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Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries

This paper examines the nature of links between the intensity of financial intermediation and economic performance that operated in the United States, the United Kingdom, Canada, Norway, and Sweden over the 1870–1929 period. After describing the co-evolution of the financial and real sectors in these countries, vector error correction models (VECMs) establish the quantitative importance of long-run relationships among measures of financial intensity and real per capita levels of output and the monetary base. Granger causality tests then suggest a leading role for the intermediation variables in real sector activity, while feedback effects are largely insignificant. The results suggest an important role for intermediation in the rapid industrial transformations of all five countries.

THE RELATIONSHIP BETWEEN FINANCIAL STRUCTURE and economic development received considerable attention in the growth literature of the 1960s and 1970s. While many important contributions (for example, Goldsmith 1969; McKinnon 1973; Shaw 1973) offered detailed arguments and evidence for a role of finance in promoting long-run growth, these studies did not establish the direction, timing, and relative strength of causal links. King and Levine (1993a) address the issue of direction in a cross-sectional study that relates broad proxies for the intensity of financial intermediation to measures of real sector performance using postwar international data, yet causal inference is restricted to the observation that economies with greater financial depth at a given point in time appear to grow faster in subsequent decades than those with lower initial levels of financial activity. Time series studies of individual countries (for example, Jung 1986) find bidirectional causality between financial and real variables in postwar data, and seem to offer little hope for disentangling direct effects from feedback.

Perhaps the disappointing time series findings arise from a focus on recent data for countries that are either already quite sophisticated financially or suffer from severely limited data availability. Such data sets preclude examining the proposition that active intermediation influences macroeconomic outcomes most emphatically when coun-

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tries are in the earlier stages of economic development (see McKinnon 1973, ch. 2). In contemporary developed economies, organized equity, debt, and derivative markets may substitute for traditional intermediated markets; thus intermediated finance may become less important as the financial system becomes more sophisticated. Wachtel and Rousseau (1995), using standard differenced VARs, offer support for this notion in a study of the Anglo-American countries that finds a stronger link from measures of financial depth to real output growth prior to the Great Depression than in the postwar era. Our results suggest that studies seeking to identify causal links between financial intermediation and general economic performance should focus on historical periods when growing intermediaries dominated the financial sector.

The following study explicitly models long-run relationships in the data for five industrializing countries (the United States, the United Kingdom, Canada, Norway, and Sweden) from the period 1870–1929 to more sharply characterize the strength and timing of links between the financial and real sectors. In so doing, we incorporate information from banks and nonbank intermediaries that may have relied on securities markets in addition to loan markets. The time series methodology facilitates more conclusive causal inferences than have been possible in cross-sectional studies. First, we find single cointegrating relationships between real per capita levels of output, money, and intermediary assets for the countries in our sample, and show that intermediation Granger-causes real per capita output in VAR systems that allow for these relationships while output does not Granger-cause intermediation. Second, we estimate a series of vector error correction models (VECMs) and find that the error correction term is usually significant in the output equations, but not in the intermediation equations. The results suggest that financial intermediation leads output and that output does not directly feed back into intermediation.

The paper is organized as follows. Section 1 considers theoretical contributions that point to a link from financial development to general economic performance, and presents evidence of coevolution in the financial and real sectors for the five countries over the 1870–1929 period. Section 2 describes the sources and construction of our measures of the intensity of intermediation, and summarizes the empirical methodology that is applied in sections 4 and 5. Section 6 concludes.

1. THE LINK BETWEEN THE FINANCIAL AND REAL SECTORS

Both the traditional and more recent literatures offer key insights for understanding the potential role of financial intermediaries in economic performance. Broadly defining financial intermediaries as individuals or institutions that "solicit loanable funds from surplus spending units and allocate these funds among deficit units whose direct debt they absorb," Gurley and Shaw (1955) focus on the ability of intermediaries to manage the debt that accumulates in a growing economy and avoid inefficiencies that tend to repress real activity.

A set of recent models highlights the role of intermediaries in resource allocation.

Bencivenga and Smith (1991), for example, formalize the "debt accumulation" channel with an overlapping generations model in which the disposition of savings shifts from unproductive liquid assets to the assets of emerging intermediaries that can exploit investment synergies and encourage output growth through the capital stock. King and Levine (1993b) construct an endogenous growth model in which intermediaries reduce inefficiencies by acquiring information about the quality of individual projects that is unavailable to private investors and public markets. The informational advantage encourages the funding of less-established firms that are likely to develop innovative intermediate and final products. A reduction in the cost of productivity enhancement is then shown to accelerate economic growth rates. Greenwood and Jovanovic (1990) demonstrate in a dynamic general equilibrium setting that as savers become able to avoid idiosyncratic risks and gain confidence in the ability of intermediaries to make profitable allocation decisions, they place an increasing portion of their surpluses with intermediaries. Here, increases in the efficiency of the financial sector lead to output growth, which in turn generates additional demand for deposits and financial services.

Another class of models focuses on the role of intermediaries in monitoring loan recipients. Sussman (1993), for example, builds on the "costly state verification" framework of Townsend (1979) to show that better monitoring of loan recipients in a monopolistically competitive banking sector reduces markups, encourages entry, and reduces the banking sector's share in GNP. Rousseau (1998) shows that a search for temporary rents among competitive intermediaries with credit rationing and informational asymmetries can lead to more efficient monitoring, narrower loan-deposit rate spreads, applicants of generally higher quality, and increases in deposits.

Both types of models suggest that the intermediating sector can increase its size (in terms of physical locations and total assets) by becoming more efficient and offering a broader range of services to its customers, both lenders and borrowers. Inflows from a more confident public may also encourage intermediaries to offer new products and to invest in technologies that expand the sector further. We believe that intermediaries are more likely to innovate, however, when new technologies can generate shifts in the portfolio choices of savers that render the inflows sustainable.

Financial intermediaries that play these roles include the most elementary—deposit banks—and more sophisticated ones such as insurance companies. To the extent that the size of the intermediating sector reflects the volume of these services and increases in the efficiency of their delivery, it should be related to output performance. Nevertheless, the patterns of growth of intermediaries appear to differ over time and across countries. Hence, our interest in relating these developments formally to the output performance of five industrializing economies.

The 1870–1929 period was one of rapid industrialization,[1] output expansion, and

1. The declining share of the agricultural sector in output over the 1880–1929 period reflects this shift toward industrialization, with agriculture's share falling from 14 percent to 8 percent in the United States, 13 percent to 4 percent in the United Kingdom, 39 percent to 8 percent in Canada, 33 percent to 17 percent in Norway, and 37 percent to 14 percent in Sweden.

TABLE 1

RATIO OF FINANCIAL INSTITUTION ASSETS TO OUTPUT

	Percent			
	1880	1900	1913	1929
United States	33.3	69.9	80.1	98.1
United Kingdom	69.3	85.8	94.2	110.9
Canada	57.2	88.5	81.7	84.3
Norway	52.8	87.0	112.0	161.1
Sweden	76.1	106.8	121.4	121.5

NOTE: See appendix for data sources for the United States, United Kingdom, and Canada. Ratios for Norway and Sweden were constructed from asset data in Goldsmith (1969) Tables D-21 and D-29 and output as described in appendix.

growth in both banks and innovative institutions like insurance companies for the countries in our study. A standard measure of the importance of intermediaries in financing real activity is the ratio of intermediary assets to annual output. Table 1 shows that this ratio, referred to as "financial depth" by Shaw (1973), triples for the United States and Norway over the sample period, increases by more than 50 percent for the United Kingdom and Sweden, and rises by nearly 50 percent for Canada. The period was also marked by an increasing role for organized markets generally. The growing ratios of the combined stock of intermediary assets and public corporate securities to total financial assets displayed in Table 2 reflect this tendency. While the table double-counts corporate debt and equity securities held by financial institutions, the figures (which are available only for the United States, the United Kingdom, and Norway) suggest a gradual shift by firms from self-financed investments to projects funded through organized markets. It is also interesting to note that despite the increase in debt and equity issues by publicly held corporations, intermediaries held a gradually increasing share of total financial assets from the turn of the century through 1929.

While there was rapid coevolution for the financial and real sectors both within and across the countries in our sample, Tables 1 and 2 do not provide evidence for our hypothesis that increases in the intensity of financial intermediation led to stronger economic performance. The remainder of our analysis focuses on establishing such a causal link statistically, though it does not distinguish between the impact of intermediation on factor accumulation (Gurley and Shaw 1955) and increases in total factor

TABLE 2

RATIO OF FINANCIAL INSTITUTION ASSETS, CORPORATE STOCKS, AND CORPORATE BONDS TO TOTAL FINANCIAL ASSETS

	Percent			
	1875	1895	1913	1929
United States	47.9	50.4	59.4	57.9
United Kingdom	36.5	49.0	44.9	44.2
Norway	37.0	42.0	43.8	48.0

NOTE: The ratios were constructed from Goldsmith (1985) Tables 38, 56, 57, and 61.

productivity (King and Levine 1993b; Greenwood and Jovanovic 1990). In so doing, we also evaluate the importance of feedback effects, such as those stressed by Robinson (1952), from economic performance to the intermediating sectors of the rapidly industrializing countries that constitute our sample.

2. DATA AND METHODOLOGY

Measures of the Intensity of Intermediation

The limited availability of detailed historical series and the desire to build comparable aggregates for all five countries render the development of useful measures of financial intensity challenging. Nevertheless, the focus on industrializing countries with relatively reliable historical data facilitates the construction of more specific measures of financial intensity than have been used in recent cross-sectional studies, which have relied on broad measures such as the ratio of the money stock to nominal output. Specifically, the measures of intermediation intensity for the United States, the United Kingdom, and Canada include the assets of commercial banks (CBA), the combined assets of commercial banks and savings institutions (BANKA), and a composite that includes the assets of commercial banks, savings institutions, insurance companies, credit cooperatives, and pension funds (FIA). Investment company assets are also included in the FIA aggregate for the United States and Canada. The difference between the stock of money and the base (MMB) also serves as a measure of the extent to which banks created credit. The intermediary aggregates for Norway and Sweden are limited to the deposits of commercial banks (CBD) and the combined deposits of commercial banks and savings banks (BANKD). Note that the BANKD aggregate is roughly comparable to the MMB measure. Aggregate output serves as our measure of general economic performance.

For the United States, data for nominal output, the implicit price deflator, and the monetary aggregates are from Balke and Gordon (1986). The assets of each intermediary type were obtained from Goldsmith (1955) for the 1896–1929 period, and aggregates from the U.S. Bureau of the Census (1973) were linked to Goldsmith's series for 1870–1895. Output data for the United Kingdom are from Feinstein (1972), and the monetary aggregates are from Capie and Webber (1985). The assets of financial intermediaries are from Sheppard (1971). The coverage of the Sheppard data determines the 1880 starting point for the U.K. analysis. Historical data for Canada were obtained from Urquhart (1986) and from official government statistics. Since the monetary base for Canada over the 1871–1929 period is not readily available, we construct an approximation from data in Urquhart and Buckley (1965). The data on individual intermediaries are from Neufeld (1972). Financial and macroeconomic data for Norway and Sweden are available from Mitchell (1992) for the post-1874 period.

All data are annual, per capita figures that have been deflated to reflect 1900 quantities, with the natural log transformation applied prior to analysis. A Data Appendix provides additional details on the sources and methods used to construct each series.

Empirical Methodology and Summary of Findings

The data permit tests of the timing and direction of causal links between the intensity of intermediation and economic performance in a vector autoregressive framework.[2] Given that parsimonious models of output fluctuations generally include some measure of narrow money, we use a system with real per capita output and the monetary base as a benchmark. Since the study examines the ability of intermediation variables to explain output fluctuations that cannot be attributed to movements in money, each VAR also includes a measure of the intensity of intermediation.

Section 3 determines whether VARs in levels or first differences are appropriate for classical inference by examining the time series characteristics of the individual data series and any long-run relationships that operate within each system. This involves a series of tests for unit roots and cointegrating relationships. The tests indicate that nonstationarity cannot be rejected for any series in levels and that nearly all three-variable systems include a single cointegrating relationship. Sims, Stock, and Watson (1990) show that under these conditions, block exclusion tests in levels VARs are asymptotically chi-square distributed. Section 4 uses this result in a series of causality tests that indicate a leading role for each measure of financial intensity in real per capita output for all five countries, with no strong evidence of feedback from output to the financial intensity measures.

The long-run relationships between output, the monetary base, and individual measures of financial intensity implied by the estimated cointegrating vectors are then used to construct vector error-correction models (VECMs) that assess the speed at which each variable responds to deviations from the common stochastic trend. These models indicate a rapid and significant response of output to such deviations, with signs on the elements of the cointegrating vectors and coefficients for the long-run terms that are consistent with a role for increases in the intensity of intermediation in upward "corrections" in output. The responses of the financial intensity measures to the same deviations are usually not statistically significant.

3. ANALYSIS OF STATIONARITY AND COINTEGRATING RELATIONSHIPS

Unit Root Tests

A cointegrating relationship exists within a set of nonstationary time series when a linear combination of the variables can be identified that yields a stationary result. This suggests that an investigator must first establish that the series of interest are nonstationary. Here, Augmented Dickey-Fuller (ADF) and Phillips-Perron tests are used to make these determinations. Table 3 presents the results of both unit root tests for the log of real per capita output, the monetary base, and measures of financial intensity for

2. Our methodology differs from the cross-sectional approach of King and Levine (1993a, 1993b). Their work allows for the inclusion of a richer array of factors that may influence long-run growth. The dynamic specifications considered here compensate somewhat for the exclusion of other factors. A dynamic panel approach (for example, Arellano and Bond 1991) could also incorporate the time dimension and capture the effects of short-run fluctuations in the system variables.

TABLE 3

AUGMENTED DICKEY-FULLER (ADF) AND PHILLIPS-PERRON (PP) STATISTICS FOR PER CAPITA MACROECONOMIC AGGREGATES AND MEASURES OF THE INTENSITY OF INTERMEDIATION

	U.S. 1870–1929		U.K. 1880–1929		Canada 1871–1929		Norway 1875–1929		Sweden 1875–1929	
Level	ADF	PP	ADF	PP	ADF	PP	ADF	PP	ADF	PP
GNP	−2.50	−3.64*	−2.73	−2.90	−2.67	−2.74	−1.58	−2.64	−2.27	−2.38
MBASE	−1.22	−0.94	−2.38	−2.99	−1.78	−1.45	−1.04	−2.62	−2.68	−3.22
FIA	−1.75	−2.49	−2.58	−2.27	−1.17	−2.06	NA	NA	NA	NA
BANKA	−1.45	−2.64	−2.47	−2.57	−0.60	−1.79	−2.42	−4.53*	−3.26	−3.40
CBA	−1.05	−1.31	−2.54	−2.77	−1.17	−1.57	−1.53	−2.49	−1.84	−1.77
MMB	−1.39	−1.73	−2.41	−2.51	−0.45	−0.67	NA	NA	NA	NA
1st Difference	ADF	PP	ADF	PP	ADF	PP	ADF	PP	ADF	PP
GNP	−4.77*	−8.86*	−4.23*	−6.06*	−4.04*	−7.32*	−4.08*	−8.00*	−3.76*	−7.07*
MBASE	−4.06*	−9.40*	−3.71*	−6.36*	−3.20	−5.92*	−3.56*	−7.75*	−3.45*	−7.76*
FIA	−3.13	−7.57*	−3.31	−4.20*	−3.21	−7.09*	NA	NA	NA	NA
BANKA	−3.73*	−8.59*	−3.42	−5.49*	−4.10*	−7.54*	−4.82*	−7.17*	−4.38*	−7.64*
CBA	−3.04	−11.28*	−3.84*	−6.32*	−3.60*	−7.15*	−3.60*	−7.23*	−3.33	−7.32*
MMB	−3.75*	−7.14*	−4.56*	−5.12*	−3.03	−8.55*	NA	NA	NA	NA

NOTE: The ADF statistics were generated by a model with constant, trend, and three lags. The PP tests use the automatic bandwidth selection technique of Andrews and Monahan (1992) in computing the spectrum. An asterisk denotes rejection of the unit root hypothesis at the 5 percent level using critical values from Fuller (1976), Table 8.5.2.

the five countries in levels and first differences.[3] Evidence of upward trends in the data suggest the inclusion of a linear time trend in the regressions.

The ADF tests fail to reject the unit root hypothesis at the 5 percent level for all variables in log levels, while the Phillips-Perron tests reject the null only for GNP in the United States and the BANKD aggregate for Norway. At least one test rejects the null for each series in log differences, which suggests that the maximum order of integration for the series under consideration is one. The qualitative implications of the ADF tests are unaffected by adding a lag to each regression. The findings imply that it is reasonable to proceed with tests for cointegrating relationships among combinations of these series under the premise of nonstationarity.

Cointegration Tests

Unable to reject decisively the unit root hypothesis for any of the series in levels, we examine next the possibility that output, the monetary base, and individual measures of the intensity of intermediation share a common stochastic trend. Inferences are based on the full information maximum likelihood approach of Johansen (1991), which identifies the number of stationary long-run relationships that exist among a set of integrated time series. Each three-variable system is modeled as the reformulated vector autoregression:

$$\Delta \mathbf{x}_t = \mu + \sum_{i=1}^{k-1} \Gamma_i \Delta \mathbf{x}_{t-i} + \Pi \mathbf{x}_{t-k} + \mathbf{e}_t, \tag{1}$$

where $\mathbf{x}$ is a matrix containing the series of interest, and k is adequately large both to capture the short-run dynamics of the underlying VAR and to produce normally distributed white noise residuals. The Johansen methodology involves testing whether the $\mathbf{\Pi}$ matrix in (1) has less than full rank.

Table 4 presents test statistics for combinations of per capita real output, the monetary base, and each measure of the intensity of intermediation. The tests for the United States and the United Kingdom indicate that single cointegrating relationships exist at the 5 percent level for nearly all three-variable systems, while all systems for Canada and Sweden indicate the presence of cointegrating relationships at the 15 percent level or less. For Norway, a single cointegrating relationship exists at the 15 percent level for the system that includes BANKD as the intermediation variable, but there is no evidence of cointegration in the system with commercial bank deposits only. Given the key role of savings banks in Norway over the sample period, however, total bank deposits is likely to be a better proxy for financial intensity than an aggregate that includes a single intermediary type. For all countries, the cointegrating relationships vanish in the bivariate specifications. This suggests that the measures of

3. The choice of three lags in the ADF tests exceeds that computed by the Akaike and Schwartz criteria (which select two lags in most cases), yet possible efficiency losses resulting from our choice appear preferable to the tendency for ADF tests to over-reject the null when these information criteria are used (see Schwert 1989). The sensitivity of ADF tests to lag selection renders the Phillips-Perron test an important additional tool for making inferences about unit roots.

TABLE 4

JOHANSEN TEST STATISTICS FOR COINTEGRATION BETWEEN REAL PER CAPITA LOG LEVELS OF OUTPUT, THE MONETARY BASE, AND MEASURES OF THE INTENSITY OF INTERMEDIATION

	Trace (η_r)		Max. Eigen. (ζ_r)			Coint. Vector
	$r = 0$	$r \leq 1$	$r = 0$	$r \leq 1$	$r \leq 2$	$\alpha_{GNP}, \alpha_{MBASE}, \alpha_{FI}$
U.S. 1870–1929	$K = 3$					
FIA	32.95**	9.25	23.70**	9.07	0.18	1, 0.582, −0.737
BANKA	35.07**	10.42	24.65**	9.28	1.14	1, 0.812, −0.910
CBA	30.11**	9.00	21.12**	6.53	2.47	1, 0.642, −0.742
MMB	27.57*	5.70	21.87**	5.42	0.28	1, 0.425, −0.588
no FIVAR	6.17	0.32	5.84	0.32	NA	NA
U.K. 1880–1929	$K = 2$					
FIA	31.79**	6.28	25.51**	6.17	0.11	1, −0.371, −0.333
BANKA	37.14**	8.67	28.47**	8.21	0.46	1, −0.348, −0.391
CBA	37.52**	12.71	24.81**	11.50	1.21	1, −0.184, −0.448
MMB	23.06	8.69	14.37	8.46	0.23	1, −0.102, −0.738
no FIVAR	9.92	0.41	9.51	0.41	NA	NA
Canada 1871–1929	$K = 3$					
FIA	25.57	8.38	17.91	8.07	0.31	1, −1.545, 0.534
BANKA	27.57*	9.54	18.02	9.32	0.23	1, −1.081, 0.063
CBA	24.59	6.68	17.91	6.44	0.23	1, 1.342, −1.957
MMB	39.61**	6.63	32.97**	6.48	0.16	1, 1.465, −1.163
no FIVAR	2.72	0.07	2.65	0.07	NA	NA
Norway 1875–1929	$K = 3$					
BANKD	24.77	9.63	15.13	8.27	1.36	1, −0.295, −0.239
CBD	16.09	4.50	11.60	4.48	0.02	1, −0.463, −0.098
no FIVAR	12.02	2.23	9.79	2.23	NA	NA
Sweden 1875–1929	$K = 3$					
BANKD	26.12	8.02	18.09	7.27	0.75	1, −1.912, 0.698
CBD	25.95	8.06	17.89	6.41	1.65	1, −1.431, 0.335
no FIVAR	12.00	2.07	9.93	2.07	NA	NA

NOTE: Each system includes logs of real per capita output, the monetary base, and the financial variable at the left. K is the lag length at which the levels terms enter the test regressions, and was determined by nested likelihood ratio tests. The columns labeled $r = 0$ test a null of no cointegration, while the $r \leq 1$ ($r \leq 2$) columns test a null of at most one (two) cointegrating vectors. * and ** denote rejections of the null at the 10 percent and 5 percent levels respectively, with critical values from Osterwald-Lenum (1992), Table 1. The final row for each country presents bivariate cointegration tests for systems that exclude the intermediation variable. Maximum likelihood estimates of the normalized cointegrating vectors appear in the right column.

financial intensity play a critical role in long-run comovements among the variables in our systems.

4. ERROR CORRECTION MODELS AND VAR SYSTEMS

The finding of cointegration at the 15 percent level or less in three-variable systems for all five countries suggests the presence of persistent comovements among the aggregates. While the estimates of the cointegrating vectors indicate the directions of attractions that maintain long-run stationarity in each system, however, they offer no information about the adjustment speeds of the variables to deviations from their common stochastic trend. This question can be addressed by embedding the stationary combination, which reflects the temporal status of the long-run relationship, in an otherwise standard VAR in first differences. Such a vector error correction model (VECM) in the three-variable case takes the form

$$\Delta x_{1,t} = \mu_1 + \sum_{i=1}^{k-1} \alpha_{1,i} \Delta x_{1,t-i} + \sum_{i=1}^{k-1} \beta_{1,i} \Delta x_{2,t-i} + \sum_{i=1}^{k-1} \zeta_{1,i} \Delta x_{3,t-i} + \gamma_1 (a x_{1,t-1} + b x_{2,t-1} + c x_{3,t-1})$$

$$\Delta x_{2,t} = \mu_2 + \sum_{i=1}^{k-1} \alpha_{2,i} \Delta x_{1,t-i} + \sum_{i=1}^{k-1} \beta_{2,i} \Delta x_{2,t-i} + \sum_{i=1}^{k-1} \zeta_{2,i} \Delta x_{3,t-i} + \gamma_2 (a x_{1,t-1} + b x_{2,t-1} + c x_{3,t-1})$$

$$\Delta x_{3,t} = \mu_3 + \sum_{i=1}^{k-1} \alpha_{3,i} \Delta x_{1,t-i} + \sum_{i=1}^{k-1} \beta_{3,i} \Delta x_{2,t-i} + \sum_{i=1}^{k-1} \zeta_{3,i} \Delta x_{3,t-i} + \gamma_3 (a x_{1,t-1} + b x_{2,t-1} + c x_{3,t-1}) \quad \text{(2a,b,c)}$$

where x_1 is output, x_2 is the monetary base, and x_3 is a measure of the intensity of intermediation. The last component of each equation in the system is the error correction term (ECT), which is formed with the elements of the cointegrating vector and enters the model at a single lag.

Since the linear long-run relationship in each system is summarized by the cointegrating vector, the sign and size of the coefficient on the ECT in each equation reflect the direction and speed of adjustments in the dependent variable to temporary deviations from this relationship. For example, a negative loading on the intermediation measure in the cointegrating vector coupled with negative and significant coefficients on the ECTs in equation (2a) would imply that output rises in response to fluctuations that depress the value of the stationary combination. The sign of the loading would also be consistent with a role for increased intermediary activity as a source of these negative deviations. An insignificant coefficient on the ECT in equation (2c), on the other hand, would suggest sluggish long-run adjustment of the financial intensity measure to movements among the system variables, including those initiated by increases in output.

The concept of Granger causality has long been used by macroeconomists to establish a leading role for one variable in the fluctuations of another. In general, VAR systems with nonstationary variables that are not cointegrated must be differenced to conduct standard block exclusion tests, yet Sims, Stock, and Watson (1990) show that this is unnecessary in cointegrated three-variable systems.[4] Thus, for our systems, levels VARs are appropriate for conducting causality tests that allow for the impact of long-run attractions. The results of VECM and VAR models for the five countries follow.

The United States

Table 5a presents estimates for the United States of error correction terms in the VECMs and Granger-causality test statistics for the levels VARs. Equations 1, 2, and

4. Toda and Phillips (1993) offer reservations about the use of levels VAR causality tests in higher dimensional systems, yet the Sims, Stock, and Watson (1990) result remains valid for causality testing in three-variable systems with a single cointegrating vector.

TABLE 5A

ERROR CORRECTION AND VAR ESTIMATES FOR SYSTEMS WITH LOGS OF PER CAPITA REAL OUTPUT, THE MONETARY BASE, AND A MEASURE OF FINANCIAL INTENSITY FOR THE UNITED STATES, 1870–1929

Intensity Measure		Error Correction Model		Levels VAR Granger Tests			
(Coint. Vector)	Eq. #	ECT	R^2/(DW)	GNP	MB	FI	R^2/(DW)
FIA	1	−0.471	0.411	0.610	−0.212	0.276	0.972
(1, 0.582, −0.737)		(0.000)	(2.07)	(0.000)	(0.051)	(0.002)	(2.20)
	2	−0.021	0.182	−0.042	0.951	0.013	0.970
		(0.837)	(1.94)	(0.564)	(0.000)	(0.147)	(1.91)
	3	0.112	0.310	0.171	0.117	0.853	0.994
		(0.255)	(2.04)	(0.279)	(0.066)	(0.000)	(1.98)
BANKA	1	−0.412	0.390	0.638	−0.237	0.291	0.971
(1, 0.812, −0.910)		(0.000)	(2.07)	(0.000)	(0.047)	(0.003)	(2.21)
	2	−0.012	0.184	−0.056	0.944	0.021	0.974
		(0.901)	(1.93)	(0.431)	(0.000)	(0.093)	(1.91)
	3	0.121	0.324	0.148	0.183	0.815	0.994
		(0.166)	(2.08)	(0.316)	(0.024)	(0.000)	(1.99)
CBA	1	−0.411	0.355	0.566	−0.210	0.278	0.970
(1, 0.642, −0.742)		(0.001)	(2.03)	(0.000)	(0.048)	(0.004)	(2.09)
	2	0.044	0.192	−0.008	0.986	−0.015	0.973
		(0.668)	(1.92)	(0.526)	(0.000)	(0.215)	(1.91)
	3	0.068	0.425	0.010	0.118	0.930	0.996
		(0.476)	(2.00)	(0.547)	(0.053)	(0.000)	(2.07)
MMB	1	−0.500	0.309	0.511	−0.215	0.280	0.970
(1, 0.425, −0.588)		(0.003)	(2.00)	(0.001)	(0.117)	(0.007)	(2.01)
	2	0.102	0.204	0.096	0.995	−0.055	0.973
		(0.465)	(1.95)	(0.785)	(0.000)	(0.229)	(1.85)
	3	0.012	0.177	0.108	0.068	0.921	0.995
		(0.937)	(1.96)	(0.264)	(0.611)	(0.000)	(1.92)

NOTE: Equations (1), (2), and (3) for each system include output, the monetary base, and a financial intensity measure as the respective dependent variables. Estimates of the normalized cointegrating vectors appear in the left column beneath the acronym for the measure of financial intensity. The coefficients on the ECT in each equation are listed in the next column, with significance levels in parentheses. The next column includes the Durbin-Watson and R^2 statistics for each VECM equation. The right panel reports the sum of the regression coefficients on output (GNP), the monetary base (MB), and the financial intensity measure (FI) in a levels VAR, with the significance level of the F-test for Granger causality in parentheses. The next column includes Durbin-Watson and R^2 statistics for each VAR equation. The VAR systems use three lags of each variable.

3 in each system include output, the monetary base, and the specified measure of financial intensity as the respective dependent variables. The negative and significant coefficient on the ECT in the output equation of each VECM indicates a rapid response of output to deviations from its long-run relationship with the monetary base and each of the financial intensity measures. In particular, negative deviations from the stationary relationship are "corrected" by increases in output. Given the negative sign on the financial intensity measure in the cointegrating vector of each system, increases in this measure could provide the impulses that drive the upward adjustments in output, though downward movements in past output or the monetary base would also reduce the value of the stationary combination. The latter scenario, however, would require an unlikely negative long-run covariance between the monetary base and output. The small and insignificant ECTs in the second and third equations indicate no tendency for the monetary base or the financial intensity measures to respond rapidly to deviations from the stationary relationships.

The levels VARs indicate that all financial intensity measures Granger-cause output at the 1 percent level with a positive sum of the regression coefficients, while output does not Granger-cause any of the financial intensity measures. In addition, the monetary base Granger-causes the intermediation variable in three of the systems with positive sums of the regression coefficients. The latter result may reflect contractions in loans that accompanied the liquidity crises that often affected the U.S. banking system prior to the establishment of the Federal Reserve. Overall, the results imply a strong leading relationship for intermediation in output performance.

The United Kingdom

Table 5b presents results for the United Kingdom that are broadly similar to those obtained for the United States. Specifically, the error correction coefficients in the VECMs imply a positive response of output to reductions in the level of the stationary long-run combination, and there is no evidence of significant adjustments in either the monetary base or the financial intensity measures to the same deviations. The levels VARs also yield positive coefficient sums on the financial intensity measures and Granger causality tests that are significant at the 1 percent level, with no evidence of feedback from output to either the intermediation variables or the monetary base.

TABLE 5B

ERROR CORRECTION AND VAR ESTIMATES FOR SYSTEMS WITH LOGS OF PER CAPITA REAL OUTPUT, THE MONETARY BASE, AND A MEASURE OF FINANCIAL INTENSITY FOR THE UNITED KINGDOM, 1880–1929

Intensity Measure (Coint. Vector)	Eq. #	Error Correction Model ECT	Error Correction Model R^2/(DW)	Levels VAR Granger Tests GNP	Levels VAR Granger Tests MB	Levels VAR Granger Tests FI	Levels VAR Granger Tests R^2/(DW)
FIA	1	−0.460	0.393	0.602	0.061	0.201	0.949
(1, −0.371, −0.333)		(0.004)	(2.12)	(0.000)	(0.359)	(0.001)	(2.03)
	2	0.243	0.191	0.261	0.811	−0.018	0.923
		(0.259)	(1.99)	(0.292)	(0.000)	(0.172)	(1.98)
	3	−0.032	0.570	-0.002	0.025	0.976	0.973
		(0.832)	(1.84)	(0.790)	(0.032)	(0.000)	(2.18)
BANKA	1	−0.457	0.412	0.600	0.063	0.246	0.951
(1, −0.348, −0.391)		(0.004)	(2.15)	(0.000)	(0.124)	(0.000)	(1.98)
	2	0.220	0.179	0.187	0.855	−0.009	0.918
		(0.313)	(2.00)	(0.527)	(0.000)	(0.502)	(1.97)
	3	−0.158	0.414	−0.135	0.067	0.999	0.952
		(0.346)	(1.82)	(0.596)	(0.374)	(0.000)	(1.97)
CBA	1	−0.471	0.440	0.541	0.002	0.302	0.955
(1, −0.184, −0.448)		(0.003)	(2.16)	(0.000)	(0.073)	(0.000)	(1.99)
	2	0.141	0.172	0.063	0.848	0.074	0.918
		(0.524)	(2.00)	(0.922)	(0.000)	(0.507)	(1.94)
	3	−0.206	0.342	−0.197	0.023	1.052	0.962
		(0.229)	(1.77)	(0.306)	(0.948)	(0.000)	(1.88)
MMB	1	−0.317	0.300	0.719	0.017	0.215	0.937
(1, −0.102, −0.738)		(0.001)	(1.96)	(0.000)	(0.939)	(0.044)	(2.07)
	2	−0.065	0.181	0.081	0.777	0.162	0.923
		(0.592)	(1.91)	(0.763)	(0.000)	(0.171)	(1.87)
	3	−0.001	0.375	0.039	0.009	0.945	0.958
		(0.993)	(1.86)	(0.348)	(0.502)	(0.000)	(2.00)

See note to Table 5a. The VARs use two lags of the system variables.

TABLE 5C

ERROR CORRECTION AND VAR ESTIMATES FOR SYSTEMS WITH LOGS OF PER CAPITA REAL OUTPUT, THE MONETARY BASE, AND A MEASURE OF FINANCIAL INTENSITY FOR CANADA, 1871–1929

Intensity Measure		Error Correction Model		Levels VAR Granger Tests			
(Coint. Vector)	Eq. #	ECT	R^2/(DW)	GNP	MB	FI	R^2/(DW)
FIA	1	0.064	0.194	0.862	−0.037	0.133	0.979
(1, −1.545, 0.534)		(0.082)	(2.05)	(0.000)	(0.874)	(0.027)	(2.09)
	2	0.144	0.408	0.002	0.846	0.112	0.984
		(0.001)	(1.99)	(0.374)	(0.000)	(0.003)	(1.91)
	3	0.090	0.322	0.236	−0.145	0.945	0.991
		(0.003)	(2.00)	(0.139)	(0.036)	(0.000)	(2.17)
BANKA	1	0.080	0.208	0.985	−0.066	0.083	0.978
(1, −1.081, 0.063)		(0.104)	(2.06)	(0.000)	(0.739)	(0.041)	(2.14)
	2	0.193	0.405	−0.006	0.862	0.119	0.984
		(0.001)	(2.01)	(0.299)	(0.000)	(0.003)	(1.96)
	3	0.148	0.335	0.249	−0.140	0.892	0.985
		(0.001)	(2.04)	(0.076)	(0.112)	(0.000)	(2.10)
CBA	1	−0.120	0.290	0.933	−0.122	0.165	0.979
(1, 1.342, −1.957)		(0.007)	(2.16)	(0.000)	(0.357)	(0.020)	(2.19)
	2	−0.205	0.478	−0.147	0.782	0.298	0.985
		(0.000)	(2.07)	(0.227)	(0.000)	(0.001)	(2.07)
	3	−0.072	0.228	0.243	−0.125	0.935	0.986
		(0.139)	(1.96)	(0.106)	(0.264)	(0.000)	(2.04)
MMB	1	−0.006	0.333	0.824	−0.018	0.100	0.982
(1, 1.465, −1.163)		(0.840)	(1.91)	(0.000)	(0.884)	(0.001)	(1.93)
	2	−0.110	0.358	−0.300	0.906	0.185	0.983
		(0.007)	(1.95)	(0.402)	(0.000)	(0.013)	(1.86)
	3	−0.156	0.484	−0.065	−0.202	1.119	0.994
		(0.000)	(1.94)	(0.293)	(0.022)	(0.000)	(2.16)

See note for Table 5a.

Canada

The causality tests for Canada presented in Table 5c indicate that all intermediation variables Granger-cause output at the 5 percent level or less with little evidence of feedback from output to intermediation. These findings, as well as those for the VECM system that includes commercial bank assets, closely resemble those obtained for the United States and the United Kingdom. The central position of commercial banks in the Canadian financial system over the sample period provides good reason to emphasize the long-run results obtained for this system. Nevertheless, the long-run interactions implied by the other VECM systems differ considerably.

In particular, the VECMs that include FIA and BANKA as the respective measures of financial intensity have ECTs in equations (2) and (3) that are significant at the 1 percent level, which indicates a strong response of both the monetary base and the financial intensity measures to deviations from their long-run relationships with output. The positive signs of these coefficients, coupled with the signs of the loadings in the cointegrating vector, are consistent with a link between increases in real sector activity and upward adjustments in financial intensity. The ECT in the output equation is significant only at the 10 percent level, indicating a weaker tendency for output to ad-

TABLE 5D

ERROR CORRECTION AND VAR ESTIMATES FOR SYSTEMS WITH LOGS OF PER CAPITA REAL OUTPUT, THE MONETARY BASE, AND A MEASURE OF FINANCIAL INTENSITY FOR NORWAY AND SWEDEN, 1875–1929

		Error Correction Model		Levels VAR Granger Tests			
Norway	Eq. #	ECT	R^2/(DW)	GNP	MB	FI	R^2/(DW)
BANKD	1	−0.287	0.551	0.740	0.017	0.107	0.985
(1, −0.295, −0.239)		(0.015)	(1.83)	(0.000)	(0.016)	(0.007)	(1.64)
	2	0.368	0.388	0.330	0.752	0.029	0.979
		(0.074)	(1.90)	(0.419)	(0.000)	(0.040)	(2.21)
	3	0.067	0.505	0.212	−0.011	0.933	0.994
		(0.707)	(1.97)	(0.334)	(0.053)	(0.000)	(2.19)
CBD	1	−0.092	0.562	0.967	−0.002	0.019	0.986
(1, −0.463, −0.098)		(0.418)	(1.92)	(0.000)	(0.001)	(0.002)	(1.61)
	2	0.429	0.439	0.349	0.792	0.001	0.980
		(0.032)	(1.94)	(0.267)	(0.000)	(0.011)	(2.27)
	3	0.628	0.431	0.496	−0.237	0.946	0.993
		(0.011)	(2.07)	(0.084)	(0.028)	(0.000)	(2.02)
Sweden	Eq. #	ECT	R^2/(DW)	GNP	MB	FI	R^2/(DW)
BANKD	1	0.267	0.314	1.293	−0.508	0.153	0.984
(1, −1.912, 0.698)		(0.002)	(2.01)	(0.000)	(0.007)	(0.051)	(2.10)
	2	0.295	0.222	0.603	0.148	0.163	0.959
		(0.028)	(2.06)	(0.141)	(0.107)	(0.313)	(2.02)
	3	0.137	0.169	0.269	−0.413	1.086	0.991
		(0.134)	(1.99)	(0.486)	(0.057)	(0.000)	(2.02)
CBD	1	0.381	0.296	1.290	−0.479	0.130	0.984
(1, −1.431, 0.335)		(0.004)	(2.02)	(0.000)	(0.009)	(0.097)	(2.10)
	2	0.493	0.222	0.596	0.172	0.147	0.959
		(0.017)	(2.04)	(0.153)	(0.111)	(0.394)	(2.04)
	3	0.186	0.145	0.186	−0.333	1.080	0.990
		(0.212)	(2.01)	(0.668)	(0.133)	(0.000)	(2.03)

See note for Table 5a.

just to these deviations. In the system with MMB as the measure of financial intensity, there is virtually no response of output to fluctuations in the stationary relationship, yet the monetary base and the MMB aggregate respond significantly.[5]

Norway and Sweden

Since the Johansen tests indicate the presence of cointegrating relationships in the three-variable systems for Norway and Sweden that are significant at the 15 percent level only, it is necessary to impose these relationships to proceed with the VECM estimation. We consider imposing these relationships, however, as preferable to assum-

5. The varied long-run results for Canada by no means suggest that the growth of financial institutions was an unimportant facet of the Canadian economic experience; rather, they imply that real activity also had a marked impact on long-run financial development. Clearly, real activity over the sample period was also influenced by external factors such as large capital inflows that did not appear immediately on the asset side of balance sheets for Canadian financial institutions. In this case, productive surges in the wake of foreign inflows could plausibly account for the increased throughput of Canadian intermediaries. Insofar as real activity in Canada was related to U.S. events, one might also expect Canadian intermediaries to react to impulses within large city banks (principally in New York) in much the same way as a country bank in the United States might respond—in general slowly and then only after evidence that an output expansion was well underway.

ing that long-run relationships are absent in the data, and the significance of the ECTs reported in Table 5d appear to support our judgment.

For Norway, results for the VECM with bank deposits resemble those obtained for the United States and the United Kingdom, with output rising in response to impulses that depress the value of the ECT and signs on the elements of the cointegrating vector that are consistent with increases in deposits as a source of the deviations. The monetary base also rises in response to deviations in the ECT related to increases in output and deposits. Bank deposits do not adjust significantly to fluctuations in the ECT. The levels VAR indicates that bank deposits Granger-cause output, while output does not Granger-cause bank deposits. The results differ for the VECM that includes only commercial bank deposits (CBD) as the measure of financial intensity. In this case, output responds slowly to deviations in the ECT, with larger responses of both the monetary base and commercial bank deposits to these same deviations. Despite the VECM finding, commercial bank deposits Granger-cause output at the 1 percent level.

The results for Sweden that appear in the lower panel are supportive of a leading role for financial intensity in output fluctuations, with ECTs in both systems that are significant at the 1 percent level in the output and money equations yet not significant in the deposit equations. The coefficients imply a rapid response of output to deviations from the long-run relationships. The output equations of the levels VARs yield positive coefficient sums on the financial intensity measures and Granger-causality tests that are significant at the 10 percent level or less, with no evidence of feedback in either the monetary base or deposit equations.

6. CONCLUSION

Our analysis examines links between the financial and real sectors for five countries that underwent rapid industrialization over the 1870–1929 period. While the nature of these links differ somewhat across countries, several commonalities emerge: (1) measures of the intensity of intermediation share long-run features with output and the monetary base; (2) the intermediation measures Granger-cause real output, with little evidence of feedback from output to intermediation; (3) coefficient estimates from VECMs that explicitly model the long run are consistent with a positive response of output to increases in the intensity of intermediation, while financial intensity is generally unresponsive to fluctuations in the long-run relationship of each system. Though not reported here, we also find that the VECMs forecast real output at three- to four-year horizons more accurately than VARs that omit the financial intensity measures or neglect to model the long-run explicitly.[6]

6. At four-year horizons, for example, mean square forecast error ratios for VECMs versus two-variable VARs (output and the monetary base only) average 35 percent for the United States, 12.5 percent for the United Kingdom, 14 percent for Canada, 55 percent for Norway, and 16 percent for Sweden. The VECMs also outperform three-variable VARs with MSE ratios that average 52 percent for the United States, 23 percent for the United Kingdom, 16 percent for Canada, 72 percent for Norway, and 23 percent for Sweden. The complete results are available from the authors upon request.

While the study focuses on countries with largely successful development experiences, the findings offer support for the notion that a rapidly growing financial system can play a key role in improving both resource allocations and general economic performance. It is in this respect that the paper confirms much of the thinking about these links that started with Joseph Schumpeter in 1911.

Some questions may arise, however, regarding the inclusiveness of our intermediation measures. In particular, though we do consider intermediaries that may rely on securities markets as opposed to loan markets, a broader approach such as that recently considered by Levine (1991), Bencivenga, Smith, and Starr (1995), and Rousseau and Wachtel (1998) may capture the role of financial sophistication in long-run performance more sharply than a focus on intermediaries alone. We believe, however, that the data limitations associated with the historical period of our study and the dominant roles of commercial banks, savings banks and insurance companies in the financial systems of these countries at the time justify our narrower focus. Nevertheless, the role of financial markets in a broader context remains an important topic for further investigation.

Overall, the study offers new information about the transmission mechanism through which financial intermediation affects economic performance, and suggests that real sector activity was a less important determinant of intermediary development during the phase of rapid growth considered here. In particular, the application of recent time series techniques that use information embedded in the levels of the data indicate clearly that financial development was a driving, causal force behind the rapid industrial transformations experienced by five leading economies prior to the Great Depression.

DATA APPENDIX

This appendix describes the sources and techniques used to create the historical series for the preceding analysis.

The United States

GNP — nominal gross national product; 1870–1929 from Balke and Gordon (1986) Table 1, pp. 781–83.

IPD — deflator for GNP (1900 = 1); 1870–1929 from Friedman and Schwartz (1982) Table 4.8.

POP — population; 1870–1929 from Friedman and Schwartz (1982), Table 4.8.

MSTOCK — money stock; 1870–1929 from Balke and Gordon (1986) Table 1, pp. 784–86.

MBASE — high-powered money; 1870–1929 from Balke and Gordon (1986) Table 1, pp. 784–86.

BANKA — assets of all banks; 1870–1929 from the Bureau of the Census (1973) series 581, pp. 1019–20.

CBA — total assets commercial banks; 1896–1929 are from the Bureau of the Census (1973) series 589, p. 1021. 1870–1895 are sum of national bank assets (series 635, p. 1027) and state commercial bank assets (series 684, p. 1031), ratio spliced to the 1896–1929 figures.

INSA — total assets insurance companies; 1896–1929 are sum of Goldsmith (1955) Table I-5(1), p. 455 "assets of all United States legal reserve life insurance companies," Table I-10(1), p. 462 "assets of fraternal orders," Table I-14(1), p. 467 "assets of mutual accident, sick benefit, and assessment life associations," Table V-54(1), p. 551 "assets of savings bank life insurance departments 1909–49," Table V-55(1), p. 553 "assets of fire and marine insurance companies," and Table V-56(1), p. 555 "assets of casualty and miscellaneous insurance companies."

PENS — total assets private pension funds; 1920–1929 are from Goldsmith (1955) Table I-16(1), p. 469 "assets of private independent pension funds."

INVCOS — total assets investment companies; 1914–1929 are sum of Goldsmith (1955), Table V-60(1), p. 559 "assets of open-end management investment companies," Table V-62, p. 563 "assets of closed-end management investment companies," Table V-69, p. 571 "assets of fixed and semi-fixed investment trusts," and Table V-72, p. 573 "assets of face amount installment investment companies."

FIA — total assets financial intermediaries; 1870–1929 is sum of BANKA, INSA, PENS and INVCOS.

The United Kingdom

GDP — nominal gross domestic product at factor cost; 1880–1929 from Feinstein (1972) Table 1, pp. T4–T7.

IPD — implicit price deflator (1929 = 1); 1880–1929 from Friedman and Schwartz (1982) Table 4.9.

POP — population; 1880–1929 from Friedman and Schwartz (1982), Table 4.9.

MSTOCK — money stock; 1880–1929 (M3) from Capie and Webber (1985) Table 1.3, pp. 76–7.

MBASE — high powered money; 1880–1929 from Capie and Webber (1985) Table 1.1, pp. 52–3.

COMBNK — total assets commercial banks; Sheppard (1971) provides the following for 1880–1929:

- Joint-Stock Banks of England and Wales, Table (A)1.2, pp. 118–19.
- Joint-Stock Banks of Ireland and Northern Ireland, Table (A)1.3, pp. 120–1. Irish bank assets included from 1880–1920 only.
- Joint-Stock Banks of Scotland, Table (A)1.4, pp. 122–23.
- Yorkshire Penny Bank, Table (A)1.5, pp. 124–25.
- Co-operative Wholesale Society Bank, Table (A)1.7, pp. 128–29.
- Miscellaneous other banks in *The Economist* private bank series, Table (A)1.5, pp. 122–23.

PO — total assets Post Office Savings Bank; 1880–1929 from Sheppard (1971) Table (A)2.2, pp. 144–45.

TSB — total assets Trustee Savings Banks; 1880–1929 from Sheppard (1971) Table (A)2.3 sum of cols. 8 and 12, pp. 146–48.
BIRM — total assets Birmingham Municipal Bank; 1920–1929 from Sheppard (1971) Table (A)2.1, pp. 142–43.
BSOC — total assets building societies; 1880–1929 from Sheppard (1971) Table (A)2.4, pp. 150–52.
INS — insurance companies total assets; 1880–1929 from Sheppard (1971) Table (A)2.5, pp. 154–56. This composite includes life, industrial, accident, bond, employer liability and fire insurance.
FRSOC — total assets friendly societies; 1920–1929 from Sheppard (1971) Table (A)2.8, pp. 162–65.
CSOC — total assets collecting societies; 1920–1929 from Sheppard (1971) Table (A)2.8, pp. 162–65.
PENS — total pension fund assets; while superannuation assets are substantial, Sheppard (1971) includes only those on record with the Registry of Friendly Societies from 1920–1929.

Given the data items listed above, the data set was constructed as follows:

(1) CBA = COMBNK (1880–1929)
(2) SAVA = TSB (1880–1929) + PO (1880–1929) + BIRM (1920–29) + BSOC (1880–1929)
(3) INSA = INS (1880–1929) + FRSOC (1920–29) + CSOC (1920–29)
(4) BANKA = sum of 1–2 above.
(5) FIA = sum of 1–3 above, with PENS (1920–29) added.

Canada

GDP — nominal gross domestic product; 1871–1925 from Urquhart (1986) Table 2.1, pp. 11–15. 1926–1929 from CANSIM series 10011 "gross domestic product at market prices."
IPD — implicit price deflator (1900 = 1); 1871–1925 from Urquhart (1986) Table 2.9, p. 30. 1926–1929 deflator constructed from CANSIM series D30013 and D40646.
POP — population; 1870–1926 from Urquhart (1986) Table 2.9, p. 30. 1926–1929 from CANSIM.
MSTOCK — money stock (M2); 1871–1929 from Bordo and Jonung (1987) worksheets in real terms and converted to nominal basis with IPD (described above).
CBA — total assets commercial banks; 1871–1929 from Neufeld (1972) Appendix B "Canadian assets of chartered banks."
SAVA — total assets savings institutions; 1871–1929 from Neufeld (1972) Appendix B, and are sum of following asset totals: Canadian assets of Quebec Savings Banks 1880–1929; Canadian assets of building societies and mortgage loan companies 1880–1929; local caisses populaires and credit unions 1915–1929; government and post office savings banks 1880–1929; provincial savings institutions 1919–1929.

INSA — total assets insurance companies; 1871–1929 from Neufeld (1972) Appendix B: sum of Canadian assets of life insurance companies 1871–1929, Canadian Assets of fraternal benefit societies 1888–1929, and Canadian assets of fire and marine insurance companies 1871–1929.

INVCOS — total assets investment companies; 1897–1929 from Neufeld (1972) Appendix B, sum of the following: Canadian assets of trust companies 1897–1929; Canadian assets of investment companies 1926–1929 which include closed-end funds and holding companies.

BANKA — total bank assets; 1871–1929 is sum of CBA and SAVA.

FIA — total financial intermediary assets; 1871–1929 is sum of BANKA, INSA, and INVCOS.

MBASE — monetary base; 1871–1929 constructed from Urquhart and Buckley (1965). The construction reflects changing reporting practices of the Canadian government and some approximation in the pre-1913 period. The following series were used:

CURROB — currency outside banks; 1913–1929 from Urquhart and Buckley (1965) series H3.

NOTEU — total Dominion or Bank of Canada notes; 1871–1929 from Urquhart and Buckley (1965) series H16.

NOTEIB — Dominion or Bank of Canada note issue held by banks; 1871–1929 from Urquhart and Buckley (1965) series H14.

CNOTE — total chartered bank note issue; 1871–1929 from Urquhart and Buckley (1965) series H19.

COIN — total subsidiary coin issue; 1901–1929 from Urquhart and Buckley (1965) series H13.

BSPECI — gold and subsidiary coin held in Canada and abroad by chartered banks; 1870–1912 from Urquhart and Buckley (1965) series H214, H197, H180, H161.

BGSC — gold and subsidiary coin held in Canada by chartered banks; 1913–1929 from Urquhart and Buckley (1965) series H113, H137.

FBGSC — gold and subsidiary coin held abroad by chartered banks; 1913–1922 from Urquhart and Buckley (1965) series H156.

GOVDEP — deposits of chartered banks with government against notes; 1891–1929 from Urquhart and Buckley (1965) series H182, H163, H140, H116.

RGOLD — central gold reserves; 1913–1929 from Urquhart and Buckley (1965) series H139, H115.

The monetary base (MBASE) series was then constructed as follows:

1913–1929: CURROB + NOTEIB + CNOTE + GOVDEP + BGSC + RGOLD
1901–1912: NOTEU + CNOTE + COIN + (.61)*BSPECI
1871–1900: NOTEU + CNOTE + (.61)*BSPECI

Note that BSPECI reflects all subsidiary coin and gold held by banks both in Canada and abroad. BGSC and FGSC divide this series between foreign and Canadian amounts from 1913–1922. The best approximation for gold and subsidiary coin in Canadian banks prior to 1913 was constructed by taking the average of BGSC/(BGSC + FGSC) over the 1913–1916 period to approximate the percentage of the bank coin and gold that is held in Canada. This percentage (.61) is then applied to the BSPECI measure from 1871–1912 to approximate BGSC for these years.

Norway

GDP — nominal gross domestic product; 1875–1929 from Mitchell (1992) Table J1, pp. 887–911.

IPD — deflator for GDP (1900 = 1); 1875–1929 constructed from nominal and real GDP series from Mitchell (1992) Table J1, pp. 887–911.

POP — population; 1875–1929 from Mitchell (1992) Table A5, pp. 76–89.

MBASE — high-powered money; 1875–1929 proxied by "bank note circulation" from Mitchell (1992) Table G1, pp. 761–72.

CBD — total deposits in commercial banks; 1875–1929 from Mitchell (1992) Table G2, pp. 773–79.

SAVD — total deposits in savings banks; 1875–1929 from Mitchell (1992) Table G3, pp. 779–90.

Sweden

GDP — nominal gross domestic product; 1875–1929 from Mitchell (1992) Table J1, pp. 887–911.

IPD — deflator for GDP (1900 = 1); 1875–1929 constructed from nominal and real GDP series from Mitchell (1992) Table J1, pp. 887–911.

POP — population; 1875–1929 from Mitchell (1992) Table A5, pp. 76–89.

MBASE — high-powered money; 1875–1929 proxied by "bank note circulation" from Mitchell (1992) Table G1, pp. 761–72.

CBD — total deposits in commercial banks; 1875–1929 from Mitchell (1992) Table G2, pp. 773–79.

SAVD — total deposits in savings banks; 1875–1929 from Mitchell (1992) Table G3, pp. 779–90.

LITERATURE CITED

Andrews, Donald W. K., and J. Christopher Monahan. "An Improved Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimator." *Econometrica* 60 (July 1992), 953–66.

Arellano, Manuel, and Stephen Bond. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Fluctuations." *Review of Economic Studies* 58 (April 1991), 277–97.

Balke, Nathan S., and Robert J. Gordon. "Appendix B: Historical Data." In *The American Business Cycle: Continuity and Change*, edited by Robert J. Gordon, pp. 781–850. Chicago: University of Chicago Press, 1986.

Bencivenga, Valerie R., and Bruce D. Smith. "Financial Intermediation and Endogenous Growth." *Review of Economic Studies* 58 (April 1991), 195–209.

Bencivenga, Valerie R., Bruce D. Smith, and Ross M. Starr. "Transactions Costs, Technological Choice, and Endogenous Growth." *Journal of Economic Theory* 67 (October 1995), 153–77.

Bordo, Michael D., and Lars Jonung. *The Long-Run Behavior of the Velocity of Circulation.* Cambridge: Cambridge University Press, 1987.

Capie, Forrest, and Alan Webber. *A Monetary History of the United Kingdom, 1870–1982: Volume I, Data, Sources, Methods.* London: George Allen & Unwin, 1985.

Engle, Robert F., and Byung S. Yoo. "Forecasting and Testing in Co-Integrated Systems." *Journal of Econometrics* 35 (May 1987), 143–59.

Feinstein, C. H. *National Income, Expenditure, and Output of the United Kingdom, 1855–1965.* Cambridge: Cambridge University Press, 1972.

Friedman, Milton, and Anna J. Schwartz. *Monetary Trends in the United States and the United Kingdom.* Chicago: University of Chicago Press, 1982.

Fuller, Wayne A. *Introduction to Statistical Time Series.* New York: John Wiley, 1976.

Goldsmith, Raymond W. *A Study of Savings in the United States.* Princeton: Princeton University Press, 1955.

______. *Financial Structure and Development.* New Haven: Yale University Press, 1969.

______. *Comparative National Balance Sheets: A Study of Twenty Countries, 1688–1978.* Chicago: University of Chicago Press, 1985.

Greenwood, Jeremy, and Boyan Jovanovic. "Financial Development, Growth, and the Distribution of Income." *Journal of Political Economy* 98 (October 1990), 1076–1107.

Gurley, John G., and E. S. Shaw. "Financial Aspects of Economic Development." *American Economic Review* 45 (September 1955), 515–38.

Johansen, Soren. "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models." *Econometrica* 59 (November 1991), 1551–80.

Jung, Woo S. "Financial Development and Economic Growth: International Evidence." *Economic Development and Cultural Change* 34 (January 1986), 333–46.

King, Robert G., and Ross Levine. "Finance and Growth: Schumpeter Might Be Right." *Quarterly Journal of Economics* 108 (August 1993), 717–37 (a).

______. "Finance, Entrepreneurship, and Growth: Theory and Evidence." *Journal of Monetary Economics* 32 (December 1993), 513–42 (b).

Levine, Ross, "Stock Markets, Growth, and Tax Policy." *Journal of Finance* 46 (September 1991), 1445–65.

McKinnon, Ronald I. *Money and Capital in Economic Development.* Washington: Brookings Institution, 1973.

Mitchell, B. R. *International Historical Statistics: Europe 1750–1988,* 3rd edition. New York: M. Stockton Press, 1992.

Neufeld, E. P. *The Financial System of Canada.* Toronto: Macmillan, 1972.

Osterwald-Lenum, Michael. "A Note with Fractiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics: Four Cases." *Oxford Bulletin of Economics and Statistics* 54 (August 1992), 461–78.

Phillips, Peter C. B., and Pierre Perron. "Testing for a Unit Root in Time Series Regression." *Biometrika* 75 (June 1988), 335–46.

Robinson, Joan. "The Generalization of the General Theory." In *The Rate of Interest and Other Essays.* London: MacMillan, 1952.

Rousseau, Peter L. "The Permanent Effects of Innovation on Financial Depth: Theory and U.S. Historical Evidence from Unobservable Components Models." *Journal of Monetary Economics* 42 (October 1998), 387–425.

Rousseau, Peter L., and Paul Wachtel. "Equity Markets and Growth: Cross-Country Evidence on Timing and Outcomes, 1980–1995." Mimeo, Vanderbilt University, 1998.

Schumpeter, Joseph. *The Theory of Economic Development.* Cambridge: Harvard University Press, 1911.

Schwert, G. William. "Tests for Unit Roots: A Monte Carlo Investigation." *Journal of Business and Economic Statistics* 7 (April 1989), 147–59.

Shaw, Edward S. *Financial Deepening in Economic Development.* New York: Oxford University Press, 1973.

Sheppard, David K. *The Growth and Role of U.K. Financial Institutions, 1880–1962.* London: Methuen, 1971.

Sims, Christopher A., James H. Stock, and Mark W. Watson. "Inference in Time Series Models with Some Unit Roots." *Econometrica* 58 (January 1990), 113–44.

Statistics Canada. CANSIM University Database.

Sussman, Oren. "A Theory of Financial Development." In *Finance and Development: Issues and Experience,* edited by A. Giovannini, pp. 29–64. Cambridge: Cambridge University Press, 1993.

Toda, Hiro Y., and Peter C. B. Phillips. "Vector Autoregressions and Causality." *Econometrica* 61 (November 1993), 1367–93.

Townsend, Robert M. "Optimal Contracts and Competitive Markets with Costly State Verification." *Journal of Economic Theory* 21 (1979), 265–93.

Urquhart, M. C. "New Estimates of GNP, Canada, 1870–1926: Some Implications for Canadian Development." In *Long-Term Factors in American Economic Growth,* edited by Stanley L. Engerman and Robert E. Gallman, pp. 9–94. Chicago: University of Chicago Press, 1986.

Urquhart, M. C., and K.A.H. Buckley. *The Historical Statistics of Canada.* Ottawa: Statistics Canada, 1965.

U.S. Bureau of the Census. *Historical Statistics of the United States: Colonial Times to 1970.* Washington, D.C.: Government Printing Office, 1973.

Wachtel, Paul, and Peter Rousseau. "Financial Intermediation and Economic Growth: A Historical Comparison of the United States, United Kingdom, and Canada." In *Anglo-American Financial Systems: Institutions and Markets in the Twentieth Century,* edited by Michael D. Bordo and Richard Sylla, pp. 329–81. Burr Ridge, Ill.: Business One Irwin, 1995.

LINKED CITATIONS

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Stable URL:
http://links.jstor.org/sici?sici=0012-9682%28199311%2961%3A6%3C1367%3AVAAC%3E2.0.CO%3B2-T

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Christopher A. Sims; James H. Stock; Mark W. Watson
Econometrica, Vol. 58, No. 1. (Jan., 1990), pp. 113-144.
Stable URL:
http://links.jstor.org/sici?sici=0012-9682%28199001%2958%3A1%3C113%3AIILTSM%3E2.0.CO%3B2-P

Literature Cited

An Improved Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimator
Donald W. K. Andrews; J. Christopher Monahan
Econometrica, Vol. 60, No. 4. (Jul., 1992), pp. 953-966.
Stable URL:
http://links.jstor.org/sici?sici=0012-9682%28199207%2960%3A4%3C953%3AAIHAAC%3E2.0.CO%3B2-Q

Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations
Manuel Arellano; Stephen Bond
The Review of Economic Studies, Vol. 58, No. 2. (Apr., 1991), pp. 277-297.
Stable URL:
http://links.jstor.org/sici?sici=0034-6527%28199104%2958%3A2%3C277%3ASTOSFP%3E2.0.CO%3B2-2

Financial Intermediation and Endogenous Growth
Valerie R. Bencivenga; Bruce D. Smith
The Review of Economic Studies, Vol. 58, No. 2. (Apr., 1991), pp. 195-209.
Stable URL:
http://links.jstor.org/sici?sici=0034-6527%28199104%2958%3A2%3C195%3AFIAEG%3E2.0.CO%3B2-3

LINKED CITATIONS

Financial Development, Growth, and the Distribution of Income
Jeremy Greenwood; Boyan Jovanovic
The Journal of Political Economy, Vol. 98, No. 5, Part 1. (Oct., 1990), pp. 1076-1107.
Stable URL:
http://links.jstor.org/sici?sici=0022-3808%28199010%2998%3A5%3C1076%3AFDGATD%3E2.0.CO%3B2-D

Financial Aspects of Economic Development
John G. Gurley; E. S. Shaw
The American Economic Review, Vol. 45, No. 4. (Sep., 1955), pp. 515-538.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28195509%2945%3A4%3C515%3AFAOED%3E2.0.CO%3B2-8

Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models
Søren Johansen
Econometrica, Vol. 59, No. 6. (Nov., 1991), pp. 1551-1580.
Stable URL:
http://links.jstor.org/sici?sici=0012-9682%28199111%2959%3A6%3C1551%3AEAHTOC%3E2.0.CO%3B2-P

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Economic Development and Cultural Change, Vol. 34, No. 2. (Jan., 1986), pp. 333-346.
Stable URL:
http://links.jstor.org/sici?sici=0013-0079%28198601%2934%3A2%3C333%3AFDAEGI%3E2.0.CO%3B2-M

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LINKED CITATIONS

Testing for a Unit Root in Time Series Regression
Peter C. B. Phillips; Pierre Perron
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Stable URL:
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G. William Schwert
Journal of Business & Economic Statistics, Vol. 7, No. 2. (Apr., 1989), pp. 147-159.
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Stable URL:
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Econometrica, Vol. 61, No. 6. (Nov., 1993), pp. 1367-1393.
Stable URL:
http://links.jstor.org/sici?sici=0012-9682%28199311%2961%3A6%3C1367%3AVAAC%3E2.0.CO%3B2-T