions of Dollars)
Corporate finance and syndication fees	929
Trust, custody, and investment management fees	909
Mutual fund fees	83
Other trust fees	184
Credit card revenue	
Securitized receivables	318
All other	745
Service charges on deposit accounts	394
Fees for other financial services	
Commissions on letters of credit and acceptances	330
Fees in lieu of compensating balances	295
Mortgage servicing fees	204
Loan commitment fees	120
Other fees	580
Trading income	
Interest rate contracts	535
Foreign exchange contracts	444
Debt instruments and other	994
Net interest income impact	-703
Other noninterest income	
Gains from equity-related investments	726
Net losses on emerging market securities sales	-80
Residential mortgage origination/sales activities	63
Loss on sale of a building in Japan	-60
Credit card securitizations	23
All other revenue	344
Total noninterest income as defined in the Y-9C report	7,377
Memo:	
Securities gains	135
Total noninterest income as shown in the annual report	7,512

Source: Chase Manhattan Corporation, *1996 Annual Report*.

ESTIMATING THE VOLUME OF PAYMENTS-DRIVEN REVENUES

In this section, sources of payments-driven revenues are examined in the order outlined above. First, we estimate misclassified deposit account activity fees and fees for payments services performed outside of a deposit account relationship. We then measure interest income earned as compensation for payments services. For some types of payments services, the amount of revenue received is determined directly from the annual reports by adding up figures shown for a specific category of noninterest income. For other types, the amount earned is estimated by taking information on a subset of the twenty-five BHCs and extrapolating a combined total for the group.

DEPOSIT ACCOUNT FEES PLACED IN THE "OTHER FEE" CATEGORY

The figure reported for "deposit account fees" does not capture all the revenue that a bank receives in the form of account maintenance and activity fees. In addition to those fees that a bank collects directly from its own deposit account customers, a bank charges fees for transactions initiated by customers of other banks or from the receivers of payments. Examples of these sources of fee income include the following:

- *Interchange and merchant discount fees generated by use of an off-line debit card.* A card-issuing bank collects an interchange fee from a merchant rather than the customer who initiates the transaction. In addition, the bank handling, or "acquiring," a debit-card transaction on behalf of a merchant collects a discount fee from the merchant.

- *ATM interchange fees and point-of-sale (POS) interchange and acquirer fees.* When a bank's ATM is used by a deposit account customer of another bank, the owner collects an interchange fee from the card-issuing bank. Similarly, when a bank's POS device is used by a deposit account customer of another bank, the owner collects both an interchange fee and a merchant's fee for handling the transaction.[7]

- *ATM surcharge fees.* These fees are imposed on ATM users who are deposit account holders at another bank.[8]

Although all large banks with retail operations collect revenue from ATM and POS transactions, information on this type of noninterest income is relatively sparse in annual reports. Only six of the twenty-three banks with substantial retail operations identify a specific amount of revenue brought in by debit/ATM card transactions or electronic banking. Although several other banks cite a rise in electronic banking fees to explain an increase in noninterest income from the previous year, they simply record the revenue in the residual subcategory "other fee income." For the BHCs that do disclose a specific figure, these fees are on average equal to 28 percent of deposit account fees. To approximate what the twenty-three BHCs earn in aggregate from electronic banking, we assume that the other seventeen BHCs earn proportional amounts of revenue from fees for electronic banking services. Therefore, we estimate that during 1996, these fees amounted to $2.6 billion, a healthy supplement to the $9.5 billion of deposit account fees. This estimate, however, could be biased if only those banks that earn a disproportionate share of noninterest income from electronic banking fees reveal the amount. Taking this effect into account, we arrive at a conservative estimate of electronic banking revenue of $1 billion, a figure that is based on the smallest amount earned among the six banks reporting a figure for electronic banking fees.

There are two reasons to believe that the actual amount earned is even higher than the seemingly generous $2.6 billion figure indicated above. First, the figure is not based predominantly on information from the more retail-oriented banks. Second, banks may not be forthcoming about this source of revenue because they do not want to draw attention to the amount they charge customers for electronic banking. The industry has been criticized for setting what are thought to be excessively high fees for basic banking services and for electronic access. The public finds ATM surcharges to be especially irksome because the installation of ATMs is supposed to cut operating expenses and allow banks to lower, not raise, deposit account fees.

Credit Card Fees

As argued earlier, transactions executed through credit cards must be included among the payments services performed for retail customers. But the dual nature of a bank-issued general-purpose credit card—which combines a source of credit with a means of payment—makes it difficult to isolate the revenue earned specifically for transaction services. Nevertheless, we feel we can separate the revenues covering the cost of payments services from the revenues covering the cost of credit.

A credit card essentially combines a charge card, where the balance must be paid in full monthly, and a revolving line of credit.[9] Keeping in mind the distinction between these two types of card services, we conclude that nearly all of the noninterest revenue generated by credit cards can be attributed to their use as a payment device rather than to their use as a line of credit. In other words, noninterest revenue brought in by credit cards would still flow to banks if the cards were transformed into charge cards and a customer made separate arrangements to secure a revolving line of credit. We estimate credit card revenues under this assumption.

The noninterest revenue derived from the use of credit cards is recorded in the category "other fees" and takes several forms:

- *Fees for handling transactions on behalf of merchants.* A bank charges a merchant for obtaining payment from a card issuer and transferring funds into a deposit account designated by the merchant.

- *Fees for handling transactions on behalf of cardholders.* A card-issuing bank receives an interchange fee for settling a transaction with a merchant, extending credit to a cardholder during the grace period, and supporting a cardholder's account.[10]
- *Fees for late payments, for exceeding the account's limit, and for annual account maintenance.* A card-issuing bank collects these fees from cardholders.

A card-issuing bank may also earn fee income for servicing securitized credit card receivables (see the section "Interest Income Earned in Return for Payments Services").

Among the twenty-five largest BHCs, twenty-two report an amount for credit card receivables outstanding.[11] These loans, which appear on a bank's balance sheet, totaled $101.6 billion for 1996. A larger amount, $156.1 billion, is reported for the group's combined managed credit card receivables and includes securitized receivables. Eighteen BHCs out of the twenty-two showing credit card loans disclose an amount of noninterest revenue that comes specifically from credit cards. In four cases, however, the figure includes an amount for servicing securitized receivables that cannot be broken out.

We will work with data on credit card fees provided by the fourteen BHCs that either do not securitize any of their receivables or exclude revenue earned by servicing their securitized receivables. In 1996, these fourteen BHCs held $62.6 billion of credit card receivables on their balance sheets and securitized an additional $25.8 billion of receivables. Together, they earned $3.1 billion of fee income, or 3.46 percent of total managed receivables. By applying this percentage to the total volume of managed credit card receivables held by all twenty-five BHCs, we estimate that the group earned $5.4 billion from credit card fees, more than half as much as the $9.5 billion earned through fees on deposit accounts. To judge the sensitivity of this point estimate, we focus on just the largest issuers, whose disclosures on credit card revenues are clearer and more detailed. For each of these banks, revenue from credit card fees falls in the range of 3 to 4 1/2 percent of receivables. According to these figures, the combined revenue earned from credit card fees is likely to be in the range of $4.7 billion to $7.0 billion.[12] This estimate suggests that fees collected on credit card transactions generously supplement deposit account fees.

Fee Income for Securities Handling and Other Processing Services

The securities-handling services performed by a bank's trust department can be classified as follows:[13]

1. *Master trust and custody:* acting as custodian or safekeeper, recordkeeper, and administrator (involving disbursements, tax payments, and accounting services) of securities and other assets and providing trade execution, settlement, cash management, foreign exchange execution, and information services (including investment performance measurement and customized reporting) for private pension plans, public pension plans, and institutional trust funds.
2. *Global custody:* acting as custodian for foreign assets, a role that requires multicurrency reporting, accounting, and cash management.
3. *Corporate trust:* acting as trustee, fiscal agent, paying agent, registrar, and defeasance escrow agent for the issuer of bonds, commercial paper, or other debt instruments.
4. *Stock transfer:* acting as transfer agent and dividend-paying agent for an equity issuer. Mutual fund services are a type of stock transfer service.

In addition to securities processing, BHCs provide wholesale or institutional customers, including depository institutions, with other processing services through subsidiaries. These services include the processing of checks; airline coupons; remittances with their accompanying documents; and ATM, POS, and credit card transactions.

Nineteen BHCs in the group state an amount of noninterest income earned by handling securities and performing related services. (The others may earn some revenue this way but do not disclose an amount.) Eight BHCs specialize in wholesale payments services, produce them on a large scale, and earn more from these services than they do from deposit account fees. For the nineteen BHCs, this business line brings in $6.5 billion of

noninterest revenue, almost three-quarters the amount of revenue from deposit account fees.

Interest Income Earned in Return for Payments Services

An estimate that takes only noninterest income into account understates the total amount of revenue brought in by payments services. An important component of *net interest* income is compensation for payments services, rather than for intermediation services. Depositors compensate banks by foregoing interest on their balances in addition to paying explicit account maintenance and activity fees. In fact, one banking company carefully acknowledges implicit interest as compensation for payments services in a recent annual report:

> Service charges on deposit accounts, paid in fees, decreased $0.7 million, or 0.3%, [to $243.7 million] in 1996, compared to an increase of $4.6 million, or 1.9%, in 1995. After adding the value of service charges paid through the maintenance of deposit balances by commercial and correspondent customers, which is included in net interest income, total service charge compensation for 1996 was $470.4 million, up $19.6 million, or 4.4%, from 1995 reflecting growth in transaction volume.[14]

Customers earn no interest on demand deposits and earn below-market rates on deposits in negotiable order of withdrawal (NOW), savings, and money market accounts. Interest revenue substitutes for higher explicit fees. In an analogous way, credit card customers compensate banks for transaction services by paying interest on their balances that is above the cost of just the loan. Again, interest revenue substitutes for explicit maintenance and activity fees. Therefore, to construct a comprehensive figure for the contribution of payments services to operating revenue, the amount of net interest revenue generated by payments services must be broken out of total net interest income.[15]

To estimate foregone interest on deposit accounts, we first assume that deposits in all accounts with payment capabilities, primarily check-writing privileges and immediate remote withdrawal or transfer, implicitly earn the federal funds rate. We also assume that the sum of foregone interest and explicit fees equals all maintenance and activity costs incurred by a bank. Under these assumptions, the twenty-five BHCs earned $15.5 billion of foregone interest on $295.5 billion of demand deposits and $13.3 billion of foregone interest on deposits of $502.6 billion in NOW, money market, and conventional savings accounts. (Because some owners may make limited use of the transaction capabilities of their savings accounts, the estimate of $13.3 billion foregone interest may overstate this subcomponent of payments-driven revenue.) By comparison, the $28.8 billion of interest foregone is almost three times as large as the fees collected on deposit accounts.[16]

To construct a comprehensive figure for the contribution of payments services to operating revenue, the amount of net interest revenue generated by payments services must be broken out of total net interest income.

Foregone interest from deposit accounts may seem extraordinarily large, but this revenue must cover the sizable expenses of running a bank's branch network, whose primary purpose today is to handle the transaction needs of household and small business customers. In analyzing banks' retail operations, industry sources estimate that a large BHC bears annual noninterest expenses at a typical branch on the order of $1.0 million to $1.5 million. Half of these expenses are incurred at the branch itself and half at headquarters and centralized operating facilities. If a branch holds $50 million of retail deposits, the implied noninterest expense ratio is 2 to 3 percent of deposits. Some expenses are recovered by collecting fees on deposit accounts and for ancillary services offered at the branch office and by processing information for certain personal and small business loans. The remainder must be recovered through foregone interest. Because demand deposits earn no explicit interest, these deposits earn a high rate of foregone interest (equal to

the federal funds rate, which averaged more than 5.00 percent during 1996); however, they also have high maintenance and activity expenses. Although savings, money market, and NOW accounts have lower maintenance and activity costs, they bring in less foregone interest per dollar of deposit because some interest is paid on the balances held in each of these accounts.

Credit Cards

As noted above, foregone interest earned on deposits is calculated by applying a market-based interest rate uniformly to all core deposits. A parallel calculation to determine the extra interest revenue collected from credit card holders cannot be carried out for two reasons. First, no readily observable consumer loan rate is available to serve as a benchmark. Second, a benchmark rate would vary across households because some borrowers are much better credit risks than others.

We use a substitute method to estimate the amount of extra interest paid on credit card balances. This method relies on information on revenue earned for servicing securitized credit card receivables. In a securitization, most of the interest paid by cardholders passes to the owner of the security, who funds the loans and bears the credit risk. A smaller portion of the interest paid by cardholders is retained by the card-issuing bank. The card issuer's revenue from securitized receivables is used to estimate the extra interest paid for payments services rendered through the card. In other words, the retained portion of interest paid is, in theory, the amount the cardholders would be assessed in explicit activity fees and maintenance charges on their accounts if interest were not used instead.[17]

Ten of the twenty-two BHCs offering credit card accounts securitized part of their receivables. Six of these ten disclose detailed information on the volumes of their securitization programs and on the impact of the programs on net interest income, provisions for loan losses, and noninterest revenue.[18] On average, securitization reduces net interest income by an amount equal to 8.33 percent of the dollar volume securitized. More than half this reduction, 5.50 percent of the dollar volume securitized, reflects provisioning for loan losses. The card issuer pockets the remainder (plus a small residual) of 3.05 percent and records it as noninterest income. This percentage serves as our estimate of extra interest paid on all credit card receivables. Applying the estimate of 3.05 percent to the entire $156.1 billion of managed credit card receivables implies that the group of twenty-five BHCs collected $4.8 billion of extra interest from cardholders as compensation for payments services. Among the banks with the clearest disclosures on the effects of their securitization programs, the extra interest earned from credit cards is in the range of 2.6 to 3.2 percent of receivables. This estimate indicates that the extra interest earned by the group is likely to be between $4 billion and $5.0 billion.

By adding up all the pieces of revenue identified . . . we find that payments services contribute as much as $59.2 billion, or 42.2 percent, to the combined operating revenue of $140.2 billion earned by the twenty-five largest BHCs.

Because extra interest paid on credit card balances is determined from a residual, our estimate probably captures more than just the interest paid to cover the costs of performing payments services. The residual may pick up excess profits from credit card operations, an implicit charge for the unused portion of a cardholder's credit line, the cost of maintaining a loan account, and compensation for any residual credit risk retained by a card issuer. For this reason, it is proper to consider the estimate of $4 billion to $5.0 billion as the upper bound of extra interest paid by cardholders.

Summing Up

By adding up all the pieces of revenue identified above, we find that payments services contribute as much as $59.2 billion, or 42.2 percent, to the combined operating revenue of $140.2 billion earned by the twenty-five largest BHCs (Table 4). Payments services bring in $21.7 billion

to $25.6 billion in the form of fee income, which is roughly one-third to two-fifths of the group's combined noninterest income. A larger amount, between $28.8 billion and $33.6 billion, is received as interest revenue, accounting for about 40 percent of the group's combined net-net interest income. Among categories of payments services, deposit accounts yield the most revenue, about $40 billion, although only about $11 billion comes from service charges. Credit cards bring in between $4.7 billion and $11.8 billion, and securities handling and other processing services yield another $6.5 billion.[19]

The very substantial amount of revenue derived from payments services indicates that the production and distribution of these services constitute one of the main business activities of commercial banks. The size of payments-related income also implies that lending contributes less revenue to banks than is commonly believed. The income from payments services together with fee income from other noncredit services—including insurance, securities underwriting, brokerage, advisory services, equity investments, and portfolio management—may account for half or more of combined operating revenues. Income earned by extending credit probably makes up the single largest share of operating revenue, but it is clearly an oversimplification to characterize banking organizations as financial institutions that take in deposits in order to make loans.

The significance of payments-driven revenue helps explain the intense intra-industry and inter-industry competition that has broken out in the payments area. Large banks are working hard to promote electronic payments media despite projections of slow consumer acceptance and the uncertainty of cost effectiveness. The objective appears to be to take business away from competitors as well as to create new demand for transaction services. Furthermore, efforts to develop new payments systems are not only an offensive maneuver but also a defensive stratagem. The payments business has attracted the attention of firms outside the industry, in particular, technology firms committed to building new electronic systems.[20] Banks are fighting to hold on to their position in the payments area and to keep nonfinancial firms from encroaching on this essential business line.

Table 4
SOURCES OF OPERATING INCOME DERIVED FROM PAYMENTS SERVICES OF THE TWENTY-FIVE LARGEST BANK HOLDING COMPANIES

Category	Estimates of Revenue Earned	Comment
Fees on deposit accounts	$9.5 billion	Fees recorded in the Y-9C reports.
Interest foregone by deposit account holders	$28.8 billion	We arrive at this estimate by imputing foregone interest of $15.5 billion from demand deposits and $13.3 billion from NOW, savings, and money market accounts.
Fees on deposit accounts recorded in "other fees"	$1.0 billion to $2.6 billion	The estimate is based on the amounts disclosed in the annual reports of six of the twenty-three BHCs with retail operations.
Securities handling and processing fees	$6.5 billion	The estimate is the sum of amounts disclosed in annual reports by nineteen BHCs.
Credit card fees	$4.7 billion to $7.0 billion	The estimate is based on the amounts disclosed in annual reports of fourteen of the twenty-three BHCs that make credit card loans; the estimate excludes securitization revenue.
Extra interest paid by credit card holders	Up to $4.8 billion	The estimate is based on the amounts disclosed by six BHCs on revenue earned from the securitization of credit card receivables.
Total	$50.5 billion to $59.2 billion	The estimate suggests that 36.0 to 42.2 percent of operating revenue comes from payments services.
Memo:		
Amount of payments-related revenue earned in the form of:		
Noninterest income	$21.7 billion to $25.6 billion	The estimate suggests that 34.8 percent to 41.0 percent of total noninterest income comes from payments services.
Net interest income	$28.8 billion to $33.6 billion	The estimate suggests that 37.0 percent to 43.2 percent of total net-net interest income comes from payments services.
Amount of payments-related revenue earned from:		
Deposit accounts	$39.3 billion to $40.9 billion	
Securities handling	$6.5 billion	
Credit cards	$4.7 billion to $11.8 billion	

Source: Author's calculations.

IMPLICATIONS

Surveys of research on financial intermediation highlight many interesting but unresolved issues. This article's findings on the amount of revenue derived from payments services point to three topics that deserve a closer look: 1) the specification and measurement of bank output, 2) the contribution of off-balance-sheet activities to bank output and operating revenue, and 3) characteristics that distinguish commercial banks from other financial intermediaries.

MEASUREMENT OF BANKING OUTPUT

Commercial banking is a service industry for which it is especially difficult to identify and measure output. One approach researchers take to this problem is to stress a bank's role as an intermediary between borrowers and savers and to measure output by the dollar volume of loans or assets recorded on the balance sheet. Deposits are treated as an input. An intermediation approach is appealing because of its simplicity, but such an approach is not in keeping with the main findings of this article. The vital contribution made by payments services signifies that this approach to banking is too narrow, at least for the group of institutions studied here.

Some researchers have taken a value-added approach, which in principle treats both asset and liability categories as outputs. This flexibility leads to a better theoretical model of a banking firm because payments services can be recognized as outputs. A value-added approach, however, may still be inadequate when put in practice. Researchers generally conduct econometric studies by forming a short list of outputs—for example, demand deposits, savings and small time deposits, real estate loans, commercial and industrial loans, and consumer installment loans. Implicit in this specification is the restriction that payments services are supplied in proportion to the volume of core deposits. This constraint makes the value-added model too limiting, given the heterogeneity in both the amount and mix of payments services produced by the top twenty-five BHCs.

The variation in payments-driven revenue across individual banks is illustrated in Table 5. The top twenty-five banking organizations in the table are ranked not by size but by share of operating revenue contributed by the payments business. The bank that is most dependent on the payments business earns three-quarters of its operating revenue from this business line. The magnitude of payments-driven revenue at this bank reflects its specialization in both credit cards and securities processing. Several other banks among the top twenty-five also earn more than 10 percent of their operating revenue from either credit cards or securities processing. The outputs generating these revenues are not highly correlated with the dollar volume of any asset or liability reported on the balance sheet. Nor will these outputs be correlated with figures for categories of off-balance-sheet instruments. Consequently, a value-added approach remains problematic even if more balance-sheet items or instrument categories are specified.

Against this background, studies of productivity, economies of scale and scope, and the effects of consolidation and technological change appear less reliable than

Table 5
SOURCES OF PAYMENTS-DRIVEN REVENUES ACROSS BANK HOLDING COMPANIES

Top Twenty-Five BHCs Ranked by Share of Payments-Driven Revenues	Payments-Driven Revenue	Deposit Account Revenue	Credit Card Revenue	Securities Processing Revenue	Operating Revenue (Billions of Dollars)
	As a Percentage of Operating Revenue				
1	74.9	39.1	10.4	25.4	3.4
2	58.3	33.5	22.0	2.8	5.2
3	56.1	40.2	3.6	12.3	3.0
4	54.9	40.4	14.5	—	2.2
5	49.6	44.7	4.8	0.1	6.7
6	49.0	39.5	3.7	5.8	2.8
7	47.6	34.7	12.9	—	6.2
8	47.4	43.3	4.1	—	2.5
9	46.8	40.2	5.9	0.7	9.4
10	46.1	31.8	6.7	7.6	2.6
11	44.4	21.0	10.4	13.0	14. 8
12	44.0	29.1	4.4	10.6	3.3
13	43.5	41.0	2.5	—	2.5
14	43.4	37.4	6.0	—	6.9
15	42.5	37.9	3.9	0.7	5.3
16	42.4	37.8	4.4	0.1	13.6
17	39.7	37.5	1.7	0.5	2.3
18	37.6	32.6	2.0	3.1	3.8
19	37.0	32.3	3.1	1.6	3.8
20	33.9	12.6	15.3	6.0	18.3
21	33.0	29.9	2.6	0.6	3.6
22	29.3	26.4	1.7	1.2	5.9
23	28.4	7.9	0.0	20.5	3.9
24	20.3	20.3	0.0	—	1.4
25	4.5	1.9	0.0	2.6	6.8

Source: Author's calculations.

Note: The point estimates of credit card revenue and electronic banking fees are used to derive the figures shown in the table.

previously thought. Similarly, studies comparing the efficiency of different banking organizations look questionable. Findings of high and variable degrees of inefficiency across a sample of banks may actually reflect differences in the amount and mix of the payments services that they produce. In addition, studies assessing the effects of investment in new systems and equipment may not find efficiency gains if they occur predominantly in the payments area and if payments services are not recognized as bank outputs.

Importance of Off-Balance-Sheet Activities

Reacting to the growing contribution that noninterest income makes to operating revenue, some researchers have sought to refine the measurement of bank output. Specifically, researchers have developed two methods of recognizing off-balance-sheet activities. The first method takes into account the credit exposure that off-balance-sheet instruments present to a bank. The potential credit exposure from unused credit lines and other lending commitments and the implicit credit exposure from interest rate swaps and other derivative contracts are added to loans recorded on the balance sheet. The resulting quantity is interpreted as an augmented measure of credit intermediation and bank output (Boyd and Gertler 1994; Edwards and Mishkin 1995). The second method treats off-balance-sheet instruments as a separate bank output. The quantity of output embodied in off-balance-sheet instruments is approximated by a volume of hypothetical on-balance-sheet loans—the volume needed to yield net interest income equal to a bank's reported noninterest income. The volume of hypothetical on-balance-sheet assets is then considered to be a component of bank output along with volumes of loans and deposits (Clark and Siems 1997).

Our review of noninterest income earned through payments services reveals weaknesses in both approaches. The problem with the first approach is that off-balance-sheet instruments that present credit risk are not the main source of noninterest income. Many other bank products besides derivative contracts and loan substitutes bring in noninterest income, and we have identified several of these as payments services. Consequently, important outputs are still unrecognized, although adding off-balance-sheet credit exposure to loan volumes may be a valid adjustment to make in pursuit of a comprehensive measure of bank lending. The problem with the second approach is that it assumes that all noninterest income is generated by off-balance-sheet instruments that present credit risk. Converting all noninterest income earned into a balance-sheet-equivalent volume of loans overstates lending and understates the size of other business lines.

Derivative Contracts and Loan Substitutes

Because a surprisingly large portion of noninterest income is payments-driven, the contributions made by loan commitments and derivatives trading may be less than generally assumed. To find the amount of revenue earned from these activities, we again turn to BHC annual reports. Three BHCs among the largest twenty-five disclose a comprehensive figure for fee income earned from off-balance-sheet forms of lending: BankAmerica, Chase Manhattan, and J.P. Morgan. BankAmerica states that during 1996 it earned $345 million of noninterest income from fees collected for "off-balance-sheet lending activities." Chase Manhattan identifies $330 million in revenue from "letters of credit and acceptances" and $120 million from "loan commitment fees." J.P. Morgan reports $156 million earned primarily from "commitments to extend credit, standby letters of credit, and securities lending indemnifications." For these three BHCs, the amounts disclosed represent 6 percent (BankAmerica), 6 percent (Chase Manhattan), and 3 percent (J.P. Morgan) of total noninterest income.[21] These small shares indicate that off-balance-sheet credit instruments do not bring in sufficient fee revenue to be a major factor behind the rising long-term trend in noninterest income.

Measuring trading revenue is straightforward because figures are presented in regulatory reports and shareholders' annual reports. But BHCs do not typically separate revenue earned by trading derivatives from revenue earned by trading conventional securities. If we assume arbitrarily that half of total trading revenue is obtained from derivative contracts, the twenty-five BHCs earned almost $4 billion from dealing in off-balance-sheet instruments. This figure represents 6 percent of the total noninterest income earned by the group. In light of the shares of noninterest

income brought in by trading and loan commitments, we conclude that the contribution that these off-balance-sheet activities make to operating revenue has been exaggerated.

The Essence of Commercial Banking

The sizable contribution made by payments services to the revenue stream of large BHCs also leads us to reconsider the problem of delineating the essential features of commercial banks. What is called for is an integrated theory of commercial banking, one that explains why commercial banks provide payments services on a large scale and that identifies the characteristics needed to succeed in payments services as well as in deposit taking and credit intermediation.[22] In an attempt to understand why a single financial intermediary offers both credit and payments services, we offer the following explanation: the skills required to succeed in the lending business—the ability to control losses efficiently—are also necessary for success in payments. Losses from payments activities can arise from fraud, operational glitches, systemic breakdowns, and failures of counterparties to fulfill obligations because of bankruptcy or other reasons. The skills necessary in the lending area encompass both preventing losses and recovering funds in the event of a loss. This requirement means that a bank's personnel must be able to prevent fraud, write contracts that offer legal protection, assess credit risk, get back funds that should not have been sent out, and claim compensation for damages. These skills would seem to carry over to the payments business, where a bank must also know how to prevent losses and make recoveries. The common set of skills required by these two business lines may largely explain why commercial banks provide both lending and payments services, a feature that distinguishes banks from other classes of financial intermediaries.[23]

What is called for is an integrated theory of commercial banking, one that explains why commercial banks provide payments services on a large scale.

Conclusion

This article explores the importance of the payments business to the banking industry by gauging the revenue generated by payments services. Our first step was to define the payments area broadly to include not only deposit accounts, but also securities processing and credit cards. We then used BHC annual reports to supplement information collected through supervisory reporting on the revenues earned from payments services.

By adding up all the components of fee income and interest income earned as compensation for transactional services, we find that the payments business generates between one-third and two-fifths of the combined operating revenue of the twenty-five largest BHCs. Thus, payments services make a significant and surprisingly large contribution to the industry's revenue stream.

In the future, the payments area may produce an even greater proportion of banks' operating income. First, if current trends persist, the trading of financial instruments will expand and banks will handle larger volumes of transactions and earn more fee income. Second, as higher proportions of household-to-business and business-to-business payments are converted to electronic forms, bank customers will make and receive payments faster and more conveniently. As payments services are improved, banks should be able to raise their fees.

According to our revenue estimates, payments services constitute one of the essential activities of the banking industry. Indeed, net revenues from payments services may be comparable to net revenues from credit services. Because of the importance of this business, the lack of analysis of the payments services in theoretical and empirical literature on the banking sector points to the need for further research. By excluding payments services in a model of a banking firm, a researcher may be overlooking one of banking's defining characteristics.

Appendix: The Twenty-Five Largest Bank Holding Companies

The twenty-five largest bank holding companies, ranked in terms of total assets as of year-end 1996, were as follows:

The Chase Manhattan Corporation
Citicorp
BankAmerica Corporation
J.P. Morgan & Company, Incorporated
Nationsbank Corporation
First Union Corporation
Bankers Trust New York Corporation
Wells Fargo & Company
First Chicago NBD Corporation
Banc One Corporation
Fleet Financial Group, Incorporated
Norwest Corporation
PNC Bank Corporation
Keycorp
Bank of Boston Corporation
Bank of New York Company, Incorporated
Suntrust Banks, Incorporated
Republic New York Corporation
National City Corporation
Wachovia Corporation
CoreStates Financial Corporation
Mellon Bank Corporation
Barnett Banks, Incorporated
Boatmen's Bancshares, Incorporated
First Bank System, Incorporated

ENDNOTES

1. Recently, however, researchers have given greater attention to payments system issues. For surveys of the issues, see Berger, Hancock, and Marquardt (1996) and Hancock and Humphrey (1997).

2. Here the criterion used to determine the twenty-five largest BHCs is total assets at year-end 1996. Together, the top twenty-five BHCs control almost two-thirds of total assets held by all BHCs and a little more than half of all bank and thrift deposits.

3. A seventh category, net realized gains on transactions involving held-to-maturity securities and available-for-sale securities, could be added. The gains made on sales of securities held outside the trading account can be thought of as an additional source of noninterest income. In fact, several BHCs include these securities gains in the category "noninterest income" in their annual reports.

4. The Y-9C report provides additional information through a supplementary schedule in which a BHC identifies its largest sources of "all other noninterest income" and records a figure for each source.

5. See Bank for International Settlements (1994) and Edwards and Eller (1996).

6. Some additional information on payments-related revenue can be extracted from the line of business results disclosed in annual reports.

7. A card-issuing bank may assess fees on its own deposit account holders for use of an ATM or debit card. However, because a card issuer collects these fees directly from its customers, this portion of ATM and debit-card revenue would be recorded in the category "fees on deposit accounts."

8. A bank's ATM surcharge fee usually applies only to customers of other banks, but sometimes it applies to a bank's own customers for use of certain offsite ATMs.

9. It should be noted that the normal use of a charge card requires short-term extensions of credit by the card issuer. Because a merchant receives payment from a card-issuing bank well before a cardholder remits money to the card issuer, extensions of credit are triggered by normal usage.

10. Credit card associations also collect a fee on each transaction to pay for promotional activities, fraud prevention, and arrangement of interbank settlements.

11. One BHC reports a figure for credit card loans in the Y-9C and not in its annual report, but the amount is trivial. Overall, the total of credit card loans shown in the Y-9C report is about 30 percent larger than the total obtained from the annual reports. The Y-9C figures are larger for three reasons. First, the Y-9C data are reported as of the end of the year and tend to be swollen because of the holiday shopping season, whereas the annual report figures are usually an average for the year. Second, the category used in the Y-9C report is defined to include not only credit cards but also other revolving consumer credit plans. Finally, some of the largest credit card issuers bought portfolios from other issuers over the course of the year.

12. These estimates may be on the low side because some credit card fees are not identified and are left out of the calculations. For example, one bank states that late fees and charges for exceeding an account limit are recorded not in "credit card revenue" but in an unspecified component of the "other fee" category. This omission may be somewhat offset, however, by overreporting of merchant fees and interchange fees, which could include revenue from debit-card usage.

13. Other services offered through a trust department include portfolio management, securities lending, and financial advice.

14. CoreStates Financial Corporation, *1996 Annual Report*, p. 39.

15. Studies of the demand for money also recognize the phenomenon of implicit interest on deposit accounts. In these studies, researchers estimate the amount of implicit interest earned on demand deposits in order to calculate the opportunity cost of holding money.

16. Berger and Humphrey (1992) report comparable figures for all commercial banks. They estimate foregone interest on demand, savings, time, and other deposits to be $41.9 billion in 1988, compared with $9.4 billion of fees on deposit accounts.

17. Unlike issuers of general-purpose credit cards, issuers of charge cards cannot cover transactions costs by collecting interest. This difference may explain why charge card issuers set higher annual fees and higher merchant discount fees than credit card issuers.

18. These six BHCs hold nearly half of the top twenty-five BHCs' combined credit card receivables. Individually, each bank securitized between 5 and 45 percent of credit card receivables. On average, the banks securitized 35 percent of credit card receivables.

19. Industry consultants have also prepared estimates of payments system revenues, but these estimates have a wider scope than those in this study. Bowers and Devine (1995) placed total payments system revenues at $84 billion in 1993. This figure, however, appears to include all interest paid on credit card balances and mixes credit services with payments services. Together, the Bank Administration Institute and

Note 19 continued
Payment Systems, Inc., have completed a study, "Profiting from Change in the U.S. Payments System," which estimates that in 1996 the banking industry's fee income from payments services was $22 billion and interest income from payments services was $78 billion. (The study is summarized in Chambliss and Taylor [1997].) This estimate of total payments-driven fee income looks low compared with ours, which is based on the twenty-five largest BHCs. The interest income figure appears to include all interest paid on credit card balances and mixes credit services with payments services.

20. Given the contribution that payments-related income makes to operating revenue, BHCs are taking significant business risks whenever they make important decisions regarding the payments area. BHCs must decide which services to offer and on what scale, what hardware and software investments to make, whether to produce in-house or outsource some aspects of these services, and which partners to take on in joint ventures. The business risks in the payments area have different dimensions from those in lending or trading, but they are present nonetheless.

21. Three other BHCs disclose a figure that covers only fees earned from letters of credit and acceptances. Bank of Boston Corporation shows that it earned $68 million from "letters of credit and acceptance fees" (5 percent of its total noninterest income), KeyCorp earned $16 million from "letters of credit fees" (1 1/2 percent of its total noninterest income), and Wachovia Corporation earned $25 million from "bankers acceptances and letter of credit fees" (3 percent of its total noninterest income).

22. In the course of reviewing the development of the U.S. payments system, Goodfriend (1991) explored reasons why "payment services and information-intensive lending have been provided jointly by the same set of institutions, i.e., banks."

23. Fama (1985) conjectures that the ability to review a firm's deposit account activity gives the firm's bank an edge over nonbank financial intermediaries and other banks in lending to the holder of a deposit account. Nakamura (1993) collects quantitative information that supports the view that at least small banks have an advantage in lending because of their handling of a loan applicant's deposit accounts. Kashyap, Rajan, and Stein (1998) argue that lending and deposit taking are essentially the same function: both serve to provide liquidity to bank customers.

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