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FEDERAL RESERVE BANK OF ATLANTA

MAY/JUNE 1991

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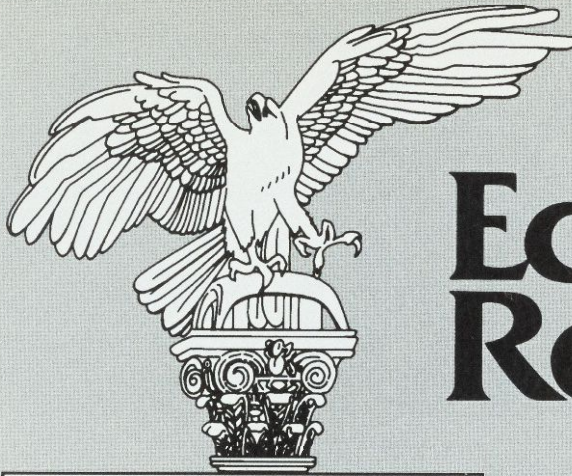
Investigating U.S. Government and Trade Deficits

Some Evidence on the Impact of Quasi-Fixed Inputs on Bank Scale Economy Estimates

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ISSN 0732-1813

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Investigating U.S. Government and Trade Deficits

Ellis W. Tallman and Jeffrey A. Rosensweig

During much of the past decade both the U.S. government and trade deficits grew dramatically, prompting empirical studies to determine whether there is a relationship between the two. Tallman and Rosensweig review casual evidence and economic models supporting the "twin deficits" notion and introduce alternative models that cast doubt on a causal link. Noting that the way researchers have used deficit data in their empirical work influences results, Tallman and Rosensweig conduct statistical tests to determine the appropriate form—either levels or variables measured as changes from the previous period—for representing the data. Using a technique that accounts for dynamic interaction among variables, the authors examine deficit data in levels form, as ratios of GNP. Their findings suggest a causal relationship between government debt and the trade deficit, indicating that fiscal policy could play an important role in balancing U.S. trade accounts.

The 1980s witnessed record-sized deficits of more than \$150 billion on both the U.S. government and trade accounts. The development of these deficits during approximately the same time span prompted frequent allusions to them in business, policy-making, and academic circles as "twin deficits."

For much of the decade, trade imbalances and government budget deficits were major news topics in the business press (see John Greenwald 1984, Mike McNamee et al. 1988, and "Some of My Best Friends Are Deficits" 1990). The media put forward an image of the United States as a debtor nation, borrowing domestically and internationally to support extravagant spending behavior by the government as well as the private economy. Meanwhile, the issue of growing debt, both the government's and the nation's as a whole, also became central in policy debates as numerous analysts questioned the long-term viability of economic progress with a growing external debt. With the change in status of the United States from net foreign creditor to debtor nation, policymakers and economists face the challenge of dealing with a possible decline in living standards.

By 1983 a casual explanation directly linking the two mushrooming deficits—the twin deficits story—was gaining wide exposure.¹ The notion suggests that the two series' large movements in the same direction occurred because of an underlying interrelationship. A combination of existing theory on international economics and what appeared to be compelling empirical facts observed

primarily in the United States during the 1980s gave rise to the idea. The validity of the hypothesized relationship between these two deficits is a crucial issue as the United States faces ongoing massive fiscal deficits into the 1990s and the foreseeable future.

Following a presentation of some of the visual evidence that prompted the twin deficits explanation, this article includes a more rigorous examination of existing theory and of scholarly investigation into the linkages between government and trade deficits. It concludes with a discussion of how the authors' original research contributes to this academic and policy debate.

Origins of the Twin Deficits Idea

Briefly, the twin deficit story as it pertains to a flexible exchange rate regime (it will be treated more fully in a later section) claims that an increased government deficit places incipient upward pressure on real, or inflation-adjusted, interest rates, attracting foreign capital in search of these higher returns. This increased flow of capital into the United States prompts the real exchange rate to appreciate, raising

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the dollar's foreign exchange value. In turn, the higher exchange rate inhibits exporting by making U.S. products costlier abroad. A higher-valued dollar also results in relatively less expensive—and therefore more attractive—imported goods. Falling exports and rising imports eventually move the trade balance toward deficit.²

The twin deficits hypothesis is one possible explanation of the comovements portrayed in data such as that shown in Charts 1 and 2. However, such an informal method of inference does not provide sufficient evidence of a fundamental underlying relationship. Further cursory analysis, performing straightforward statistical analysis (standard correlation techniques) on these two deficit series to explore basic relationships among the data, reveals that the two series have positive correlation contemporaneously, with correlation coefficients of approximately 0.7 in level terms and 0.34 in ratios to nominal GNP (see Table 1). These findings suggest that the variables move together to some extent over time, consistent with the comovement displayed in Charts 1 and 2.

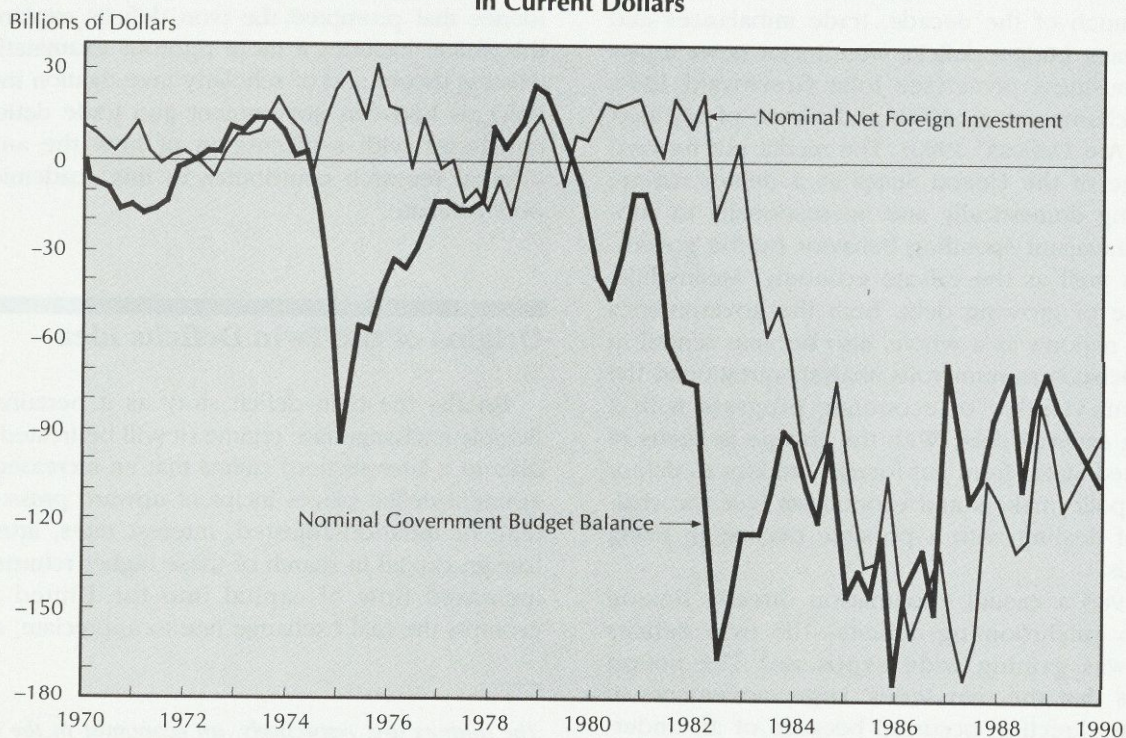
Chart 1 shows the gross facts regarding the two deficits, facts that underlie the initial appeal of the

hypothesized relationship between them. The two data series—net foreign investment balance and total government budget balance—both moved dramatically into deficit during the 1980s; the government balance turned radically into unprecedented deficits (in nominal magnitudes) prior to similar movements in the trade measure.³

The striking aspect of Chart 1 is the apparently extreme magnitude of both deficit measures during the 1980s. However, because these deficits are measured in level terms in current face-value or nominal dollars, observed associations between these deficit magnitudes may not be based on a structural interrelationship between the data series.

Many macroeconomic series tend to grow over time because of inflation as well as economic growth. Therefore, economists often scale or normalize nominal dollar totals by dividing them by a nation's nominal gross national product (GNP). Taking each deficit series as a ratio to nominal GNP accounts for economic growth and removes any inflationary bias from using nominal magnitudes, allowing clear focus on the specific relationship between the deficits. Most of the study uses deficit measures scaled as a ratio to GNP.

Chart 1
Total Government Budget Balance and Net Foreign Investment
in Current Dollars



Source: All charts and tables were calculated by the authors using data from the National Income and Produce Accounts (NIPA), U.S. Department of Commerce, Bureau of Economic Analysis.

Does the apparent relationship of the two deficits remain after adjusting them for GNP? Chart 2 plots the two measures as ratios to GNP; the fiscal and trade deficits still appear to be related, although the similarities in movement are less striking. What is noteworthy, however, is the lengthy duration of substantial deficit in the 1980s that the two series have in common.⁴

Consistent with Chart 1, Chart 2 shows that the government budget balance ratio to GNP turns sharply into deficit immediately before the similar downturn in the trade balance ratio (to GNP) during the early 1980s. This empirical observation likely enhanced the popularity of the twin deficit explanation for the conjunction of record-sized deficits. The explanation not only refers to a relationship between the deficits but suggests a causal impact running from the government to the trade deficit.

To investigate the possibility of lead-lag relationships, cross-correlation techniques, which measure the linkage of one variable's movement with that of another a number of periods before or after observation of the initial variable, have been used. Table 1 presents the cross-correlations for various quarterly lags and leads spanning twelve periods in either di-

rection. The table indicates large positive correlations of movements in trade and those in the government budget deficit several quarters earlier the largest correlations exist roughly at the point when the government deficit measure is lagged seven quarters relative to the trade deficit: 0.87 for deficits measured as nominal levels and 0.72 for deficits as ratios to nominal GNP. To compare movements in the government balance with succeeding movements in trade, Chart 3 shows the government deficit ratio lagged seven quarters in relation to the trade deficit ratio.

As expected, given the pattern found in the cross-correlations, Chart 3 shows an even stronger relationship between the two deficit series than Charts 1 and 2 indicate. However, like the visual and statistical evidence presented earlier, this information is still only casual evidence that increased government deficits may lead to larger trade deficits.

Theoretical Support

In addition to the suggestive casual evidence, there are theoretical frameworks that support the existence

Chart 2
Total Government Budget Balance and Net Foreign Investment
Relative to Nominal GNP

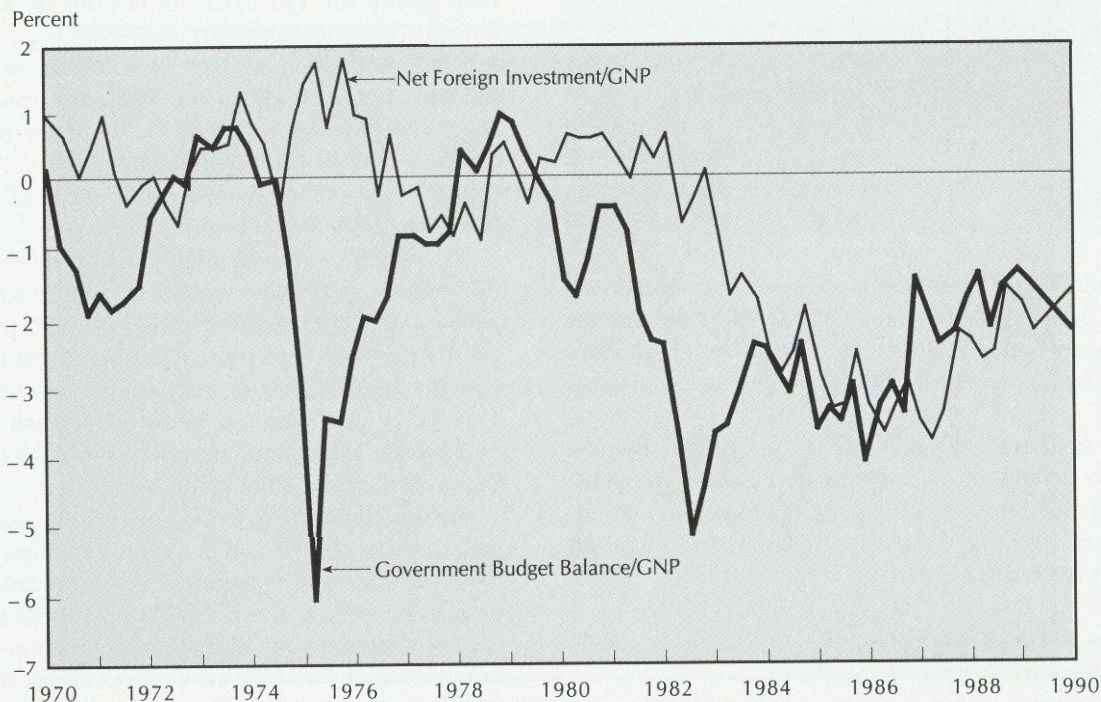


Table 1
Correlations and Cross-Correlations of
U.S. Government Deficits
and Trade Deficits

Cross-Correlations of Trade Deficits
with Quarterly Leads (-) and Lags of Government
Deficits*

Lead/Lag	Levels	Ratios
-12	.161	.067
-11	.202	.079
-10	.255	.083
-9	.313	.093
-8	.346	.092
-7	.375	.092
-6	.424	.109
-5	.488	.168
-4	.529	.210
-3	.558	.245
-2	.611	.270
-1	.662	.306
0	.698	.339
1	.707	.389
2	.756	.458
3	.815	.559
4	.832	.608
5	.837	.662
6	.854	.685
7	.867	.724
8	.844	.709
9	.813	.690
10	.794	.660
11	.776	.648
12	.731	.582

* Cross-correlations at 0 are contemporaneous correlations.

of a twin deficits relationship. Combined, these two factors have provided ample motivation for further inquiry into the validity of a twin deficit notion, which has been the focus of recent academic research.

The frequently hypothesized relationship between the two deficits is often buttressed by the presence of both deficits in a variant of the core savings/investment identity from the National Income and Product Accounts (NIPA):

$$\text{Gross National Savings} = \text{Gross Investment by the Nation.} \quad (1)$$

This identity can be disaggregated into a familiar form:

$$S_p + S_g = I + NFI, \quad (2)$$

where S_p is private savings, S_g is government savings (total government budget balance), I is private domestic investment, and NFI is the nation's net foreign investment. The additive inverse of NFI is net foreign borrowing, which in this research is considered a theoretically pleasing broad measure of the trade deficit. Thus, net foreign borrowing ($-NFI$) is used as the trade deficit measure, $TDEF$. Employing the additive inverse of government savings ($-S_g$) as the government deficit ($GDEF$), the following relationship suggests the twin deficits relationship:

$$TDEF = GDEF + (I - S_p). \quad (3)$$

The identity above provides a useful framework for analyzing the proposed twin deficits relationship. While the framework does not indicate any behavioral or temporal relationships, it predicts that any government deficit increase not offset by changes in the private-sector savings/investment balance will affect the trade deficit. The trade deficit may not respond if private savings changes to offset government deficit movements. The crucial question is whether or not government deficit changes are fully offset by private savings responses.

A model of international economics proposed by Robert Mundell and J. Marcus Fleming in the early 1960s provides one theoretical perspective that may help justify the twin deficits notion. In a world of capital mobility and flexible exchange rates, the Mundell-Fleming model predicts that increased government budget deficits put incipient upward pressure on domestic interest rates, inducing capital inflows that lift the foreign exchange value of the dollar. After a time lag, the higher value of the dollar retards exports and stimulates imports.

According to the Mundell-Fleming model, a positive relationship exists between government deficits and trade deficits because, it is assumed, people implicitly perceive government bonds issued to finance deficit expenditures as increasing their net wealth. Thus, they do not see a need to increase their current private savings to cover future tax liabilities arising from the deficit financing.

Recent theoretical work concerning government fiscal policy suggests that private savings behavior may change in the presence of increased budget deficits. Robert J. Barro (1974) reintroduced a concept, referred to as Ricardian equivalence (in acknowledgement of the contribution by David Ricardo), suggesting that people recognize that financing tax cuts by bonds merely alters the time profile of taxation. In this view, rational people re-

alize that a tax cut financed by bonds does not increase their net wealth: while current taxes are reduced, future tax liabilities, in "present value" terms, increase by the same amount. As a result, a tax cut resulting in a government budget deficit may induce rational individuals to save an additional portion of their income.⁵ The Ricardian equivalence proposition suggests that the net private savings term in the savings/investment identity increases to offset government deficit movements. If Ricardian equivalence holds, then private savings rather than the trade deficit (net foreign borrowing) finances the increased government deficit. There is no anticipation of a twin deficits linkage in this framework.⁶

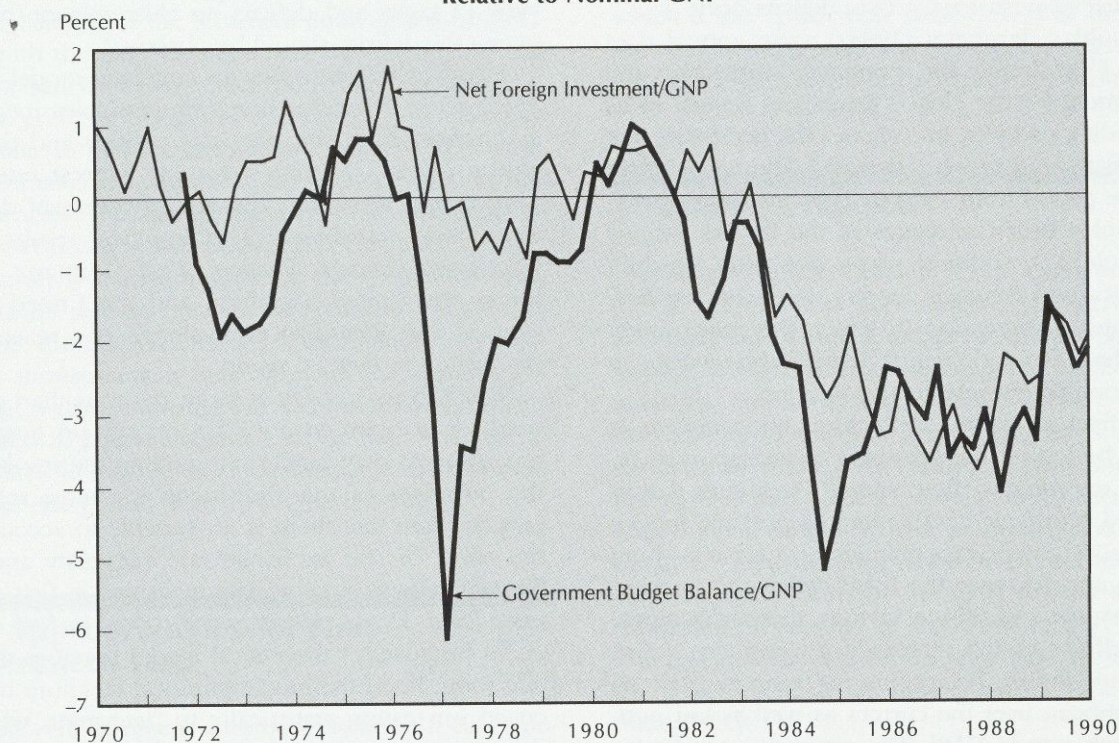
The implications of the Mundell-Fleming approach contrast clearly with those of Ricardian equivalence in regard to the relevance and validity of a twin deficits relationship. Among the numerous theoretical approaches to open-economy macroeconomics, these two were selected as frameworks for interpreting the empirical analysis because of their prominence in the discipline and their sharply contrasting conclusions.

Research Findings

Recent economic research has produced a substantial body of empirical literature employing rigorous econometric estimation techniques to test the validity of the twin deficits hypothesis. Nonetheless, the current body of evidence does not yield a consensus on the relationship between government and trade deficits. Some studies using a Mundell-Fleming framework indicate that the twin deficit notion is consistent with the data. In contrast, other studies, finding no underlying relationship between government and trade deficits, are consistent with the predictions of Ricardian equivalence.

How did the empirical work lead to such diametrically opposed conclusions? The following summaries of selected, representative empirical studies include some possible explanations for such varying results and implications. Clearly, certain issues are of primary importance—for example, the choice of appropriate data series and data samples (periods) for examination. These and other important issues are emphasized in the following discussion of existing

Chart 3
Government Budget Balance (with Seven Lags) and Net Foreign Investment
Relative to Nominal GNP



empirical research into whether the twin deficits notion fits the evidence.

Stephen M. Miller and Frank S. Russek's (1989) empirical work is concentrated on two subperiods of post-World War II U.S. data—one subsample associated with the fixed exchange rate period (1946:Q1 to 1971:Q2) and the other generated during years of flexible exchange rates (1971:Q3 to 1987:Q2). The researchers use measures of the trade and government deficits in nominal levels as well as in ratios to nominal GNP. Only in the flexible exchange rate period do their results support the twin deficit notion for *both* deficit levels and deficit ratios. Thus, Miller and Russek present evidence suggesting a causal impact of government deficits on trade deficits during the floating rate era.⁷

Despite rigor and attention to detail in their study, Miller and Russek, using bivariate analysis of two deficit measures, do not address the interrelationships between government and trade deficits and other relevant explanatory variables. The observed relationship between the two deficit measures does not necessarily reflect an underlying twin deficits structure because one or more other variables may explain the apparent comovements in both series.⁸ Research into the twin deficits story requires explicit examination of the entire set of variables that may relate meaningfully to trade and government deficits behavior. A number of other studies estimate relationships between a selection of additional variables that appear relevant for the twin deficits story.

B. Douglas Bernheim (1988), using annual data from the Organisation for Economic Cooperation and Development for the United States and several of its major trading partners, investigates the possibility that fiscal deficits lead to trade deficits.⁹ The data sample spans the period from 1960 to 1984, and the estimations employ broad measures of the deficits relative to the relevant nominal gross domestic product (GDP) measures for each country. Bernheim explicitly estimates a regression in which the government deficit affects the trade deficit, but not the reverse, an assumption that restricts his specification.

The effect of budget deficits on trade deficits is likely to be less in the presence of unemployed resources, according to Bernheim.¹⁰ He argues that in weakened economic conditions it is possible for additional government expenditures or a tax cut—both of which may increase the fiscal deficit—to increase private income and private savings, thereby minimizing the effects of the increased government deficit on the trade deficit. To account for business-cycle effects, Bernheim uses the current as well as last period's growth rate in GDP. The estimation results for the United States suggest that the fiscal deficit does

significantly affect the trade deficit. Evidence for the trading partners—except for Japan, where no relationship appears to exist—is also consistent with the twin deficits story.

While it provides some evidence for the existence of a twin deficits relationship across nations, the Bernheim study is limited by the absence of additional potentially important variables, namely the real exchange rate and the real interest rate. Because they are not included as explanatory variables in Bernheim's estimations, some aspects of a twin deficit investigation remain unresolved.

Another criticism of earlier studies, aside from excluding important variables from the estimations, is that there is no explicit theoretical structure generating the empirical models for estimation. Rather, those previous studies are centered on a proposed relationship suggested by the Mundell-Fleming framework. The lack of a formal structure as a foundation for the empirical work leaves researchers with few hypotheses that can be rejected.

Recent research by Paul Evans (1989) uses an abstract model economy in which people (agents) make decisions rationally and over a lifetime horizon; his model and theoretical framework provide a more rigorous structure for empirical estimation than has been seen in prior research. Primarily, the model generates a testable hypothesis about the relationship between fiscal deficits and trade deficits—specifically, that in a world incorporating a Ricardian view of taxes and deficits no clear relationship between the deficits should be observed.

Evans (1989) estimates an empirical model that is specified in first-difference form (variables measured as changes from the previous period) and that includes a real (inflation-adjusted) interest rate, real government spending, and real government debt as explanatory variables.¹¹ The empirical results using data from Canada, France, West Germany, Italy, Japan, the United Kingdom, and the United States suggest that Ricardian equivalence is a reasonable abstraction in the real world.

While Evans's study is more rigorous than earlier work, it is open to criticism on certain empirical grounds that may hinder interpreting the results. For the purposes of this discussion the most relevant criticisms are that there is no variable to account for the effect of real exchange rate variability and that the estimations employ data measures in first difference form. Evans estimates the model in first differences because his theoretical model specifies data in that form. Recently, much empirical literature has focused on testing statistically to determine whether data are more appropriately modeled in levels than in first differences. The issue becomes most relevant

when results achieved by using first-differenced data have implications different from those of tests involving data specified in levels. In Evans's case the use of first-differenced data is simply intrinsic to the model, but, as discussed below, the question of whether it is more appropriate to model in levels or in differences can be addressed explicitly and prior to estimation of an empirical model, as in Jeffrey A. Rosensweig and Ellis W. Tallman (1991). The topic is addressed more fully in the next section.

Walter Enders and Bong-Soo Lee (1990) follow Evans in modeling more rigorously the economic behavior underlying the observed relationship between the trade and government deficits.¹² Using quarterly data on the United States from 1947:Q3 to 1987:Q1 for real consumption, real government spending, real public debt, real interest rates, the external current account, and the exchange rate, the researchers apply an estimation methodology known as vector autoregression (VAR). Through techniques that account for dynamic interaction among variables, the methodology allows estimation of relationships without imposing very restrictive assumptions on the specification. Essentially, a VAR specifies that each variable in a system or model is determined by its own lagged values (an autoregression) and the lagged values of all other variables in the system. Despite what appears to be an important effect of the changes in the real public debt on the current account, the model suggests no direct relationship. An explicit test of the Ricardian equivalence proposition with the data cannot reject the hypothesis that budget deficits do not affect the current account.

The criticism of Enders and Lee's (1990) research is similar to that lodged against Evans (1989). First, the estimates are performed on data specified in first differences. The specification in first differences is only a criticism if statistics suggest that such a transformation is inappropriate for the data. However, Enders and Lee do not provide statistical evidence to support the first difference transformation. An additional shortcoming is that, although the nominal exchange rate is among the explanatory variables included in Enders and Lee's work, their measure of this variable exhibits no movement for the fixed exchange rate period from 1947:Q3 until 1973.

The Appropriateness of First-Differenced Data

One vein of recent empirical literature focuses on statistical tests that examine whether data are more appropriate for model estimation in first differences

or in level form. Statistical techniques are used to determine whether data are stationary in levels—that is, whether the data series' statistical properties, such as means and variances, do not change over time. That quality is an important one to identify because nonstationary data employed in estimation techniques produce statistics that should not be analyzed in the same way as those generated from stationary data. In many cases, estimations using nonstationary data series produce results that lead to incorrect statistical inferences.

Clearly, the answer to the question of whether data used in an examination of twin deficits should be in levels or in first differences is more pertinent if estimation results using first-differenced data lead to inferences that are different from those drawn from data in level form. Among the empirical studies surveyed above, those that support the twin deficits notion tend to have either deficit levels or deficit ratios to GNP as the main variables under study. On the other hand, researchers who found no twin deficits relationship were more often investigating data transformed into first differences.¹³ These patterns suggest that the particular data transformation does significantly color the results of inquiry into the twin deficits phenomenon; the choice of data transformation influences whether evidence supports or contradicts the twin deficits story.

The research discussed below, detailed in Rosensweig and Tallman (1991), explicitly considers which is the appropriate form (levels or differences) for representing the data in estimation. Statistical tests guide the choice of data transformation.

Additional Evidence

Rosensweig and Tallman (1991) examine the empirical relationship between the U.S. government and trade deficits using a data set that includes a real interest rate measure as well as a real exchange rate measure. The additional variables capture common movements in trade and government deficits that result from these two variables. Like Enders and Lee (1990) and John D. Abell (1990), Rosensweig and Tallman employ vector autoregression methodology.¹⁴ Additional evidence presented below concerning support for the twin deficits story corroborates the results in Rosensweig and Tallman. The research focuses on the idea that movements in the government deficit have a causal impact on the trade deficit.

The data set employed consists of quarterly observations on the variable measures listed above from

the period of flexible exchange rates, 1971 to 1989. The trade and government deficit variables are measured as ratios to GNP to account for growth and inflation, as discussed above.

Despite contrasting evidence from typical Dickey-Fuller tests for stationarity, the Rosensweig and Tallman (1991) study shows that there is statistical support for estimating the VAR in level form rather than as differences.¹⁵ Hence, in the research reported here, levels of the four variables (with the deficit series as ratios to GNP) in a VAR with eight lagged quarterly values of each series have been used.¹⁶ Each part of the investigation takes place within the paradigm of VAR, employing the set of four variables described above.

According to the twin deficits notion, movements in the government deficit precede similar changes in the trade deficit, implying that past government deficits would explain a substantial portion of the movements in subsequent trade deficits. This assertion is tested using VAR, which is well suited for such inquiries, by determining whether the statistical evidence supports the hypothesis that the other variables are unaffected by past movements in the government deficit.¹⁷ If the statistics suggest that the movements in other variables are not affected by past movements in the government deficit, the implication would be that the government deficit movements do not precede the movements in the other variables.

The estimated statistics imply rejection of the proposed hypothesis at conventional significance levels, as shown in Table 2, indicating that the government deficit has an important explanatory role and appears to precede statistically the movements in the trade deficit. The implications of these statistics are consistent with evidence from the simpler single-equation estimations also presented in Table 2, where the F-statistics show that *GDEF* is important for explaining *TDEF* movements.

For completeness, the importance of lagged values of *TDEF* on the remaining system of variables is examined by testing statistically for whether the model's other variables respond to trade deficit (as ratio to GNP) movements. The twin deficits story suggests that past movements of the trade deficit should show no impact upon subsequent movements of the other variables.

If the statistical evidence suggests that past trade deficits do have substantial effects on the other variables' subsequent values, then the inferences from the finding that government deficit movements precede trade deficit changes is weakened. Instead, the indication would be that the trade and government deficit variables each affect the other. In formal

Table 2
Block-Exogeneity Tests and
Single-Equation Block F-Tests

Tests of the Multivariate Hypothesis

GDEF (ratio to GNP) lags are unimportant to the VAR system

$\chi^2(24) = 41.75$
Critical Value 36.415 at 5 percent significance level.
Reject the null hypothesis. *GDEF* lags are important to the VAR system.

TDEF (ratio to GNP) lags are unimportant to the VAR system

$\chi^2(24) = 27.94$
Critical Value 36.415 at 5 percent significance level.
Cannot reject the null hypothesis that *TDEF* lags are unimportant for the VAR system.

Single-Equation Block F-Tests*

Variable	F-Statistic on 8 lags	Significance Level
Dependent Variable - <i>GDEF</i>		
<i>GDEF</i>	8.34	.00
<i>REALI</i>	.66	.72
<i>REALEX</i>	1.32	.26
<i>TDEF</i>	.84	.57
Dependent Variable - <i>REALI</i>		
<i>GDEF</i>	2.08	.07
<i>REALI</i>	4.71	.00
<i>REALEX</i>	.42	.90
<i>TDEF</i>	1.98	.08
Dependent Variable - <i>REALEX</i>		
<i>GDEF</i>	1.73	.13
<i>REALI</i>	2.22	.05
<i>REALEX</i>	15.77	.00
<i>TDEF</i>	1.70	.13
Dependent Variable - <i>TDEF</i>		
<i>GDEF</i>	3.06	.01
<i>REALI</i>	1.07	.40
<i>REALEX</i>	.97	.47
<i>TDEF</i>	4.98	.00

* *REALI* indicates real interest rates; *REALEX* indicates real exchange rates.

terms, if the statistics imply rejection of the hypothesis that lagged values of the trade deficit have no impact on the other variables, then the statistics would suggest bidirectional causality.

The statistics generated from the test on the trade deficit measure suggest that past trade deficits do not affect subsequent movements in other variables.¹⁸ Results from tests of the single-equation restrictions (tested by F-statistics and presented in Table 2) coincide with those of the multivariate test. Overall, the evidence suggests that trade deficits have little effect on the subsequent behavior of the system's variables. Both the statistical evidence presented above and the findings of Rosensweig and Tallman's (1991) empirical work point toward the existence of a twin deficit relationship in U.S. data.¹⁹

Conclusion

The movement of both the U.S. fiscal and external trade accounts into substantial, persistent coinciding deficits has become an often noted or bemoaned phenomenon. This joint, precipitous slide into deficits during the 1980s, combined with an apparent temporal relationship whereby fiscal changes precede trade balance movements, led to the development of a popular "twin deficits" story. This explanation has relied on casual evidence to assert a causal influence of the government deficit on subsequent trade deficits.

The notable gross facts of dual deficit expansion underlying the widely popular twin deficit hypothesis has been further backed up by certain economic

frameworks that lend theoretical underpinnings to the notion. However, other frameworks, stemming from a Barro-Ricardian theory, are less supportive of the possibility that there is a truly causal linkage between the deficits. The crucial nature of large and persistent deficits in the U.S. government budget and external accounts, the seemingly compelling evidence of their coincidence during the 1980s, and the uncertainty arising from theoretical alternatives about their potential causal linkage have stimulated intensive empirical scrutiny of the twin deficit notion's validity.

The evidence from a range of detailed studies has been mixed or inconclusive. Those starting from a Ricardian framework (such as Evans 1989 and Enders and Lee 1990) find Ricardian results; that is, they find little support for a clear link between the two deficits. However, many of these studies that fail to support the twin deficits idea use particular data transformations (first differences). In contrast, other studies (for example, Bernheim 1988 and Miller and Russek 1989) present evidence in favor of a twin deficit explanation.

The original research reported here was based on an extensive data set and a relatively unrestricted vector autoregression methodology. Further, the deficits data were examined in levels form (as ratios of GNP). This crucial choice of data transformation—versus first differences—was motivated by tests for stationarity of the data. The results provide clear evidence favoring the validity of a twin deficits notion.²⁰ Clearly, if, as the evidence suggests, government deficits lead or influence subsequent trade deficits, then fiscal policy could well have an important role to play in any attempt to bring the U.S. trade accounts toward balance.

Notes

1. See, for example, Feldstein (1983), Laney (1986), and Volcker (1984).
2. Feldstein (1983), Laney (1986), and Volcker (1984) are useful references for the story.
3. The two data series are net foreign borrowing (additive inverse of net foreign investment), a broad measure of the trade deficit, denoted as *TDEF*, and the total government deficit (additive inverse of government balance) as the government deficit series, denoted as *GDEF*. These series are examined on a quarterly basis for the period 1971:Q1 to 1989:Q4, from essentially the beginning of the flexible exchange rate regime under which the large trade and government deficits of the 1980s developed.
4. In ratio form, the government deficit reached 6 percent of nominal GNP in 1975 during the deep recession in 1974-75. In 1982 the deficit-to-GNP ratio approached 5

- percent again during a recessionary period, then remained in the 3 percent to 4 percent range throughout the recovery and expansion years as well. Government budget deficits are likely during recessions because, as incomes shrink, tax revenues decline and government outlays for unemployment compensation and the like rise. These "automatic stabilizers" increase the government deficit in ways that may have little to do with the trade deficit and its movements. This recessionary phenomenon is likely to appear again during 1991.
5. In a simple economic model, the Ricardian equivalence proposition predicts that agents will save the tax cut so that the interest proceeds will cover increased tax liabilities in the future.
6. The Ricardian view does not imply that a twin deficit phenomenon cannot be observed in data. The proposition suggests, though, that there are no behavioral or

- structural underpinnings to the observation of twin deficits. The main empirical difficulty in distinguishing between Mundell-Fleming and Ricardian implications is that if government deficit movements are correlated with changes in government spending behavior, the twin deficits may appear to be consistent with Mundell-Fleming and also to behave consistently with a Ricardian view. This situation, referred to as observational equivalence, may arise because of the Ricardian view that government spending behavior affects private consumption decisions by reducing the amount of output available for private consumption. Government choice of financing method—debt versus taxes—does not alter the amount of output available for private consumption and therefore does not affect perceived wealth.
7. The researchers present empirical evidence about whether the government deficit “Granger causes” the trade deficit. Granger causality is a statistical notion that innovations in one variable precede innovations in another variable. The inferences drawn from Granger causality tests can be controversial. However, the statistical evidence is consistent with the theoretical implications presented in the Miller and Russek article.
 8. Darrat (1988) finds bidirectional Granger causality between the government deficit and the trade deficit in estimates that use an assortment of additional explanatory variables. Also, he estimates the relationship using one data sample that mixes data generated during both the fixed and flexible exchange rate regimes.
 9. The countries he studies are Canada, Japan, Mexico, West Germany, the United Kingdom, and the United States.
 10. This point relates to the argument above that business-cycle downturns affect the government budget deficit in ways that probably do not influence the trade deficit.
 11. The model includes the real government spending variable because the theory suggests that government spending rather than the method of financing government spending affects private consumption decisions (see note 5). Also, Evans (1989) discusses measurement error in the existing current account data that fails to account for the increased market value of U.S. investment abroad. For more detail on this issue see Dewald and Ulan (1990).
 12. Abell (1990) estimates a VAR system with several relevant explanatory variables. Using first-differenced data, he finds little support for the government deficit as a primary explanatory variable for the trade deficit measure. The results suggest the absence of the causal underpinnings of the twin deficit story. It is notable that the data sample—monthly observations from 1979 to 1985—presents only a limited picture of the historical behavior of the two deficits and the related variables.
 13. It is also important to note that Evans (1989) and Enders and Lee (1990) employ government spending variables and measures of the real public debt rather than only measures of the fiscal deficit, as in the previous studies. The model implications suggest the relevance of the government spending measures for the estimates.
 14. Runkle (1987) criticizes the use of VAR techniques without providing some mechanism to infer statistical significance of the results. Rosensweig and Tallman (1991) provide confidence intervals for the relevant statistical output.
 15. Rosensweig and Tallman (1991) employ Monte Carlo integration techniques to estimate a Bayesian posterior probability for the stationarity of the data in level form. Results suggest that the model should be specified in levels.
 16. A VAR with six lags produced statistics with the same inferences as those presented in the text.
 17. A block exogeneity test, a multivariate test that examines whether the regressions for all the remaining variables are (statistically) significantly changed by removing the lagged values of the government deficit (to GNP) ratio from all regressions, is used. The chi-square statistic with 24 degrees of freedom of 40.9 suggests rejection of the null hypothesis that *GDEF* lags are unimportant at the 5 percent significance level.
 18. The chi-square statistic for 24 degrees of freedom of 27.94 does not allow rejection of the null hypothesis at the 5 percent significance level.
 19. See Rosensweig and Tallman (1991) for more detailed attention to issues like the percentage of variance explained, the direct impact on particular variables of shocks to other variables, and the dynamic effects of shocks.
 20. These findings do not contradict Ricardian equivalence because the specification does not allow a direct test of Ricardian hypotheses.

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Some Evidence on the Impact of Quasi-Fixed Inputs on Bank Scale Economy Estimates

William C. Hunter and Stephen G. Timme

Studies of bank production and costs have increased understanding of the production process in financial institutions and influenced public opinion about banking consolidation. However, the robustness of these studies' conclusions has not been established with models that account for the quasi-fixed nature of some bank inputs. Hunter and Timme report on their own analysis comparing bank production function estimates using variable inputs with those that allow some inputs to change only after a time lag. Including quasi-fixed inputs in specifications, the authors conclude, enhances the statistical accuracy of bank cost function analysis but does not substantially alter policy conclusions that arose from earlier studies. As the banking industry evolves, empirical enhancements like those the authors discuss may help policymakers target prescriptions more effectively.

Public policy concerning commercial bank product deregulation, geographic expansion, and consolidation relies heavily on empirical analyses of bank production and cost functions. Policy questions involving bank expansion and consolidation generally center on whether or not larger banks, merely because of their size, are more efficient than smaller banks, while the crux of product deregulation issues is whether banks that are allowed to offer a wide variety of financial services under one corporate banner enjoy lower costs because of certain economies resulting from multiproduct production. Because the absence or presence of these economies is essentially an empirical question, it is easy to understand the policy significance of empirical literature examining bank production and costs.

The seminal studies by Stuart Greenbaum (1967) and Fredrick Bell and Neil Murphy (1968), and, more recently, the papers by George Benston, Gerald Hanweck, and David Humphrey (1982), Jeffrey Clark (1984), Thomas Gilligan and Michael Smirlock (1984), Allen Berger, Hanweck, and Humphrey

(1987), William C. Hunter and Stephen G. Timme (1986, 1991), Douglas Evanoff (1988), Colin Lawrence (1989), and Hunter, Timme, and Won Keun Yang (1990), among others too numerous to mention, have all provided valuable empirical evidence related to these efficiency questions.¹ Despite their sometimes seemingly conflicting results, these studies have increased understanding of the production process in financial firms. In addition, this voluminous empirical literature has been influential in solidifying public opinion about banking expansion and consolidation and, as a result, is likely to influence the evolution of the U.S. banking industry.

Public policy prescriptions emanating from the empirical production and cost function literature have been generally consistent. For example, the consensus of the most rigorous studies is that there are indeed significant scale economies at small banks (total assets of \$50 million to \$100 million) and small but significant diseconomies at the largest banks (total assets exceeding about \$25 billion). The results imply that banks having total assets

within the \$50 million to \$25 billion range incur roughly similar average costs of producing basic banking products or services. In economic terms, a relatively flat industry long-run average cost curve prevails over a wide range of asset sizes. An obvious policy implication of this pattern is that consolidations involving very small banks (less than \$50 million in assets) that create postmerger firms within this \$50 million to \$25 billion asset range should be encouraged because significant scale economies can be realized. Consolidations of banks already within this range that produce postconsolidation organizations remaining in the same size range would appear to be innocuous except when excessive market concentration results. Even in the latter case, significant diversification, customer convenience, and product and cost innovation benefits and advantages quite possibly will offset any potentially negative effects.²

Although the above conclusions have been found to be robust across studies employing different statistical methodologies, data definitions, output measures, periods, and number of products (outputs) examined, this robustness has not been explicitly established with respect to models that recognize the quasi-fixed nature of many bank inputs.

The purpose of this article is to report on the authors' basic research examining the robustness of bank scale economy estimates derived from a specification or model that explicitly recognizes the quasi-fixed nature of some inputs into the bank production function.³ The analysis directly compares estimates of bank cost functions that assume completely variable inputs with those that take into account the quasi-fixed nature of core deposits and bank branches for the period from 1984 through 1987.

If the short-run fixity of bank inputs truly affects the efficiency of bank production, then policy recommendations made on the basis of results obtained from models that ignore these fixities could be called into question. On the other hand, if the research findings prove to be robust when quasi-fixed inputs are recognized, then the conclusions found in the bank scale economies literature summarized earlier are further strengthened.

The Nature of Fixed or Quasi-Fixed Inputs

The production characteristics of a firm can be summarized by its short-run or long-run production or cost functions. In economic theory the short run is defined as the period in the production process

during which certain factor inputs (that is, the fixed or quasi-fixed inputs) cannot be changed. The long run is the period during which all factor inputs can be varied. While a production function simply depicts the relationship between the output of a good and the inputs (factors of production such as labor, physical capital, and the like) required to make that good, the cost function depicts the relationship between the total production cost and the prices of the inputs required to produce a good (that is, the factor prices). The long-run and short-run modifiers simply establish the degree to which a firm can change the amounts of inputs employed as it attempts to meet profit objectives.

In analyzing a firm's short-run optimizing behavior—profit maximization or cost minimization—it is assumed that some factor inputs cannot be varied. On the other hand, the underlying assumption of long-run analysis is that all factors of production are completely variable and thus can be employed at their long-run equilibrium (cost effective or profit maximizing) levels. Depending on the firm being described, production functions can be of a single- or multiproduct nature.

The short-run fixity of some inputs such as physical capital (for example, buildings, branches, and computer systems) has long been acknowledged in economic theory. Despite this fact, extant studies of bank scale economies assume all inputs to be completely variable, adjusting instantaneously to their long-run equilibrium levels.⁴ Furthermore, there are reasons to believe that short-run fixities extend beyond pure physical capital to include factors related to transactions and information costs. For example, the notions of "core deposits" (interest-rate insensitive retail deposits) and the "bank-customer relationship" exhibit characteristics traceable to fixity of bank factor inputs and transactions and information costs.

Core Deposits, Customer Relationships, and Branches

As noted above, core or retail deposits are an example of a bank input with quasi-fixed characteristics.

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Mark Flannery (1982) has argued that such deposits should be considered quasi-fixed inputs because both the bank and its customers incur set-up costs or transaction-specific investment costs when opening new accounts. Flannery has shown that because of these investments a bank is less likely to reduce retail deposits during times when, at the margin, these deposits are not needed but are expected to be needed in the future. As a result, the rate paid on interest-bearing retail deposits during these periods may exceed that paid on purchased funds (for example, negotiable certificates of deposits).

Elsewhere in the literature (see, for example, Gary Becker 1962, Walter Oi 1962, and Donald Parsons 1972) it has been noted that when trading partners incur significant set-up costs, these common expenses provide strong incentives for the parties to continue the relationship, although it may not be profit maximizing in a particular period. Bank customers are less likely to switch banks to avoid incurring further set-up costs and having to become familiar with a new bank's service delivery mechanism. On the lending side, banks' costs associated with learning about customer payment and borrowing habits can also be considered switching or set-up costs. Given that such information is durable, banks find it cheaper to service customers over time and can offer these familiar customers preferred rates (equivalent to repeat business discounts like the points given for consumer charge-card purchases and the frequent-flyer benefits offered by most major airlines).

As noted above, bank physical capital is an obvious quasi-fixed input into the production function. Investment in home and branch offices generally varies little in the short run, primarily because severe costs are associated with quickly building or disposing of these facilities. However, factors other than adjustment costs can make an input quasi-fixed in the short run. Regulation is one such factor. For example, it has been suggested that the Community Reinvestment Act of 1977 has prompted many banks to continue operating branches in certain community areas when it is not cost effective to do so. In the case of branch banking, state restrictions can prevent banking offices from reaching their long-run equilibrium level; although banks may be expected to find alternative means for expanding deposits, such means may not be efficient. This kind of nonequilibrium situation could occur, for example, when a banking organization is forced to expand geographically by way of holding company acquisitions or chain banking as opposed to simply opening new branches.

Total-Cost versus Variable-Cost Functions

In the authors' research, tests of bank-scale economy estimates' robustness in the presence of quasi-fixed inputs were carried out by analyzing two models or specifications of a bank's cost function—the total-cost and the variable-cost specification. Applied to bank production, the total-cost model corresponds to a long-run bank cost function that considers all inputs as variable. Thus, it is assumed that a bank can adjust all factor inputs appropriately to minimize its costs (maximize its profits). In contrast, the variable-cost model essentially assumes that the bank is in equilibrium with respect to a set of variable inputs conditional on the observed levels of the quasi-fixed inputs. The bank's optimizing behavior is carried out subject to certain inputs' being fixed during the period of analysis.

Under the total-cost specification, the bank's total cost—that is, the sum of the quantities of inputs employed multiplied by their factor prices—is expressed as a function of the quantities of outputs produced and all input factor prices. Under the variable-cost specification—because the bank minimizes the cost of a subset of its inputs, conditional on the level of the quasi-fixed inputs (for example, physical capital, core deposits, and so forth)—the relevant costs to be minimized are variable costs (the sum of the quantities of the variable inputs multiplied by their factor prices). Thus, for the variable-cost function total variable costs are expressed as a function of products (outputs produced), the factor prices of the variable inputs employed, and the quantities of the quasi-fixed inputs used in producing the outputs.

Estimating Bank Scale Economies

The notion of scale economies, or, more properly, returns to scale, refers to the rate at which output changes as all input quantities are varied. If, for example, a firm doubles the quantity of its inputs and its output doubles, then its production technology is said to exhibit constant returns to scale. If output increases by less than 100 percent, decreasing returns to scale or diseconomies of scale prevail, and if by more than 100 percent, increasing returns to scale or simply economies of scale prevail. In the above definitions, the term scale serves as a reminder that all inputs are being varied. The concept is a long-run equilibrium concept, and the presence of economies of scale means that the average cost of producing a

product, in the long run, declines as more of the product is produced. If, because of the presence of quasi-fixed inputs, banks are not in long-run equilibrium with respect to the quantities of their inputs, scale economy measures derived from cost functions that assume all inputs are variable may be misleading.

For the analysis of bank scale economies presented below, the first step involved specifying and estimating a functional form for each of the cost functions. Once these forms were estimated or fitted to sample data, scale economy measures could be computed and compared. In addition, other economic properties of the two cost function specifications could be examined to determine if one clearly dominates the other in describing bank costs.

Second-order transcendental logarithmic (translog) approximations were used to statistically fit the total-cost and variable-cost specifications. The translog functional form, a generalized or flexible mathematical model capable of approximating many different production technologies, includes most popular specifications as special cases and is able to capture complex patterns of input substitution.⁵ These features have gained it wide acceptance in the empirical literature examining production and cost relationships in financial intermediaries.

Variable Definitions

Outputs. The criterion of value added employed by Berger, Hanweck, and Humphrey (1987) was used in the research reported on here to determine the composition of the various output categories examined. In both cost function specifications, output includes wholesale loans, represented by the dollar volume of all commercial and industrial and security loans; consumer loans, comprising the dollar volume of credit cards and other personal loans except for loans secured by real estate; and real estate and other loans, including those secured by real estate, agricultural loans, and others in the wholesale or consumer categories. In addition, an output category is defined to capture the off-balance-sheet activities of the sample banks. These include such items as loan sales, letters of credit, securitization, swaps, and clearing activities, all of which are becoming increasingly important at U.S. commercial banks. This proxy output variable is defined as total noninterest income, including service charges received on transaction and nontransaction deposit accounts. Securities are excluded from the definition of output because banks add only negligible, if any, value to these assets.

Inputs and Input Prices. The inputs into the bank production function are taken to be labor, physical capital (plant and equipment), deposits, and other miscellaneous inputs (for example, director services and advertising). Thus, the cost functions include the following input or factor prices: the price of labor (the total salaries and benefits divided by the number of full-time employees), the price of physical capital (the ratio of occupancy and fixed-asset expense to net bank premises), the price of deposits (the interest rate paid on all deposits divided by the sum of all interest-bearing deposits outstanding), and a proxy price for miscellaneous inputs (pretax noninterest expenses less labor and capital expenses divided by total assets).

Quasi-Fixed Inputs. Core deposits and a measure of physical capital are treated as the quasi-fixed inputs in variable-cost specification. Core deposits are defined as each sample bank's previous year's dollar volume of demand deposits, negotiable orders of withdrawal (NOW accounts), and other interest-bearing checking accounts, savings accounts, and small time deposits. Purchased funds are excluded from the definition of core deposits.

Quasi-fixed capital for a given year is defined as the number of branches the bank operated in the previous year. Branches are chosen as a proxy for quasi-fixed capital inputs because, for planning purposes, they are typically considered fixed in the short run. In addition, branching networks represent a substantial proportion of most banks' investment in physical capital.

Total and Variable Costs. Total costs are defined as total noninterest costs plus allocated interest expense (the product of the ratio of total loans to earning assets times total interest expense). The allocation of interest expense is necessary because securities are not specified as an output and many banks incur a substantial proportion of their interest costs to finance their securities portfolio. The output/cost specification used in this study is consistent with the intermediation approach to examining bank costs discussed in Humphrey (1985).

Variable costs are defined as total costs less the previous year's expenses for premises and fixed assets and interest allocated to core deposits. The interest price of core deposits is defined as the current year's total interest on all deposits less than \$100,000 (for example, NOW accounts, saving and time, IRAs, and Keoghs) excluding all interest on purchased funds (Fed funds, retail repurchase agreements, and jumbo CDs) divided by the sum of all noninterest-bearing demand deposits plus all interest-bearing deposits less than \$100,000, excluding any purchased funds. Total allocated interest

equals the interest price of core deposits times the amount of core deposits.

The Data

The data used to estimate the cost functions were taken primarily from the Federal Reserve end-of-year Reports of Condition and Income filed by banks for 1984 through 1987. This period of analysis was chosen for several reasons. First, significant changes in bank regulation and markets occurred in the early 1980s. Hence, combining more recent data with earlier data could have produced misleading results. Second, during the period from 1984 through 1987, retail CDs exhibited characteristics associated with quasi-fixed inputs. That is, for some periods the effective cost of retail deposits exceeded the cost of purchased funds. Data from this period should

therefore be particularly useful in examining the impact of quasi-fixed inputs on bank scale economy measures.

Data for all banks having at least \$1 billion in total assets as of year's end 1987 and complete data for the entire 1984-87 period were collected. Although these banks represented a small percentage of the total number of U.S. banks operating in 1987, they held approximately 60 percent of all banking assets. Banks in states with unit banking laws were dropped from the sample because analysis of nonunit banking banks is expected to provide more useful insight into issues currently confronting bank regulators. The final sample included 254 banks.

The sample banks were found to vary both with regard to their scales of outputs and their product mixes. As a result, the sample banks were divided into seven subgroups based on total assets as of the year ending 1987. Table 1 presents summary statistics for each of the seven subgroups.

Table 1
Summary Statistics for Sample Banks for 1987¹
(means and standard deviations in parentheses)

Asset Size	Number of Banks	Output				Quasi-Fixed Inputs	
		Wholesale Loans	Consumer Loans	Real Estate and Other Loans	Other Outputs	Core Deposits	Number of Branches
\$1.0-1.5	69	\$.21 (.09)	\$.20 (.12)	\$.35 (.12)	\$.02 (.11)	\$.63 (.15)	33.5 (23.9)
\$1.5-2.0	36	.32 (.12)	.26 (.14)	.53 (.15)	.03 (.03)	.92 (.28)	44.5 (25.1)
\$2.0-3.0	32	.52 (.22)	.32 (.14)	.79 (.24)	.03 (.01)	1.22 (.27)	49.8 (20.9)
\$3.0-5.0	50	.76 (.25)	.52 (.27)	1.21 (.39)	.05 (.03)	1.74 (.45)	83.9 (53.7)
\$5.0-10.0	36	1.58 (1.50)	.91 (.45)	2.02 (.66)	.09 (.05)	3.26 (1.08)	118.3 (65.7)
\$10.0-25.0	21	4.07 (2.19)	1.48 (.99)	4.35 (1.45)	.20 (.11)	5.88 (2.41)	188.6 (95.5)
\$25.0 plus	10	16.51 (7.18)	4.41 (4.07)	20.90 (11.19)	1.04 (.80)	20.57 (10.90)	375.3 (332.2)

¹All dollar amounts are in billions of dollars for the year ending 1987.

Source: Calculated by the authors from data in Consolidated Reports of Condition for Insured Commercial Banks and Consolidated Reports of Income for Insured Commercial Banks filed with the Federal Reserve System.

Results of the Tests

Both the total-cost and variable-cost specifications were statistically fitted using data for the overall sample. However, scale economy estimates are reported for each subgroup identified in Table 1 to account for differences in the subgroups' scale and product mix. Because the cost functions are multiproduct cost functions, the scale economy measures or indices reported below are ray scale economy indices, which are the multiproduct firm equivalent of the traditional scale economy index used in analyzing the single-product firm. In simple terms, a ray scale economy index measures the change in total (or variable) costs as the firm's scale is increased, holding product mix constant. As presented in this article, if a ray scale economy index (RSCE) equals 1.0, constant returns to scale prevail, and if the index is less or greater than 1.0,

decreasing or increasing returns to scale, respectively, prevail.

Using pooled data for the years 1985-87, the statistical technique of full information maximization likelihood was used to estimate the two cost specifications' parameters. Including time-dependent dummy or indicator variables accounted for possible structural shifts in the sample banks' production functions during the sample period.

Table 2 reports the estimated ray scale economy indices for the total-cost specification (RSCE-TC) and the variable-cost specification (RSCE-VC) for each of the seven sample bank subgroups for 1985, 1986, and 1987. For the total-cost model the estimated ray scale economy indices for 1985 indicate significantly increasing returns to scale (RSCE-TC > 1.0) for banks with total assets of \$5 billion or less. Banks with \$5 billion to \$10 billion in total assets exhibit approximately constant returns to scale, whereas banks with total assets in excess of

Table 2
Ray Scale Economy Estimates of the Total-Cost and Variable-Cost Models
(standard errors in parentheses)

Asset Size ¹	1985		1986		1987	
	RSCE-TC ²	RSCE-VC	RSCE-TC	RSCE-VC	RSCE-TC	RSCE-VC
\$1.0-1.5	1.042** (.015)	1.038** (.015)	1.056** (.017)	1.028 (.017)	1.074** (.015)	1.052** (.018)
\$1.5-2.0	1.033** (.013)	1.031* (.013)	1.053** (.015)	1.030* (.015)	1.064** (.013)	1.039** (.014)
\$2.0-3.0	1.020 (.016)	1.025* (.011)	1.031** (.010)	1.024 (.013)	1.045** (.011)	1.025* (.012)
\$3.0-5.0	1.009 (.019)	1.009 (.010)	1.023* (.010)	.998 (.011)	1.054** (.013)	1.011 (.011)
\$5.0-10.0	.999 (.019)	1.004 (.010)	1.011 (.009)	.997 (.010)	1.030** (.010)	1.010 (.011)
\$10.0-25.0	.980 (.013)	.986 (.010)	.996 (.011)	.987* (.011)	1.008 (.016)	1.004 (.012)
\$25.0 plus	.940** (.016)	.962** (.013)	.959* (.017)	.956** (.014)	.978 (.017)	.966** (.013)

¹ Assets are given in billions of dollars for the year ending 1987.

² "RSCE-TC" denotes the ray scale economies index from the total-cost model; "RSCE-VC" denotes the ray scale economies index from the variable-cost model.

* Significant at the .05 level.

** Significant at the .01 level.

Source: Calculated by the authors from data in Consolidated Reports of Condition for Insured Commercial Banks and Consolidated Reports of Income for Insured Commercial Banks filed with the Federal Reserve System.

\$10 billion exhibit moderate to large decreasing returns to scale ($RSCE-TC < 1.0$). The results for 1987, relative to those for 1985, indicate more pronounced increasing returns to scale and more muted decreasing returns to scale. The 1987 estimates suggest that only the largest banks—with assets in excess of \$25 billion—exhibit decreasing returns to scale.

A number of factors could account for the apparent change in the sample banks' efficiency between 1985 and 1987. First, because it ignores the presence of quasi-fixed inputs, the total-cost specification may be inappropriate. This possibility will be discussed in detail below when the results obtained under the variable-cost specification are examined.

A second possible explanation for the apparent change is that product mixes of the sample banks may have varied significantly during the period covered. The validity of this explanation was explored by reestimating the ray scale economy indices using the fitted parameter values of the total-cost specification for the year 1987 and the mean output data taken from 1985. The indices obtained under this procedure for 1987 were essentially the same as those reported in Table 2. This analysis, along with other comparisons, suggests that changes in the quantity and mix of outputs among the sample banks did not contribute significantly to the changes observed in the ray scale economy indices using the total-cost specification.

New technology is another factor that could explain the changes observed. If technological change during this period was scale-biased—that is, if it worked to increase the threshold of efficiency in terms of asset size—then, assuming all other factors were constant, banks should have exhibited higher (lower) increasing (decreasing) returns to scale over time. Tests for the presence of scale-biased technological change during the 1985-87 period did reveal the presence of statistically significant scale-biased technological change. Thus, the changes in the ray scale economy indices derived from the total-cost specification can be explained, in part, by a technology-induced shift in the total cost function.⁶

Ray scale economy indices derived from the variable-cost specification are also given in Table 2 for each of the bank subgroups. For 1985 the RSCE-VC indices indicate either increasing or constant returns to scale for banks with total assets in amounts up to \$10 billion. Banks with total assets in excess of \$10 billion exhibit modest to substantial decreasing returns to scale. Although these results are very similar to those obtained using the total-cost speci-

fication, the estimated RSCE-VC indices are relatively stable for the 1985-87 period, indicating a slight but statistically insignificant increase (decrease) in ray scale economies (diseconomies). The lack of time-dependent scale economy indices contrasts sharply to the pattern exhibited by the indices derived from the total-cost specification.

Further testing of the differences between the two cost specifications involved a statistical test to determine which model best fits the sample data. Because the variable-cost specification contains all of the total-cost specification's estimated parameters and total costs differ from variable costs by the amount of fixed costs, the parameters of the total-cost specification are a subset of those used to fit the variable-cost model. Thus, by reestimating the variable-cost specification with total rather than variable costs as the quantity to be explained, a statistical test of the best-fitting model could be conducted. The results of the test indicated that the two specifications are not identical. The more general variable-cost specification was found to provide a more accurate description of the sample data.

Although the variable-cost specification better fits the data, the results in Table 2 show that the ray scale economy indices for both specifications are virtually identical for 1985, and the largest discrepancies appear in 1987, as discussed above. Using the standard errors of the estimates reported in Table 2 for 1987, tests were conducted to see if the differences in the ray scale economy indices are statistically different. These test results indicate that only the indices for the subgroups in the \$5 billion–\$10 billion and \$3 billion–\$5 billion total assets categories are statistically different.

Additional insight into the significance of the observed differences can be obtained from an analysis of the projected increases in costs resulting from increases in scale under each specification. This comparison was performed using the statistical results obtained for 1987. For both cost specifications, changes in total and variable costs were computed for each bank subgroup using observed costs, ray scale economies estimates in Table 2, and an assumed 5 percent increase in all outputs. In all cases, the differences in the projected cost increases derived from the two specifications were found to be minor. These comparisons suggest that over the time period examined managerial policy decisions would be fairly similar regardless of which specification was used in the production planning process, even though the variable-cost specification appears to provide a better statistical fit.⁷

Implications and Conclusions

The results of the empirical analyses show that the variable-cost specification better fits the sample data when compared with a total-cost specification. Thus, it would appear that explicitly recognizing the short-run fixity of some bank inputs is required in bank cost function analysis if statistical accuracy is the guiding criterion.

However, the analysis also demonstrates that efficiency measures of the type typically used in public policy debates concerning bank product deregulation, geographic expansion, and consolidation—measures that have traditionally been computed from models ignoring these short-run fixities—will not necessarily produce erroneous policy prescriptions. In the case examined in this article, it is clear

that ray scale economy measures produced under the two different cost specifications are essentially identical. It follows that public policy prescriptions based solely on these estimated ray scale economy indices should not be affected by the particular cost specification employed. These results provide strong support for the notion that policy prescriptions emanating from the empirical bank production and cost function literature are in fact robust.

On the other hand, these findings do not imply that the two cost specifications will never produce significantly different public policy prescriptions. Instead, they make it clear that as banks and banking markets continue to evolve, policy-oriented studies of bank production and cost functions should establish the robustness of policy prescriptions to specification changes if the prescriptions are to be seriously considered in policy debates.

Notes

1. Comprehensive reviews of this literature can be found in Clark (1988) and Humphrey (1990).
2. See Hunter and Timme (1991) for an examination of the relationship between concentration and innovation in banking markets.
3. For a more detailed and technical discussion of the research reported in this article see Hunter and Timme (1990).
4. The one exception in the published literature is the paper by Noulas, Ray, and Miller (1990). However, the authors fail to compare the estimates of bank cost characteristics they derive from a quasi-fixed specification with those derivable from a traditional specification assuming instantaneous adjustment. In addition, their study examines only one quasi-fixed input (core deposits), and therefore the importance of quasi-fixed

physical inputs cannot be ascertained. Finally, because Noulas, Ray, and Miller have examined bank cost data for only one year, their study provides no insight into the dynamic aspects of quasi-fixed inputs in bank production.

5. The review article by Clark (1988) contains an excellent technical discussion and overview of the properties of the translog cost function.
6. Empirical evidence on technology-induced shifts in bank production and cost functions is reported in Hunter and Timme (1991).
7. Neither does consistency with economic theory make one specification preferable over the other. It should be noted that both the variable-cost and the total-cost specifications were found to produce results consistent with most of the dictates of economic theory.

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FYI: The Interest Rate Sensitivity of Stock Prices

David W. Stowe

Changes in interest rates affect all financial securities, simple or complex, to some degree. Thus, it is important to assess any financial asset's interest rate risk—the potential for fluctuations in the general level of interest rates to cause movements in the value of a security. Traditionally incorporated in fixed-income security analysis, interest rate risk should be a consideration in equity security analysis as well.

The relationship between interest rates and the price of a risk-free bond (such as a Treasury note) is straightforward; the bond's value is inversely related to its yield to maturity.¹ However, the relationship among stock prices and interest rates is less direct. The common myth that a decline in interest rates leads to a subsequent rise in stock prices is not always accurate. For one thing, the interest rate is only one factor affecting a stock's value. Assuming a predictable cause-and-effect relationship between interest rates and stock prices fails to consider interaction among interest rates and other economic variables that can determine a stock's value. For example, in the case of a share of common stock, its price is a function of interest rates, its correlation with other assets in the market, and the projected cash flows from the security arising from corporate earnings. In short, while a basic fixed-income security's value is directly related to interest rates, an equity security's value has only an indirect relationship.

The objective of this article is to provide some basic insight into the complex relationship among interest rates and stock prices as well as to explore

methods of measuring a stock's interest rate sensitivity. The interest rate sensitivity, or elasticity, of a financial security is its duration, which measures the direct interest rate sensitivity of a financial asset but does not account for the correlations among interest rates and other economic variables. For fixed-income securities, duration is the only measure needed. However, because other factors are correlated to some degree with interest rates to determine an equity security's value, duration has limitations as a tool for quantifying these securities' interest rate elasticity. This article explores ways to adjust the standard duration model so that it will incorporate the interactive effects of interest rates and other variables on a stock's value. In doing so, its findings should contribute to a better understanding of the ways in which interest rates influence a stock's price.²

Measuring Interest Rate Risk: A Note on Duration

The concept of duration was proposed separately by two economists in the 1930s. Frederick Macaulay ([1938] 1980) introduced it as a measure of the "longness" of a loan—the average number of years until a

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lender would recover a loan's present value. Macaulay's approach contrasted with the traditional loan-maturity concept, which measures only the time of receipt of the last payment. His specification of duration is calculated by weighing the time to receipt, t , of each loan payment by the payment's present value as a proportion of the current value of the loan or bond.

$$Duration = \frac{\sum_{t=1}^n \frac{C_t}{(1+r_t)^t} (t)}{P} \quad (1)$$

t = the time to receipt of a security's cash flow.

As an example, for a security with a ten-year maturity providing annual payments t would begin at year one and end at year ten.

C_t = the payment, or cash flow, to be received at time t . This could be a coupon payment for years one through ten and a repayment of principal at the end of year ten.

r_t = the rate at which the cash flow is discounted to the present from time t . This is the market-determined yield for the bond. Macaulay simplifies the calculation by assuming the yield curve is flat—that is, r_t is the same for all periods. Furthermore, he assumed that the yield curve shifts in a parallel fashion when interest rates change (the yield curve always remains flat).

P = the current price of the security (for example, the present value of the bond).

In long-hand form, the duration equation is the following:

$$Duration = \left[\frac{C_1}{1+r_1} (1) + \frac{C_2}{(1+r_2)^2} (2) + \dots + \frac{C_{n-1}}{(1+r_{n-1})^{n-1}} (n-1) + \frac{C_n}{(1+r_n)^n} (n) \right] / Price, \quad (2)$$

where n is the time of receipt of a security's last cash payment.

An interpretation of duration more useful for the purposes of this discussion is that of John R. Hicks (1939). Hicks introduced the idea of the average period of a stream of payments, a concept essentially the same as Macaulay's notion of duration. Hicks also demonstrated that this measure was equal to the elasticity of the present value of the stream of payments with respect to the discount factor $(1 + r_t)$. In other words, duration measures the sensitivity of the financial asset's value to

changes in the discount factor, or yield. Given a small relative change in the yield, the percentage change in the security's price, $\% \Delta P$, can be estimated using Macaulay's duration value, D , as follows (the relative change in the yield, $\% \Delta r$, is the increase or decrease in the yield level, Δr ; divided by one plus the initial yield, $1 + r$):³

$$\% \Delta P / \% \Delta r = -D \cdot \Delta r / (1 + r). \quad (3)$$

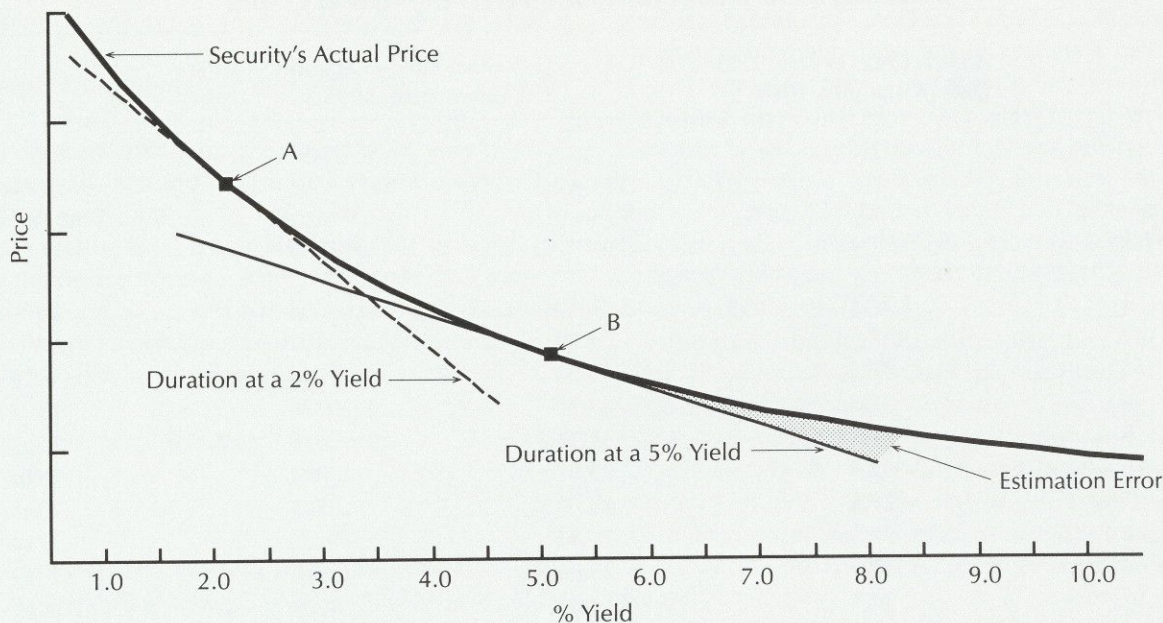
The percentage change in the price of a security given a percentage change in its yield equals the negative of Macaulay's duration multiplied by the change in the yield over one plus the initial yield level.

For this article, the concern is with the concept of duration as a measure of the elasticity of a security's price with respect to interest rates.⁴ Chart 1 illustrates the inverse, or negative, relationship between a security's price and its yield. It should be noted that the relative price change is not the same for every yield level; that is, the relationship is nonlinear. The security's price rises at a comparatively faster rate when the yield falls than it would decline if the yield rose by an equal amount. The security's price graph is convex.

Duration measures the slope of the security's price graph at a particular yield level. Clearly, duration changes as a security's yield changes. The slopes of each of the straight lines adjacent, or tangent, to the price graph in Chart 1 represent the security's duration at the two different yield levels. The duration measure accurately approximates the security's actual price change for a very small range of yields near the point where the duration line is tangent to the security's price curve. If the duration value (B) were employed in estimating the relative price change from a large increase in the yield level—for instance, from 5.0 percent to 8.0 percent—accuracy would be considerably reduced. The size of the error equals the vertical distance between the duration line at the 8.0 percent yield level and the actual price curve, represented by the shaded area.

A generic duration index such as that shown in Table 1 is simple; it measures the direct interest rate sensitivity of a security. For example, the duration index of a Treasury note weights the time to receipt of each of the security's cash flows (for example, the coupon payments and principal) by the present value of that cash flow as a proportion of the note's market price as in equation (1). For a Treasury security, whose risk of default is considered to be remote, the cash flows, time to receipt of each cash flow, and maturity are all known in

Chart 1
Duration versus a Security's True Price Function



advance (ex ante) with certainty. Changes in the interest rate, or the note's yield to maturity, affect neither the amount nor timing of cash payments. Only the rate at which these cash flows are discounted to their present value is changed. From the duration measure in Table 1, the interest rate elasticity of the T-note's price for a 1 basis point, or .01 percentage point, increase in the yield level would be calculated using equation (3) as follows:

$$\text{Percent change in price} = -4.27 \cdot .0001 / (1 + .0761) = -.04\%$$

Thus far the discussion of duration has been targeted toward bonds, specifically a simple Treasury note, to illustrate the application of the duration concept. The duration of an equity security is more complex. For one thing, rather than being synonymous with interest rate sensitivity as in the example above, with regard to stocks duration is an input in an interest rate sensitivity model. The duration measure from equation (1) requires inputs for the security's price, expected cash payments, and timing of each payment. With stocks, none of these variables are known in advance but must be projected.

Deriving a stock's price is not an exact science; many models can be employed. For the sake of simplicity, most researchers studying the topic of equity securities' duration have assumed that a stock's

price is based on one available model—the dividend discount model.⁵

Valuing an Equity Security

The dividend discount model (DDM) is a relatively simple model frequently employed in calculating the intrinsic value of a common stock.⁶ The model bases the value of a share of stock on the present value of all the future dividends, or cash flows, it is expected to provide in perpetuity. Thus, use of this model requires forecasting the stock's dividend stream.

The simplest dividend discount model is the constant growth model, which assumes that future dividends will increase or grow from the current dividend at a constant rate. Because the common stockholder is a residual owner of a company and is entitled to dividends (a prorated share of the company's net earnings) only after all other obligations have been met, the receipt of the projected dividends is not guaranteed. Allowing for the uncertainty involved, the estimated cash flows are discounted by a risk-adjusted required rate of return (discount rate). This rate of return is assumed to be a combination of a risk-free interest rate (for example, the T-bill rate) and a unique risk premium. The constant growth dividend discount model determines the stock price as follows:

Table 1
Macaulay's Duration Index for a Five-Year Treasury Note

		Annual Coupon Rate: 7.50% Date of Maturity: 1996				Annual Yield to Maturity: 7.61% Current Price: \$995.3
(1)	(2)	(3)	(4)	(5)		
Semiannual Period	Cash Payment	Present Value of Payment	Weight: (3) ÷ Price	Weighted Time Period: (4) • (1)		
1	\$ 37.5	\$ 36.13	.0364	.0364		
2	37.5	34.80	.0351	.0702		
3	37.5	33.53	.0338	.1014		
4	37.5	32.30	.0326	.1303		
5	37.5	31.11	.0314	.1569		
6	37.5	29.97	.0302	.1813		
7	37.5	28.87	.0291	.2038		
8	37.5	27.82	.0280	.2244		
9	37.5	26.80	.0270	.2432		
10	37.5	714.58	.7202	7.2015		
	and 1,000					
				Duration in semiannual periods:	8.55	
				Duration in years:	4.27	

$$\begin{aligned}
 \text{Stock Price} = & \frac{D_0(1+g)}{(1+k)} + \frac{D_0(1+g)^2}{(1+k)^2} + \dots + \frac{D_0(1+g)^t}{(1+k)^t} \quad (4)
 \end{aligned}$$

for $g < k$.

- D_0 = current dividend per share.
- g = the growth rate of dividends, assumed constant.
- k = the risk-adjusted discount rate (investors' required rate of return for holding a specific stock), defined as the risk-free interest rate plus a risk premium. This discount rate is assumed constant. The risk premium is defined as the security's beta, which is its correlation with the market portfolio of all assets, multiplied by the market risk premium, which is the difference between the risk-free rate and the rate of return for the market for all assets. That is, the risk premium equals $\beta_i(R_M - R_F)$.

t = time of receipt of each cash payment. Theoretically, a stock has an infinite maturity.⁷

Equity Duration Based on the Dividend Discount Model

The concepts provided by Macaulay and the dividend discount model can be used to formulate a duration equation for equities. The following equation is a combination of the dividend discount model, equation (4), and Macaulay's duration, equation (1):⁸

$$\text{Equity Duration}_{DDM} = \frac{\sum_{t=1}^{\infty} \frac{D_0(1+g)^t}{(1+k_t)^t} (t)}{\text{Stock Price}} \quad (5)$$

The equation equals the weighted average time to receipt of each dividend payment a stock provides. The numerator is the product of each dividend's

present value and its respective time of receipt, t . The denominator represents the present value of a common stock as based on the dividend discount model. Equation (5) reduces to the following basic equation:

$$\text{Equity Duration } D_{DDM} = (1 + k)/(k - g), \quad (6)$$

which assumes that a firm has a constant growth rate over the long run and pays a dividend at discrete intervals in perpetuity.

Because the concern in this research is with approximating an equity security's interest rate sensitivity, or elasticity, it must be assumed that the cash flows are paid out continuously rather than at discrete intervals, as in the following equation:

$$D_{DDM} = \text{equity duration} = 1/(k - g), \quad (7)$$

and

$$\text{Percentage change in the price of a stock} = -D_{DDM} \cdot \Delta k / (1 + k). \quad (8)$$

Equation (7) is a simple approximate of a stock's direct sensitivity to interest rates. It is the reciprocal of the difference between a stock's required rate of return, k , and its dividend growth rate, g . In equation (8), the duration value, D_{DDM} , is multiplied by the change in the stock's required rate of return, k , as in equation (3); the calculation produces the percentage change in a stock's price given a change in the security's required rate of return.

The dividend yield of a stock, or its dividend relative to its price (Dividend/Price), can be derived from the stock pricing equation (4) and is equal to the difference between the required rate of return, k , and the dividend growth rate, g . Acknowledging this fact and knowing that a stock's duration equals the inverse of the difference between the required rate of return and growth rate, the duration for a stock with constant dividend growth is equal to the reciprocal of the security's dividend yield. (Both of these variables can be observed in the stock quote pages of news periodicals.) Thus,

$$D_{DDM} = \text{equity duration} = \text{Price/Dividend}. \quad (9)$$

Limitations of Equity Duration Based on the Dividend Discount Model

While the measure D_{DDM} is easy to compute and apply, caution must be exercised in its application as a measure of a stock's interest rate sensitivity. To be-

gin with, the assumptions underlying the dividend discount model (for example, employing a constant dividend growth rate) may be unrealistic when applied to valuing the stock of a given company. Because duration depends on the security's price, and a stock's market price can be different from that the dividend discount model suggests, the duration measure based on the model may not give a reliable quantitative value for a stock's duration. A fixed-income security's duration value is a more reliable measure because the parameters of a fixed-income security (for example, cash flows and price) are more easily determined.

Moreover, duration measures the direct relationship between a security and interest rates. As such, applied to stocks it is a measure of an equity security's sensitivity to changes in its discount rate, k . Therefore, equity duration based on the dividend discount model is best used as an analytical tool for measuring a stock's price sensitivity to changes in the security's discount rate, k , or required rate of return.

As discussed earlier, interest rates indirectly affect a stock's value because of the correlations between interest rates and other stock price variables. The basic duration model fails to account for this fact, but these correlations must be incorporated to gauge interest rates fluctuations' potential impact on a stock's price.

How Interest Rates Affect a Stock's Value

Clearly, variability in interest rates influences the present value of a financial asset's future cash flows. With stocks, however, the nominal value of these payments to the shareholder may be affected also. Because a common stock's expected cash flows are not fixed, interest rate movements can shape both the cash flows (the numerator) and the discount rate (the denominator) of the basic stock pricing model. For example, an increase in interest rates will precipitate a rise in the risk-adjusted rate of return, k , (the discount rate), for a stock. Considering that all other variables remained constant, the rate at which the stock's future dividends are discounted to the present value would then rise. Hence, the stock price should decline. In addition, a change in interest rates may influence the growth rate of the stock's expected dividends through its impact on a firm's earnings growth. For example, high interest rates could slow economic activity and thereby adversely affect a company's earnings. All else being equal, if an increase in the general level of interest rates would

precipitate a decline in a firm's dividend growth rate, the stock price should decline.

Furthermore, fluctuations in the nominal interest rate can have a different effect on a stock's growth rate than on the discount rate. The nominal, or quoted, interest rate consists of two variables—the real interest rate and expected inflation—and the reaction of a stock price depends on which of these two variables is changing. For instance, companies in relatively price-inelastic industries, where demand for the product or service is not sensitive to price changes, may be able to pass cost increases arising from higher inflation to their customers. The nominal interest rate and the stock's discount rate would rise in conjunction with expectations of increased inflation. However, because the firm's earnings may not be affected, the dividend growth rate would not change, all else being equal. Stocks of firms whose customers absorb the inflation would be less sensitive to changes in the nominal interest rate caused by a change in inflation expectations.

On the other hand, most stock prices would be adversely affected by a rise in the real interest rate. In a simple case, a higher real rate could lead to higher costs for capital for companies, in turn dampening expansion and therefore earnings growth projections. Furthermore, rising real interest rates tend to restrain general economic activity, further inhibiting a firm's earnings growth. In sum, rising real interest rates would likely lower a company's earnings growth rate and raise the discount rate for the stock, leading to a declining stock price.

The correlation of interest rates and other economic variables that may influence an equity security's price complicates any clear connection between stock prices and interest rates. For this reason, the simple equity duration equation must be modified. One such model has been proposed by Martin Leibowitz and others (1989).

A Differential Approach to Equity Duration

In the traditional equity duration model, the growth rate, g , of the payment stream is assumed to be unrelated to changes in the discount rate, k . In the differential approach Leibowitz and his coauthors used, the dividend discount model-based duration, D_{DDM} , is an input. This duration value is then modified for the different effects of a change in either the real interest rate or inflation, or both. The researchers developed equation (10) to extend the dividend discount model duration:

$$\text{Percentage change in price} = \quad (10)$$

$$-D_{DDM} \{[(1 - \gamma + \delta b/\delta r)\delta r] - [(1 - \lambda + \delta b/\delta I)\delta I]\}.$$

$$D_{DDM} = 1/(k - g).$$

I = the inflation component of the nominal interest rate.

r = the real interest rate component of the nominal interest rate.

g = constant growth parameter.

b = equity market risk premium. Recall that the discount rate, k , is a function of the nominal interest rate, i , plus an equity market risk premium, b , which is assumed to be equal to $\beta_i(R_M - R_F)$.

γ = the growth rate's sensitivity to changes in real interest rates.

λ = the inflation flow-through, ranging from 0 to 1.

$\delta b/\delta r$ = a change in the stock's risk premium given a change in the real interest rate.

$\delta b/\delta I$ = a change in the stock's risk premium given a change in inflation expectations.

Equation (10) states that the interest rate sensitivity of a stock is directly related to the dividend discount model-based duration plus two terms that account for the price effects of changes in both the real interest rate and inflation.

This equation makes it possible to isolate the significance of a change in inflation expectations for the value of a firm's equity. The inflation flow-through in higher profits is accounted for by λ , which approaches 1 for complete flow-through. The more inflation a firm can pass on—the higher the inflation flow-through—the lower the interest rate sensitivity of its stock price, all else equal, assuming the change in interest rates was caused solely by a change in inflation expectations. If the equity risk premium, b , is unaffected by a change in inflation ($\delta b/\delta I = 0$), the interest rate sensitivity of a stock can be estimated using equation (11):

$$\text{Percentage change in price} = -D_{DDM}(1 - \lambda)\Delta I. \quad (11)$$

In addition, one can isolate the stock's sensitivity to changes in the real interest rate:

$$\text{Percentage change in price} = -D_{DDM}(1 - \gamma)\Delta r. \quad (12)$$

The calculations by Leibowitz and others (1989) produce much shorter duration values—results that differ greatly from the traditional equity duration based on the dividend discount model. This discrepancy

results from the fact that the two models measure different things. Leibowitz and his coauthors attempt to measure a stock price's total interest rate sensitivity, while the dividend discount model-based duration measures the stock's sensitivity to its discount rate.

How the Factors Determining an Equity's Value Affect Its Duration

Research examining the interest rate sensitivity of stock prices and its relation to factors like dividends and earnings growth that compose a stock's value has provided results consistent with those of equity duration. Duration provides an analytical tool for estimating how stocks of companies in different types of industries (for example, growing or mature) or different risk classes may be affected by interest rate volatility. When analyzing the various stock-pricing factors below and how they influence equity duration, Macaulay's duration index, equation (1), should be kept in mind.

The duration measure, or a security's interest rate sensitivity, is negatively related to the size of a security's cash flows, the frequency of the cash payments, and the level of a security's yield. In other words, when any one of these variables rise while all other variables are constant, the duration measure for that security will decline—that is, its interest rate sensitivity will decrease. On the other hand, duration is positively related to the maturity of a security, all else equal. With regard to equities, the sensitivity of the duration measure to factors influencing a stock's price is outlined below.

- Duration is inversely related to the size of a stock's periodic dividend, or its dividend yield. A stock that pays higher dividends will be less sensitive to changes in interest rates, if all other variables are equal, than a low dividend stock. With higher dividends, more weight is applied to the closer time periods, t . Thus the investor will recoup the present value of an investment in fewer years and the security will have less interest rate sensitivity.
- Duration is positively related to the growth rate, g , of a security's cash flows, all other variables equal. High-growth stocks are more sensitive to changes in interest rates than low-growth stocks. A higher growth rate increases the more distant cash flows' contribution to the present value of the security and thus assigns greater weight to the distant time periods, resulting in a longer duration. Furthermore, duration is posi-

tively related to the term of the expected growth (for example, the length of time the firm's earnings are expected to grow at rate g).

- Duration is negatively related to the level of a security's discount rate, k , all other variables equal. The higher the required rate of return on a stock, the lower its duration, all else equal. This factor has the opposite effect of the growth rate on the stock's duration. A higher discount rate would lower the present value of the more distant payments and thus the weight applied to the distant time periods, reducing the duration.
- The discount rate is a combination of the level of the risk-free interest rate and a risk premium. Holding the risk premium constant, the discount rate, k , will rise with the general level of the risk-free interest rate. Therefore, the higher the general level of interest rates in the market, disregarding a security's risk premium, the lower a stock's sensitivity to changes in the level of interest rates will be, all other variables equal.
- Alternatively, holding the risk-free rate constant, the required rate of return, k , will increase with a rise in the stock's risk premium, $\beta_i(R_M - R_F)$. Therefore, a security with a higher risk premium will be relatively less sensitive to changes in the level of interest rates than a less risky security, all else equal.
- The risk premium is partly influenced by a stock's beta, or its correlation with the market. Thus, the duration of an equity security is negatively related to its beta, β_i , all other variables equal. Low beta stocks are more sensitive to changes in interest rates than high beta stocks, all else equal. This was found to be a partial inverse relationship.⁹

Conclusion

In contrast to a bond price's inverse relationship to interest rates, the relationship between interest rates and stock prices is indirect and complex. For example, if interest rates were to decline, stock prices may or may not rise. Although the present value of a stock's expected dividends will rise, the nominal value of these cash flows may be affected by a correlation of interest rates and other economic variables that could offset the favorable effect on a stock's price.

While a bond's price variability can be fully explained by interest rate fluctuations, employing Macaulay's duration, a stock price's sensitivity to changes in interest rates can be adequately gauged

only by incorporating the correlations between interest rates and other economic variables affecting a stock's price with duration. Moreover, the effects of a change in the nominal interest rate based on a change in the real interest rate or in inflation expectations must be specified as illustrated by Leibowitz and others' (1989) equity interest rate sensitivity model.

Because many interactive factors may influence stock prices, there can be no simple assumptions about their behavior. For instance, if interest rates

are expected to fall, stock prices do not necessarily rise. A recent example occurred in early 1991 when the slow domestic economy was pushing interest rates down and at the same time indirectly pressuring stock prices downward partly because lower corporate earnings were being projected. Even though it is possible to successfully account for the direct and indirect effects of interest rates on a stock's value, doing so explains only a portion of the security's variability.

Notes

1. For risk-free bonds the yield is derived from the price based on the assumption that the cash flows (for example, coupon payments) are reinvested as received at the yield during a bond's life.
2. It should be kept in mind that even if the duration model is successfully modified to account for the indirect influences of interest rates, it will generally explain only the portion of the stock price's variability that can be attributed solely to movements in interest rates.
3. It is common to see this calculation as $-D^* \cdot \Delta r$, where D^* is $D/(1+r)$, or modified duration.
4. Duration is the derivative of the security's price with respect to its yield, $\delta P/\delta y$. This derivative approximates the rate of change in the security's price when the change in its yield is very small. The smaller the change in y , the closer the approximation is to the true value of $\Delta P/\Delta y$. Thus, duration is a linear approximation to a nonlinear relationship. Duration is the second term in a Taylor series expansion of a security's price func-

tion. The third term, convexity, is the second derivative of the security's price function with respect to its yield, $\delta^2 P/\delta y^2$. It is a measure of the curvature of the price-yield graph, the change in duration. Adding convexity to the duration value more closely estimates a security's price change.

5. See, for example, Boquist, Racette, and Schlarbaum (1975), Malkiel (1963), Casabona, Fabozzi, and Francis (1984), Ben-Horim and Callen (1989), and Reilly and Sidhu (1980).
6. For a more extensive review of the dividend discount model concept, see Brealey and Meyers (1988).
7. Equation (4) reduces to $D/(k-g)$, where $D = D_0(1+g)$.
8. The approach to computing Macaulay's duration for a common stock based on employing the traditional dividend discount model is taken from the research of Boquist, Racette, and Schlarbaum (1975).
9. See, for example, Casabona, Fabozzi, and Francis (1984).

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Book Review

International Trade and Finance Reference Sources

Jerry J. Donovan

This review of international trade and finance reference sources includes information on classic worldwide directories of administrative, geographical, and political units as well as worldwide statistical compendiums. These publications have demonstrated their usefulness over many years. A selection of periodicals dealing with international trade and finance, ranging from popular to academic, will be discussed in the July/August issue of Economic Review. The forthcoming review will place more emphasis on principal identifiable trade and finance areas of the world such as the Pacific Rim, the European Community, and Latin America.

The imminent attainment of a single European Market ("Europe 1992"), scheduled to become operational January 1, 1993, indicates that global economic integration is becoming a reality.¹ Such a development, along with the spread of regional trade agreements, in turn draws attention to the increased need for systematic access to data and information on international trade and finance. Fortunately, a wide selection of publications tracks the levels and composition of this international activity and provides timely analysis that can be useful not only to economists, statisticians, and academicians but also to business people, bankers, and staff in government agencies.

A selection of these sources is reviewed here. All the titles considered are serials, whose format allows continuous updating of data, categories, names, and regimes important in world markets and their finance.

The publications described here are, for the most part, classics with proven track records, forming the nucleus for an international trade and finance reference book shelf. (One, first published in 1864, is in its 127th edition.) They range in subject matter from commercial publications like directories of administrative, geographical, and political units to statistical compendiums and outlook discussions by international agencies. The first section of this review will

cover worldwide directories, and the second will present worldwide statistical compendiums.

Worldwide Directories: Administrative, Geographical, and Political Units

The Europa World Year Book 1990. London: Europa Publications Ltd., 1990. \$265.00/set (two-volume index). ISSN 0956-2273.

The Europa World Year Book, a well-known encyclopedia that began in 1926, provides reliable, detailed information on political, economic, and commercial institutions of Europe and the world. The yearbook is published in a two-volume set.

Volume 1 is in two parts, the first giving exhaustive overviews of international organizations. Part 1 begins with a description of the structure of the United Nations with its components: Regional Commissions (for example, the Economic Commission for Africa), Other Bodies (such as the World Food Council), and Specialized Agencies within the UN System (such as the International Labor Organisation). Listings for more than fifty additional international bodies follow, ranging from the African Development Bank and the Andean Group to the World Federation of Trade Unions. Volume 1, part 2,

begins the alphabetical coverage of nations with Afghanistan through Jordan and concludes with an index to international organizations. Volume 2 continues the alphabetical treatment of nations from Kenya through Zimbabwe; at the end of the volume is an index of the entire list of nations.

Accounts of countries in *The Europa World Year Book* are always elaborately detailed. Each description begins with a survey of the nation's geographical location, climate, history, and socioeconomic conditions, accompanied by statistical surveys drawn from official publications. Each territorial entry also provides information about government structure (including the constitution, where applicable), political parties, diplomatic representation, the population's religious affiliations, press, publishers, radio and television, finance, trade and industry, transport and tourism, and atomic energy. The names of important government officials are furnished, making the book a virtual international who's who.

The Europa World Year Book's extensive coverage of the European Community (EC) encompasses topics such as a list of members; addresses and phone numbers of permanent representatives; a summary of the 1958 Treaty of Rome, establishing the European "Common Market"; community institutions (for example, the Commission of the European Communities); community activities (such as the European Monetary System); and publications, including the address and phone number for the Office for Official Publications.

Both volumes have complete lists of the numerous and often obscure abbreviations used by international organizations, like ECOSOC, the United Nations Economic and Social Council. These lists eliminate the need to switch back and forth between volumes to identify crucial abbreviations.

The Europa World Year Book is admittedly cumbersome because of its extensive coverage and comprehensive detail. However, it is a keystone for a collection of books and periodicals on foreign nations and international organizations.

The Statesman's Year-Book 1990-91: Statistical and Historical Annual of the States of the World, edited by John Paxton. New York: St. Martin's Press, 1990. \$55.00. ISBN 0-312-04614-6.

While the two-volume *Europa World Year Book* consumes five inches or more of shelf space, *The Statesman's Year-Book* offers adequate detail in the same subject areas in a handy, less expensive format that can be tossed in a desk drawer. *The States-*

man's Year-Book: Statistical and Historical Annual of the States of the World, which dates back to 1864, ranks very high on any list of concise and dependable reference manuals about countries of the world and international organizations. It is a major compendium, mostly discursive, but also packed with useful statistics.

The yearbook's (one-volume) arrangement roughly parallels that of *The Europa World Year Book*, with discussions of "International Organizations" (part 1) followed by "Countries of the World A-Z" (part 2). In the 1990-91 edition, special features like tables listing world foodstuffs are worked in before the formal beginning of part 1. There is also a chronology of world events for the year preceding the imprint date. Special indexes covering international organizations, products, names, and places facilitate quick reference. "Further Reading" lists of available official publications and corollary articles and books conclude each topical section. *The Statesman's Year-Book* gives fundamental facts for every country through concise summaries on the nation's geography, history, politics and government, education, economics, agriculture, commerce, banking and credit, religion, and social welfare. The yearbook also provides comparable details at the individual state, province, and territory levels. This technique proves useful because many large states or provinces like California or Quebec clearly exceed the economic or political importance of small sovereignties.

The World Factbook 1990, U.S. Central Intelligence Agency. Washington: U.S. Government Printing Office, n.d. \$19.00. (Available on CD-ROM at \$99.00.)

The Central Intelligence Agency's *World Factbook* is produced annually for use by U.S. government officials, although it is available to the public. Its terse style, format, coverage, and content are designed to meet government requirements. Less detailed than *The Europa World Year Book* or *The Statesman's Year-Book*, the compactly organized *World Factbook* is devoted almost entirely to coverage of individual nations.

Lengthy "Notes, Definitions, and Abbreviations" open the work. Information on international organizations is presented in diagrams and tables in the appendixes, which consist of a diagram of the United Nation's components, followed by tables for the

The reviewer is the research librarian in the Atlanta Fed's research library.

international organizations and their member nations; tables of weights and measures; and a cross-reference list of geographic areas, which indicates where various names, including alternate and former versions, and political or geographical entities can be found in the book. *The World Factbook* also contains extensive maps of world regions corresponding roughly to the continents, as well as a "World Guide to Regional Maps" and a breakout of "Standard Time Zones of the World."

The incisive design of this Central Intelligence Agency production makes it an "executive summary" of material that the other two world yearbooks treat more diffusely and in more detail. The alphabetical arrangement of the country studies obviates an index, but the table of contents provides convenient and quick access.

A conspicuous shortcoming of the book is the perfunctory treatment of the Common Market and the European Communities, which are given only passing mentions in the table of Country Membership in International Organizations. The realization of Europe 1992 will warrant more extensive attention in a future *World Factbook*. Nevertheless, for users who wish to go straight to unembellished fact, sometimes relying on the design of the printed page to point up inherent relationships, the CIA publication is the definitive choice. Given its low price as well, the book is a sound value.

Encyclopedia of Associations—International Organizations, 1991, 25th ed., edited by Linda Irvin. Detroit: Gale Research, 1991. \$285.00. ISBN 0-8103-7406-4 (Parts 1-2).

The *Encyclopedia of Associations—International Organizations* is one of three components of the Encyclopedia of Organizations "family" whose combined texts present entries for more than 78,000 organizations. It is available in hard copy and CD-ROM. Sibling to the *Encyclopedia of Associations—National Organizations of the U.S.* and the *Encyclopedia of Associations—Regional, State, and Local Organizations, International Organizations* (in a two-volume set) rounds out worldwide coverage of associations and organizations. *International Organizations* covers "nonprofit organizations that are international in scope, membership, or interest . . . including multinational and binational groups, and national organizations headquartered outside the U.S."

An example of a typical trade and development association entry in *International Organizations* illustrates the publication's potential usefulness (see

Figure 1

★295★ TURKISH INDUSTRIALISTS' AND BUSINESSMEN'S ASSOCIATION (TIBA)

(Türk Sanayicileri ve İşadamları Derneği - TUSIAD)
Cumhuriyet Caddesi 233/9-10

Harbiye

TR-80230 Istanbul, Turkey

Phone: 1 462412

E. Ihsan Ozol, Sec.Gen.

Founded: 1971. **Members:** 297. **Staff:** 19 **Budget:** TL 4,000,000,000.

Languages: French, Turkish; *corresponds in English.* **National.** Bankers, companies, contractors, industrialists, and other business professionals.

Aims to contribute to the success of Turkey's industrial development and assist in attaining welfare standards enjoyed in the industrialized world.

Promotes public welfare through private enterprise by bringing together the views, experience, and support of those engaged in industry and business.

Conducts research in economic prospects and trends, fiscal and monetary developments, marketing, industrial performance, the world economy, and public affairs. Maintains 3000 volume business library.

Computerized Services: Accounting services; data base; electronic publishing; mailing list. **Telecommunications Services:** Fax, 1 470082; telex, 22318 TSAD-TR. **Committees:** Turkey-EC Relations; Turkish Tourism. **Divisions:** Economic Research; Press. **Affiliated With:** Union of Industrial and Employers' Confederations of Europe.

Publications: *State of the Turkish Economy* (in Turkish), annual. ● *Turkish Economy* (in English), annual. ● *TUSIAD Members' Company Profiles* (in English), periodic. Directory. ● Also publishes economic reports and studies.

Convention/Meeting: annual symposium.

Source: *Encyclopedia of Associations—International Organizations*, 1991, 25th ed., Linda Irvin, ed. (Detroit: Gale Research, 1991), 34.

Figure 1). The entry for the Turkish Industrialists' and Businessmen's Association provides information essential for communication with this organization—not only the name of the person in charge and the address, telephone, and FAX numbers but also the crucial fact that the group is prepared to converse only in French and Turkish, although it will correspond in English. The particular areas of economic development the Turkish Industrialists' and Businessmen's Association promotes are spelled out along with the fact that they maintain a sizable library, conduct research, and are affiliated with the Union of Industrial and Employers' Confederations of Europe (an organization also included in this directory).

The *Encyclopedia of Associations—International Organizations's* deep indexing makes it quite easy to use. To find one's way around part 1 of the set, which is organized by item number, it is necessary to employ one of the four indexes that make up part 2: geographic, executive, organization name, and keyword. Introductory material explains the organization of entries and the fifteen broad subject categories; provides a keyword list to relate the us-

er's "natural" vocabulary to these categories; gives worldwide abbreviations for geographical entities; and lists the currencies of the world nations. The *Encyclopedia of Associations—International Organizations*, whether in hard copy or online, is a basic tool for access to trade associations and professional groups around the world.

1988-1989 World Currency Yearbook, by Philip P. Cowitt. Brooklyn, N.Y.: International Currency Analysis, Inc., 1991. \$250.00. ISBN 0-917645-03-0.

A working knowledge of foreign currencies is crucial to importing and exporting in world markets, searching out new markets, or protecting investments abroad. The *World Currency Yearbook* provides practical historical and current information about social, political, fiscal, and monetary policies, as well as factors such as political corruption, all of which potentially influence the exchange rates of currencies. In addition, the publication gives measures (estimates) of flight capital and includes such facts as how much national currency a traveler can bring in or take out of a country. It also provides information on world currencies, including official and "black market" exchange rates.

The *World Currency Yearbook* is a formidable single source of practical information about money. The current volume provides complete descriptions of 147 world currencies as well as a monetary glossary; a list of abbreviations; currency, trade, and other organizational areas (of the world); monetary "spheres of influence" (like Franc-Zone and OPEC); currency control categories (such as, free, liberal, or strict control); gold restrictions; and international black market positions.

Representative of the topics addressed in this yearbook and its thoroughness is the CFA franc presentation. CFA stands for the Communauté Financière Africaine, an area comprising the Central African Currency Union and the West African Currency Union. The yearbook's discussion encompasses an exhaustive protocol of factors necessary to understanding the CFA franc, including the history and transferability of the currency; developments in each country within the CFA (at length—twenty-five pages); currency varieties and administration (see Figure 2); the names of the governors of each central bank; statistical information on all countries in the CFA; a ten-year currency record; the total amount of currency in circulation and per capita; and parallel market rates of U.S. dollars or unlicensed transfers abroad.

Figure 2

CURRENCY VARIETIES

In CFA Francs per U.S. Dollar (At December 30, 1988)

Official

- A. CFA Franc (*Theoretically Defined At 3.2 Milligrams Of Fine Gold*), Or 0.02 French Francs . . . 230.207
- B. Effective CFA Franc; Controlled Floating Rate, Applicable To All Transactions 302.95
- C. Nonresident CFA Franc Accounts (*Comptes Etrangers*); Resulting From Conversion Of Foreign Currencies, Current Payments And Authorized Capital Transfers. Freely Transferable Abroad 302.95

Unofficial

- D. Parallel Market CFA Franc; Resulting From Unauthorized Dealings Of Foreign Currency Banknotes And/Or Unlicensed Transfers Abroad 310.00

CURRENCY ADMINISTRATION

The Banque des Etats de l'Afrique Centrale (BEAC) is the Central Bank for the Central African Currency Union, while the Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO) is the monetary authority for the West African Currency Union. Both institutions hold their exchange reserves in French Francs in an Operations Account (*Compte d'Opérations*) with the French Treasury, except for the BEAC maintaining 20% and the BCEAO 35%, respectively, of their reserves in foreign currencies. In the individual states, exchange and trade licensing controls are usually handled by the Directorate of Economic Controls and External Finance attached to the Ministry of Finance, in cooperation with or under the supervision of the appropriate Central Bank. Trade licensing or controls is usually under the jurisdiction of the Ministry of Commerce and Industry or the Ministry of Finance. The CFA group is in the Franc-Zone, has an associated status with the Common Market, and belongs to the International Bank and International Monetary Fund in Washington.

Source: *1988-1989 World Currency Yearbook*, Philip P. Cowitt. (Brooklyn, N.Y.: International Currency Analysis, Inc., 1991), 63.

Concluding the *1988-1989 World Currency Yearbook* are a discussion of the Eurocurrency market; an appendix for currency circulation per capita (with an accompanying table giving descending national rank, as of 1987, at Free Rate of U.S. Dollar—that is, converted into U.S. dollars at the free or black market values of the currencies as compiled by the staff of the publisher, and listed according to U.S. dollar amount); money supply per capita (ranked as per capita currency in circulation); a directory of countries' central bank officials, listed alphabetically from Afghanistan to Zimbabwe; and the index.

The *World Currency Yearbook* has been published annually since 1984. Its predecessor, *Pick's*

Currency Yearbook, dates back to 1955. Volumes from 1955 to 1984 are available on microfilm.

Annual Report on Exchange Arrangements and Exchange Restrictions, 1990, the International Monetary Fund. Washington: IMF, 1990. \$39.95. ISSN 0250-7366 (English only).

The International Monetary Fund's *Annual Report on Exchange Arrangements and Exchange Restrictions*, dating from 1950, provides detailed country-by-country descriptions of the exchange and trade systems of the 152 individual IMF member countries, as well as Hong Kong (for which the United Kingdom has accepted the IMF's Articles of Agreement), Aruba and the Netherlands Antilles (for which the Kingdom of the Netherlands has accepted the IMF's Articles of Agreement), and Switzerland (which does not belong to the IMF).

The information in this publication is current for both the year indicated by the title as well as for the first quarter of the year after the one cited in the title. Despite some format changes in the reports for 1989 and 1990, this directory remains critical to coverage of factors affecting world trade and finance.²

The annual report is actually a manual that provides standardized coverage of a broad range of topics for each country: exchange arrangements, including the official exchange rate as of December 31 (unless otherwise noted); the authorities responsible for financial policy (for example, central bank or the ministry of finance); the selection of currency and method of settlement for transactions with other countries; facilities and limitations attached to account holders not regarded as resident in the country; import-licensing requirements; payments for invisibles (such as travel expense, transfers of salaries and wages). Other topics detailed include exports and export proceeds, including detailed explanations of expressions such as "exchange receipts must be surrendered," indicating the disposition of export proceeds as to kind of currency and rate of exchange and authorized banks or dealers who may participate; limitations on the import of foreign and domestic bank notes; special arrangements or limitations attached to international capital movements; and, finally, a summary of the principal regulations governing holding, negotiating, importing, or exporting gold coin or gold in other forms.

Country coverage of principal nations ends with a calendar of significant changes during the past year in each of the categories listed above. A table summarizing features and a list of abbreviations concludes the volume. There is no index.

For the practitioner whose interests in world trade and finance are limited to IMF countries, the *Annual Report on Exchange Arrangements and Exchange Restrictions*, at about \$40, may be a better value than the more expensive *World Currency Yearbook*. The *Annual Report*, in fact, offers more detailed coverage of places like Chad, Grenada, or St. Kitts and Nevis than does the *World Currency Yearbook*, whose brief references are embedded within the coverage for "CFA Franc" (for Chad) and the "East Caribbean Dollar" (for Grenada and St. Kitts and Nevis).

Worldwide Statistical Compendiums

Historical statistics quantify and record the past, but at the same time they present data which, through empirical analysis, can be helpful in predicting the future. Thus, statistical series form a basic part of any core collection on international finance and trade. The statistical compendiums described here, which complement each other, present a world view of international trade and finance.

The International Monetary Fund (IMF) and the Organisation for Economic Cooperation and Development (OECD) are probably the two most comprehensive sources of up-to-date worldwide statistical data. A comparison of the purposes and objectives of the two organizations (as spelled out in *The Statesman's Year-Book, 1990-91*, pages 19 and 35, respectively) helps in choosing between these two agencies as the principal sources for international trade and finance data.

The International Monetary Fund. The International Monetary Fund, with more than 150 member nations, was established as an independent international organization in 1945 and began operation in 1947. The purpose of the IMF, as stated in *The Statesman's Year-Book*, is "to promote international monetary co-operation, the expansion of international trade and exchange rate stability; to assist in the removal of exchange restrictions and the establishment of a multilateral system of payments; and to alleviate any serious disequilibrium in members' international system of payments by making the financial resources of the Fund available to them, usually subject to conditions to ensure the revolving nature of Fund resources."

Although many of the titles in the long list of IMF publications are distinguished and attract a variety of informed users, only four statistical compendiums stand out as germane to this discussion: *International Financial Statistics Yearbook*, *Balance of Payments Statistics Yearbook*, *Direction of*

Trade Statistics Yearbook, and *Government Finance Statistics Yearbook*. These titles are published principally in English, French, and Spanish, although sometimes in German and Portuguese. The yearbooks summarize the annual activity of their respective monthly publications and give historical series.

All four of the statistical publications of the International Monetary Fund are available on magnetic tape. Statistical information is entered into the IMF Economic Information System (EIS), a computer system for storing, maintaining, and manipulating data, as well as assembling tables for hard copy publications. Researchers interested in finding EIS information in a hard copy format can consult recent yearbooks, which contain a table displaying the EIS code, the line number, and a title (in English, French, and Spanish) for each line of the yearbooks' statistical tables.

International Financial Statistics, International Monetary Fund. \$148.00 (twelve monthly issues and a yearbook). ISSN 0250-7463.

International Financial Statistics is a standard source of statistics on all aspects of international and domestic finance. Although the yearbook includes illustrative international charts while the monthly issues do not, both feature the same basic design: a section of world tables and a section of country tables. The yearbook provides comparative data, by country, for thirty years. For each country, the tables include exchange rates, international liquidity, money and banking, international transactions, prices, production, government finance, interest rates, and other items. The *International Financial Statistics Yearbook* is published simultaneously in English, French, and Spanish.

Direction of Trade Statistics, International Monetary Fund. Washington: IMF. \$52.00 (twelve monthly issues and yearbook). ISSN 0252-3019.

Direction of Trade Statistics functions as a supplement to *International Financial Statistics*. The 1990 yearbook, the twenty-fifth in the series, presents figures on the value of merchandise exports and imports by trade partners for the 1983-89 period for 161 countries. The beginning tables are area and world aggregates showing trade, denominated in dollars, between major world areas. The composition of these areas, along with area codes, is printed inside the back cover. Introductory material is provided in English, French, and Spanish.

Data on exports and imports by trading partners vary in terms of frequency and timeliness. Approximately forty countries, comprising virtually all of the industrialized economies and about twenty developing nations, report their figures monthly. In recent years, these forty countries have represented about 80 percent of the value of recorded world exports and imports. The fact that much of the data is bilateral makes it possible to include estimates for current periods not only for countries less current in their reporting but also for countries for which data are not obtainable from other sources.

Since publication of the 1989 yearbook, the estimation procedure has been modified and enhanced: now the entire DOTS computerized data base is continuously supplemented with estimates based on total exports and total imports reported independently and published in *International Financial Statistics*. The methodology for presenting benchmark data is thoroughly discussed in the introduction.

For the seven years of data presented in each *Direction of Trade Statistics* yearbook, usually published in July, statistics are divided into two sets of world and area summaries, as well as by individual country. World and area trade information can be gleaned from data from reporting countries and their partner countries in those transactions.

Balance of Payments Statistics, International Monetary Fund. Washington: IMF, 1990. \$63.00 (two-part yearbook). ISSN 0252-3035.

Balance of Payments Statistics reports balance of payments data sent to the International Monetary Fund by member countries. The publication contains monthly, quarterly, and yearly balance of trade statistics for about 140 countries, compiled in accordance with the IMF's *Balance of Payments Manual* (4th ed., 1977). Until recently, the publication consisted of twelve monthly issues with a two-part yearbook. The monthly issues ceased publication, however, with the April 1991 issue. Monthly data will still be available on subscription magnetic tapes. The yearbook will continue to be published and will contain the same information as in the past.

Part 1 of the yearbook includes two tables that show aggregate as well as detailed transactions data for eight years and explanatory notes. Available data on external assets and liabilities are shown in a third table. Part 2 of the yearbook provides fifty-five tables of data on area and world totals for balance of payments components and aggregates.

Government Finance Statistics Yearbook, International Monetary Fund. Washington: IMF, 1990. \$48.00 (published annually). ISSN 0250-7374.

The *Government Finance Statistics Yearbook* for 1990 provides annual financial statistics for up to a ten-year period on the 122 member country governments in detailed tables on central government revenue, expenditure, lending, financing, and debt. The publication also presents, in somewhat less detail, data on subnational government levels (states, provinces, municipalities). The inside back cover displays a guide to statistical and institutional tables that indicates the years for which data are given for countries in the yearbook.

Introductions and main headings are printed in English, French, and Spanish. Detailed headings for French-speaking, Portuguese-speaking, and Spanish-speaking countries are usually given in English and in the national language.

The Organisation for Economic Cooperation and Development. Encompassing essentially only the world's industrialized nations, the Organisation for Economic Cooperation and Development (OECD) has more limited membership than the IMF. The OECD succeeded its predecessor, the Organisation for European Economic Cooperation (OEEC), in September 1961. The change in title marked the organization's altered status: inclusion of Canada and the United States meant the organization was no longer purely European. The revamped organization also added development aid to the list of its other activities. The membership at the present time consists of twenty-four nations: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Yugoslavia participates in the organization's activities with special status.

The objectives of the Organisation for Economic Cooperation and Development are "to promote economic and social welfare throughout the OECD area by assisting its member governments in the formulation of policies designed to this end and by coordinating these policies; and to stimulate and harmonize its members' efforts in favor of developing countries." The IMF statistical sources provide data on a wider range of countries than do those from the OECD, but OECD statistical publications offer a wider array of subjects than do those of the IMF, which tend to focus solely on international and national financial data.

Through its Economics and Statistics Department (ESD), the OECD publishes statistics on factors influencing economic development in publications such as *Quarterly National Accounts* and *National Accounts* (two volumes, annual), *Monthly Statistics of Foreign Trade* and *Foreign Trade by Commodities: Series C* (annual), *Quarterly Labour Force Statistics* and *Labour Force Statistics* (annual), *Main Economic Indicators* (monthly), and *Indicators of Industrial Activity* (quarterly). Hard copy editions, magnetic tapes, and diskettes are available; statistics on foreign trade by commodity can also be obtained on microfiche.

Main Economic Indicators provides at-a-glance information on the most recent changes in the economies of the OECD countries and a collection of statistics on economic developments affecting OECD areas during the past few years. This comprehensive publication covers national accounts, industrial production, deliveries, stocks and orders, construction, internal trade, labor, wages, prices, domestic and foreign finance, interest rates, international trade, and payments.

Although the *OECD Economic Outlook* is not, strictly speaking, a statistical publication, this semi-annual review contains important numerical data based on an analysis of each country. Practitioners specializing in forecasting will find the *Outlook* particularly useful because it provides the OECD's projections for output, employment, prices, and current balances over the next two years, based on an OECD review of each member country and the feedback effect of international developments on each of them. Specific attention is paid to the policies governments are adopting to solve present economic problems. Summary statistics and projections are included for the external accounts of OPEC and non-oil developing countries.

Supplementary Sources. Although the IMF and OECD data sources reviewed above are thorough enough for most needs, they do not represent total closure on available data. Some important publications from several international organizations that have not been included here may need to be taken into account to achieve an exhaustive overview of the international finance and trade literature. For example, the pertinent source for U.S. trade data disaggregated by sector or commodity is the *Survey of Current Business* (U.S. Department of Commerce, Bureau of Economic Analysis). Comprehensive, albeit delayed, coverage of national accounts is provided by the United Nations' *National Accounts Statistics: Main Aggregates and Detailed Tables*. To find specific information on particular imports and exports, rather than summary figures, one would

have to consult at least one of three alternative statistical sources: *World Debt Tables 1990-1991*; *External Debt of Developing Countries* (The International Bank for Reconstruction and Finance/The World Bank); *International Banking and Financial Markets Developments* (Bank for International Settlements [BIS]); and *Handbook of International Trade and Develop-*

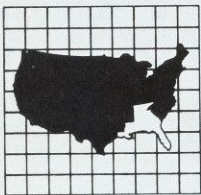
ment Statistics (United Nations Conference on Trade and Development).

With this caveat in mind, a researcher can use the collection of statistical compendiums discussed in this review to construct a solid historical base for analyzing domestic and overseas finance and trade activity.

Notes

1. For a full discussion of the Europe 1992 program and its agenda, see the forthcoming article by Janice L. Boucher, "Europe 1992: A Closer Look," scheduled for the July/August issue of *Economic Review*.
2. A section called "Developments in the International Exchange Rate and Restrictive Systems," which for years formed part 1 of the two-part report, has been omitted from the 1989 and the 1990 reports. The IMF has scheduled separate publication of this assessment of develop-

ments for the 1989 report as a forthcoming component of its series *World Economic and Financial Surveys*. It will be titled "Developments in the International Exchange Rate and Restrictive Systems." At this writing, the IMF has no plans for separate publication of assessment of developments for the 1990 report. With the publication of the 1991 report, however, the former two-part format will be resumed, including the assessment of developments.



Economic Review

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