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MIDWESTERN STATE UNIVERSITY
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FOREWORD

Bureau of Business and Government Research
Midwestern State University

This issue of the *Review* contains eight articles of interest to our readers. The articles are:

- Professor Paul Sarmas discusses the "Episodic Evaluation Of The Exchange Rate Under The Asset Market View";
- Professor Kristin Howell reports on "The Effects of Bank For International Settlements-Related Lending To Mexico In Combination With IMF, World Bank, Bilateral, and Private Lending";
- Professors Gregg Dimkoff and Glenn Pitman made some suggestions to help finance departments internationalize their curricula;
- Dr. Mohammad Shaaf examined "OPEC's Terms of Trade" through a comparison of the seventies with the eighties;
- Drs. Victor Prybutock and Ted Nam Kyungdoo looked into the "Application of Neural Networks To Statistical Production/Inventory Forecasting";
- Professor Michael D. Richard and Mr. James B. Faircloth explored a multiple discriminant analysis of public golf course choice intentions;
- Professors Richard Schroeder, Alan Reinstein, and Bill Schwartz investigated how management fraud goes undetected even when competent annual audits are performed; and
- Professors T. K. Bhattacharya, Abdul Sukar, and Taisier Aldiab reported on the "Changing Economic Structure Of The Southwest".

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EPISODIC EVALUATION OF THE EXCHANGE RATE MODELS UNDER THE ASSET MARKET VIEW

PAUL SARMAS, Assistant Professor of Finance, California State Polytechnic University, Pomona

I. EXCHANGE RATE THEORIES

The monetary approach indicates that the supply of and demand for two currencies determine their equilibrium rate of exchange. Most monetary approach models assume perfect mobility of international capital, perfect substitution between domestic and foreign bonds, and perfect substitution between domestic and foreign goods. The exchange rate models are basically divided into two categories of the flexible-price monetary model and the fixed-price keynesian model, which are discussed later in this section.

The portfolio-balance approach to exchange rate determination maintains the assumptions of perfect capital mobility and perfect substitution in the goods markets, but it relaxes the assumption of perfect substitution between domestic and foreign bonds. Due to differences in maturities, taxability, default risk, political risk, and exchange risk, domestic and foreign bonds reconsidered an imperfect substitute. The portfolio-balance model of exchange rate is reviewed later in this section.

A. Flexible-Price Monetary Model

Most flexible-price monetary models are founded on the basis of the following four assumptions: (a) perfect capital mobility; (b) perfect price flexibility; (c) perfect substitution between domestic and foreign goods; and (d) perfect substitution between domestic and foreign bonds. The last three assumptions are shared by the fixed-price keynesian model of exchange rate determination. The above-mentioned assumptions reflect both the monetary nature and the foreign exchange market efficiency concepts of the flexible price model.

According to the flexible-price monetary model, the exchange rate is determined by the demand for and supply of money in each country. The money supply is determined exogenously by the monetary authorities of each nation. The money demand function is a derivative of levels of income, price, and interest rate in each country.

$$\ln M_d^D = \ln P_d + \alpha \ln Y_d + \beta i_d \quad (1)$$
$$\ln M_f^D = \ln P_f + \alpha \ln Y_f + \beta i_f \quad (2)$$

where M^D, P, Y, and i represent money demand, price level, real output, and short-term interest, respectively. The "d" and "f" subscripts denote domestic and foreign variables, respectively.

In a state of equilibrium, relative money supply equals relative money demand and, consequently, the following equation is derived.

$$(\ln M_d^s - \ln M_f^s) = (\ln P_d - \ln P_f) + \alpha(\ln Y_d - \ln Y_f) - \beta(i_d - i_f) \quad (3)$$

The uncovered interest parity doctrine of perfect capital mobility permits the substitution of expected change in exchange rate, $E(\Delta \ln X)$, for the relative interest rates component. Thus, the above equation is rewritten as shown below.

$$(\ln P_d - \ln P_f = (\ln M_d^s - \ln M_f^s) - \alpha(\ln Y_d - \ln Y_f) + \beta[E(\Delta \ln X)] \quad (4)$$

In addition, the purchasing power parity doctrine allows for the following two substitutions. First, the relative price level term is replaced with logarithm of exchange rate, lnX. Second, the anticipated inflation rates differential, $(\pi_d - \pi_f)$, is substituted for the term $E(\Delta \ln X)$. Following the above substitutions, the equation 4 can be rewritten as follows:

$$\ln X = (\ln M_d^s - \ln M_f^s) - \alpha(\ln Y_d - \ln Y_f) + \beta(\pi_d - \pi_f) \quad (5)$$

The coefficients "α" and "β" represent the income elasticity of money demand and interest rate semi elasticity of money demand, respectively. The exchange rate, X, is defined as the domestic price of the foreign currency. The model excludes the nominal interest rate from the analysis because changes in nominal interest rates are believed to be directly linked to changes in inflationary expectations.

The flexible-price monetary model of the exchange rate, or equation 5, implies that: (a) an increase in

the domestic money supply causes a depreciation in the value of domestic currency; (b) an increase in the domestic real income results in appreciation of the domestic currency; and (c) an increase in expected rate of inflation at home puts downward pressure on the domestic currency. Empirical results from testing the flexible price model are presented and examined in section II.

B. Fixed-Price Keynesian Model

The fixed price keynesian model of the monetary approach assumes that exchange rates are partially a monetary phenomenon. The keynesian view of exchange rate movement mainly reflects the liquidity effect of money supply changes, and allows for short-term deviations from the purchasing power parity. Accordingly, the flexible price model implies that, in the asset market, prices adjust instantaneously to economic shocks; whereas, in the commodity market prices are stuck in the short-run and adjust slowly to economic disturbances. Consequently, the speedy adjustments of exchange rates and sluggish adjustments of commodity prices to economic shocks can result in short-term deviation from purchasing power parity and exchange rate overshooting. In the long run, however, the exchange rate equilibrium is regained through purchasing power parity.

The flexible price model's attempt to distinguish between short-run and long-run analysis is the basis for the exchange rate overshooting concept. The exchange rate effects of changes in interest rates depend on the underlying cause of such changes. If domestic interest rates increase due to a short-run liquidity effect of tight monetary policy at home, then domestic currency will appreciate as a result of capital inflow. However, if the increase in domestic interest rates is caused by a long-term inflationary effect of expansionary monetary policy at home, then the domestic currency is expected to depreciate in the foreign exchange market. On that basis, Dornbusch (1976) claims that an increase in stock of money at home lowers domestic interest rates instantly and causes capital outflows, which in turn result in depreciation domestic currency beyond its long-run equilibrium level. This is known as spot exchange rate overshooting, because the domestic currency is expected to appreciate and cancel out the interest rate differentials.

In the long run, by maintaining the purchasing power parity assumption, the fixed price model's exchange rate equation is identical to that of the flexible price model.

$$\ln X_L = (\ln M_d^s - \ln M_f^s) - \alpha(\ln Y_d - \ln Y_f) + \beta(\pi_d - \pi_f) \quad (6)$$

where "$\ln X_L$" denotes the logarithm of the long-run equilibrium spot exchange rate.

In the short run, the spot exchange rate overshoots it long-run equilibrium value by an amount proportional to the real interest differentials.[1] The extent of overshooting is a function of the speed by which the asset and the commodity markets clear, the interest rate elasticity of money demand, and the degree of international capital mobility. The following equation shows the method of calculating "Φ" or the speed at which the gap between the spot exchange rate and its long-run equilibrium value is expected to close.

$$\ln X - \ln X_L = (1/\Phi[(i_d - \pi_d)-(i_f - \pi_f)] \quad (7)$$

By incorporating equation 6 into the above equation, the fixed price keynesian model can be defined in the following mathematical format:

$$\ln X = (\ln M_d^s - \ln M_f^s) - \alpha(\ln Y_d - \ln Y_f) - (1/\Phi)[i_d - \pi_d)-(i_f - \pi_f) + \beta(\pi_d - \pi_f)] \quad (8)$$

The fixed-price keynesian model of exchange rate determination, equation 8, implies that an increase in domestic money supply, a reduction in domestic real income, a decline in short-term interest rates at home, and/or higher inflationary expectations at home will force domestic currency to depreciate in the foreign exchange markets. The empirical evidence from testing this model have been summarized and reviewed in section II.

C. Portfolio-Balance Approach

In general, a portfolio-balance model of exchange rate is composed of money, bonds, and foreign assets. The model requires simultaneous adjustment of foreign exchange rates and interest rates in order to establish equilibrium in money and bond markets. For example, if monetary policy in the United States is expanded then the economy will encounter an excess supply of money and an excess demand for domestic and foreign bonds. A decline in the domestic interest rate will absorb the additional stock of money and eliminate excess demand for domestic bonds. However, in order to eliminate the excess demand for foreign bonds, the exchange value of domestic currency must be depreciated. This will restore equilibrium in both the money and bond markets.

The portfolio-balance theory also explores the relationship between current account balances and

exchange rate movement.[2] Exchange rates are affected by current account imbalance directly as a result of changes in currency composition of an asset portfolio, or indirectly through changes in real interest rates and their impact on expenditures and money demand. If the home country experiences a current account surplus, then the resulting accumulation of foreign assets will cause real interest rates to rise, which in turn will force domestic currency to appreciate in the foreign exchange market.

A simple portfolio-balance model of exchange rates may require uniform portfolio preference across nations and impose the restriction of rational and static expectations in order to make exchange rate risk premium equal to zero. The portfolio-balance model as defined in equation 9, sets the exchange rate as a function of interest rate differentials, the net supply of domestic bonds and the net supply of foreign bonds.

$$\ln X = \beta_0 + \beta_1(i_d - i_f) + \beta_2 \ln D_d + \beta_3 \ln D_f + \beta_4 \ln F_d + \beta_5 \ln F_f \quad (9)$$

In the above equation, variables D_d and D_f denote the supply of domestic bonds held by domestic and foreign residents, respectively. Also, variables F_d and F_f represent the supply of foreign bonds held by domestic and foreign residents, respectively.

The theoretical implications of the portfolio balance model or equation 9, are: (a) an increase in domestic interest rates causes an appreciation in the value of domestic currency; (b) an increase in the holdings of domestic and foreign bonds by home residents forces the domestic currency to depreciate; and (c) an increase in the holdings of domestic and foreign bonds by foreign residents results in appreciation of domestic currency. The empirical results of the portfolio-balance model of exchange rate determination are summarized and reviewed in the next section.

II. REVIEW OF EMPIRICAL RESULTS

The asset market exchange rate models are empirically examined in two stages. First, these models are tested using the dollar/pound, the dollar/mark, and the dollar/yen exchange rates over the 1973-1990 period. Second the exchange rate models of identical currencies are retested on an episodic basis. The objective is to discern if, during particular episodes, certain exchange rate models outperform other theories of exchange rate determination. Additionally, the intention is to determine whether the short-run view of the flexible price theory or the long run philosophy of the fixed price model influence the outcome of empirical testing of the "asset market" models. It is generally believed that the monetarist flexible price model is a short-term model by nature, and thus, studying it on a episodic basis may produce more favorable results relative to the keynesian fixed price model, which has a long-term prospect.

The estimation techniques used to test these models include the ordinary least square (OLDS) regression method, the Cochrane Orcutt (CORC) iterative process, and the seemingly unrelated regression (SUR) procedure. The CORC iterative process is employed in order to correct for first-order autocorrelation. The SUR procedure is implemented in order to take into account the interrelationship between the exchange rate markets between nations in a bilateral exchange rate set up. The empirical results of all three models of the exchange rate are summarized and discussed in the following sections.

A. Flexible-Price Monetary Model

According to the flexible-price monetary theory of exchange rate, the relative money supply coefficient must be positive and close to unity; the income elasticity of money demand or relative income coefficient is expected to be negative; and the interest elasticity of money demand or relative inflation coefficient is assumed to be positive. The model, as presented by equation 5, was tested using OLS, CORC, and SUR estimation techniques, and the statistical results are summarized in tables 1 through 4.

According to table 1, where the results of testing the flexible price model over the entire sample period are tabulated, there is no supporting evidence for the dollar/pound exchange rate. The estimated coefficients either are insignificant or carry an incorrect sign, or both. In the case of the dollar/mark exchange rate, once the correction is made for the first-order autocorrelation, the estimated coefficients are in concern with the flexible price theory. The problem is that by using the CORC method, the estimated coefficients lost their statistical significance. In the case of the dollar/yen, as shown in table 1, the OLS estimation of the coefficients is statistically significant and conforms to the flexible-price monetary theory. However, the determination, R^2, and the D.W. statistics indicate poor explanatory power of the independent variables and first-order autocorrelation among residual terms, respectively.

The flexible-price model was reexamined in terms of the three exchange rates on an episodic basis. These episodes were selected on the basis of two factors--maximum explanatory power of independent variables and minimum first-order autocorrelation among residual terms. The failure of the model with

TABLE 1

Flexible Price Model of Exchange Rates
Monthly data: January 1973-December 1990
(t-statistics in parentheses)

Dependent Variable $\ln S_t$	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	R^2	S.E.	D.W.	Γ
Dollar/pound	OLS	0.473	-0.008	-1.446	0.033	0.35	0.156	0.06	
		(3.030)	(-0.250)	(-6.418)	(1.117)				
	CORC	0.301	-0.048	-0.182	-0.003	0.97	0.032	1.85	0.982
		(1.105)	(-0.995)	(-0.429)	(0.887)				
	SUR	2.593	-0.003	-0.456	0.011				
		(13.68)	(-1.210)	(-10.61)	(9.868)				
Dollar/mark	OLS	-0.894	0.054	0.797	0.044	0.41	0.143	0.09	
		(-18.61)	(0.891)	(6.353)	(10.18)				
	CORC	-0.648	0.005	-0.051	0.005	0.97	0.035	1.98	0.982
		(-3.585)	(0.432)	(-0.429)	(0.887)				
	SUR	-2.940	0.031	0.427	0.006				
		(-12.06)	(3.177)	(8.261)	(2.963)				
Dollar/yen	OLS'	1.172	1.303	-0.709	0.030	0.64	0.167	0.20	
		(1.641)	(9.062)	(-3.093)	(10.85)				
	CORC	-5.079	-0.012	0.070	0.004	0.99	0.034	1.84	0.992
		(-9.366)	(-0.220)	(0.443)	(1.703)				
	SUR	-10.34	0.010	1.088	0.002				
		(-45.10)	(7.621)	(21.99)	(1.587)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.956 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; and π - expected inflation measured by annualized rate of change in the Consumer Price Index.

TABLE 2

Flexible Price Model
Dollar/Pound Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	R^2	S.E.	D.W.	Γ
1973.01-1975.12	OLS	-0.368	-0.296	-0.837	0.014	0.84	0.027	0.75	
		(-0.479)	(-1.480)	(-5.960)	(5.833)				
	CORC	0.313	-0.130	-0.530	0.010	0.91	0.021	1.56	0.752
		(0.336)	(-0.537)	(-2.808)	(3.283)				
	SUR	-0.904	-0.016	0.435	-0.003				
		(-2.667)	(-3.403)	(5.152)	(-6.365)				
1976.01-1980.12	OLS	-4.492	-1.245	1.112	-0.014	0.71	0.065	0.58	
		(-4.817)	(-5.772)	(4.166)	(-4.355)				
	CORC	2.459	0.172	-0.144	-0.007	0.94	0.030	2.00	0.995
		(0.536)	(0.891)	(-0.762)	(-2.079)				
	SUR	-1.634	-0.025	0.5391	0.008				
		(-2.503)	(-5.936)	(3.515)	(3.367)				
1981.01-1984.12	OLS	8.583	1.848	-0.188	-0.017	0.89	0.058	1.29	
		(17.43)	(16.71)	(-1.178)	(-1.530)				
	CORC	-0.804	-0.177	-0.455	-0.008	0.97	0.029	2.11	0.969
		(-0.968)	(-1.138)	(-1.406)	(-0.992)				
	SUR	3.429	-0.010	-0.699	0.043				
		(6.960)	(-4.229)	(-6.324)	(14.86)				
1985.01-1990.12	OLS	-0.767	-0.247	0.670	0.019	0.69	0.070	0.37	
		(-5.575)	(-9.265)	(1.293)	(2.666)				
	CORC	0.186	-0.070	0.106	0.008	0.92	0.037	2.04	0.903
		(0.558)	(-1.152)	(0.298)	(0.843)				
	SUR	-5.669	-0.000	1.313	0.008				
		(-7.821)	(-0.049)	(8.443)	(2.291)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.956 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; and π - expected inflation measured by annualized rate of change in the Consumer Price Index.

TABLE 3

Flexible Price Model
Dollar/Mark Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	R^2	S.E.	D.W.	Γ
1973.01-1980.12	OLS	-2.854	2.224	0.014	0.014	0.76	0.110	0.61	
		(-9.205)	(5.052)	(0.020)	(7.199)				
	CORC	-0.766	0.093	0.150	0.003	0.95	0.036	1.97	0.946
		(-6.611)	(0.762)	(0.690)	(0.335)				
	SUR	-6.852	0.286	1.014	-0.004				
		(-20.16)	(15.38)	(17.39)	(-2.612)				
1981.01-1983.12	OLS	-0.842	-0.248	-0.960	0.025	0.72	0.037	0.75	
		(-4.653)	(-0.899)	(-4.606)	(6.326)				
	CORC	-0.928	-0.062	-0.564	-0.003	0.87	0.026	1.64	0.832
		(-9.449)	(-0.437)	(-2.095)	(-0.300)				
	SUR	0.545	-0.067	-0.248	0.013				
		(0.802)	(-3.442)	(-1.911)	(7.373)				
1984.01-1987.12	OLS	-2.854	2.224	0.014	0.158	0.76	0.110	0.61	
		(-9.205)	(5.052)	(0.020)	(7.199)				
	CORC	-1.434	-0.002	-0.068	-0.005	0.97	0.039	2.25	1.020
		(-1.778)	(-0.009)	(-0.332)	(-0.285)				
	SUR	-11.097	0.165	2.032	-0.060				
		(-6.000)	(4.731)	(4.965)	(-5.798)				
1988.01-1990.12	OLS	-0.733	0.016	-1.596	0.073	0.66	0.047	0.82	
		(-16.00)	(0.760)	(-6.059)	(4.276)				
	CORC	-0.584	0.005	-0.406	0.014	0.84	0.033	1.69	0.898
		(-7.437)	(0.489)	(-1.200)	(0.605)				
	SUR	-2.218	-0.001	0.354	-0.002				
		(-3.892)	(-0.047)	(2.956)	(-0.572)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.956 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; and π - expected inflation measured by annualized rate of change in the Consumer Price Index.

TABLE 4

Flexible Price Model
Dollar/Yen Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	R^2	S.E.	D.W.	Γ
1973.01-1976.12	OLS	-4.444	0.226	-0.752	0.002	0.50	0.034	0.88	
		(-13.17)	(3.330)	(-4.112)	(1.419)				
	CORC	-6.862	-0.237	0.131	0.003	0.77	0.023	1.63	0.944
		(-12.22)	(-2.172)	(0.541)	(1.254)				
	SUR	-6.424	0.004	0.172	-0.000				
		(-31.34)	(3.202)	(3.701)	(-0.896)				
1977.01-1978.12	OLS	-4.316	0.227	-0.136	0.049	0.89	0.055	1.05	
		(-1.908)	(0.522)	(-0.156)	(10.57)				
	CORC	-4.961	0.003	-0.081	-0.003	0.94	0.043	2.35	0.962
		(-2.948)	(0.013)	(-0.101)	(-0.188)				
	SUR	-21.43	0.095	3.497	-0.007				
		(-24.72)	(16.98)	(18.55)	(-2.131)				
1979.01-1982.12	OLS	-4.022	0.279	1.268	-0.008	0.49	0.057	0.68	
		(-4.247)	(1.484)	(5.580)	(-1.035)				
	CORC	-5.686	-0.043	0.034	0.002	0.77	0.039	1.60	0.836
		(-7.640)	(-0.297)	(0.091)	(0.283)				
	SUR	-4.810	0.002	-0.149	0.003				
		(-19.62)	(1.149)	(-2.556)	(1.714)				
1983.01-1990.12	OLS	2.909	1.701	-2.743	0.123	0.72	0.141	0.73	
		(2.327)	(6.770)	(-7.500)	(7.701)				
	CORC	-4.258	0.054	0.106	0.010	0.99	0.033	1.84	0.991
		(-3.670)	(0.798)	(0.454)	(1.533)				
	SUR	-13.17	-0.028	1.809	-0.050				
		(-25.25)	(-5.647)	(15.68)	(-5.559)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.956 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; and π - expected inflation measured by annualized rate of change in the Consumer Price Index.

respect to the dollar/pound exchange rate during all four episodes, as shown in table 2, could easily be noticed by the incorrect signs of estimated coefficients. The empirical results improved slightly when the model was tested episodically for the dollar/mark and the dollar/yen exchange rates. For instance, table 3 shows that the model's estimated coefficients for the dollar/mark exchange rate, during the period from January 1988 to December 1990, appeared with the correct sign and were mostly statistically significant when the OLS estimation technique was adopted. Despite loss of statistical significance, the coefficients continued to maintain their correct sign when the estimation technique was switched to the CORC method. In the case of the dollar/yen exchange rate, the results in table 4 show that the OLS's estimated coefficients conform to the theoretical model during the three time episodes. Even though the R^2 coefficient and the D.W. statistics were somewhat less than acceptable, the coefficients were statistically significant on many occasions. The application of the SUR procedure produced favorable results during the episode of January 1979-February 1982. In general, the empirical results on an episodic basis appear to be more supportive of the flexible price model.

B. Fixed-Price Keynesian Model

The fixed-priced model of exchange rates, as formulated in equation 8, implies that the estimated coefficients of relative money supply and the expected inflation differential should carry a positive sign, and those coefficients of relative income and real interest inferential are expected to be negative. The estimated coefficients of the fixed price model using all three estimation techniques, both for the entire sample period as well as different episodes, are summarized in table 5 through 8. As shown in table 5, the CORC estimation of the dollar/mark exchange rate is the sole case in support of the fixed-price keynesian theory. All OLS- and USR-generated coefficients carry the wrong sign, and the model appears to have serious problems as far as the R^2 coefficient and the D.W. statistics are concerned. It must be noted, however, that in comparison to the OLS and CORC statistics, the results provided by the SUR procedure show a lower standard error of regressions, higher coefficient of determination, and higher t-statistics.

When the fixed price model was retested in an episodic framework for the dollar/pound, the dollar/mark, and the dollar/yen exchange rates, all empirical re-

TABLE 5

Fixed Price Model of Exchange Rates
Monthly Data: January 1973-December 1990
(t-statistics in parentheses)

Dependent Variable $\ln S_t$	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	r_d-r_f	R^2	S.E.	D.W.	Γ	
Dollar/pound	OLS	0.382	-0.030	-1.528	0.008	0.006	0.35	0.156	0.06		
		(2.167)	(-0.792)	(-6.450)	(1.562)	(1.116)					
	CORC	0.313	-0.046	-0.196	-0.002	0.001	0.97	0.032	1.86	0.982	
		(1.140)	(-0.960)	(-1.475)	(-0.461)	(0.485)					
	SUR	2.590	-0.003	-0.454	0.010	-0.001					
		(13.62)	(-1.500)	(-10.55)	(5.428)	(-0.544)					
Dollar/mark	OLS	-0.804	-0.013	1.116	0.026	-0.025	0.48	0.135	0.19		
		(-16.561)	(-0.241)	(8.372)	(4.921)	(-5.206)					
	CORC	-0.640	0.005	-0.058	0.004	-0.001	0.97	0.035	1.99	0.982	
		(-3.477)	(0.432)	(-0.485)	(0.641)	(-0.863)					
	SUR	-4.301	0.041	0.723	0.005	-0.018					
		(-16.91)	(3.677)	(12.86)	(1.920)	(-6.231)					
Dollar/yen	OLS	1.167	1.302	-0.709	0.030	0.000	0.64	0.167	0.19		
		(1.625)	(9.007)	(-3.086)	(7.988)	(0.083)					
	CORC	-5.015	-0.002	0.185	-0.002	-0.007	0.99	0.034	1.81	0.992	
		(-9.179)	(-0.031)	(1.128)	(-0.604)	(-2.451)					
	SUR	-11.06	0.011	1.051	-0.001	-0.007					
		(-47.73)	(6.265)	(24.85)	(-0.671)	(-2.307)					

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; π - expected inflation measured by annualized rate of change in the Consumer Price Index; and r- real interest rates measured by short-term money market rates minus expected inflation rate.

TABLE 6

Fixed Price Model
Dollar/Pound Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	r_d-r_f	R^2	S.E.	D.W.	Γ
1973.01-1976.12	OLS	4.614	0.979	-0.546	0.023	0.026	0.96	0.030	1.21	
		(15.51)	(12.02)	(-3.676)	(6.691)	(8.455)				
	CORC	-13.54	0.037	-0.179	0.007	0.009	0.97	0.025	1.72	0.999
		(-0.016)	(0.187)	(-0.903)	(1.105)	(1.675)				
	SUR	-0.024	-0.007	0.200	-0.002	-0.001				
		(-0.034)	(-0.751)	(1.169)	(-0.501)	(-0.350)				
1977.01-1980.12	OLS	-4.922	-1.346	1.238	-0.023	-0.015	0.84	0.047	1.10	
		(-6.352)	(-7.472)	(6.177)	(-6.603)	(-4.853)				
	CORC	-1.193	0.174	-0.187	-0.008	-0.005	0.96	0.028	2.43	1.004
		(-0.056)	(0.807)	(-0.982)	(-1.808)	(-1.609)				
	SUR	0.141	-0.016	0.106	0.022	0.019				
		(0.177)	(-3.512)	(0.570)	(7.825)	(6.562)				
1981.01-1984.12	OLS	8.225	1.768	-0.353	-0.009	0.010	0.90	0.057	1.30	
		(14.96)	(14.35)	(-1.790)	(-0.693)	(1.404)				
	CORC	-0.850	-0.184	-0.382	-0.011	-0.003	0.97	0.029	2.14	0.969
		(-1.015)	(-1.172)	(-1.123)	(-1.238)	(-0.760)				
	SUR	3.789	-0.007	-0.800	0.047	0.011				
		(7.300)	(-2.454)	(-6.706)	(14.24)	(2.313)				
1985.01-1990.12	OLS	-0.762	-0.255	0.635	0.022	0.015	0.71	0.069	0.35	
		(-5.594)	(-9.473)	(1.236)	(3.049)	(1.521)				
	CORC	0.301	-0.067	0.144	0.026	0.026	0.93	0.034	2.10	0.895
		(0.963)	(-1.184)	(0.427)	(2.443)	(3.157)				
	SUR	-5.980	0.026	1.377	-0.008	-0.042				
		(-9.811)	(7.010)	(10.57)	(-2.290)	(-7.540)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; π - expected inflation measured by annualized rate of change in the Consumer Price Index; and r- real interest rates measured by short-term money market rates minus expected inflation rate.

TABLE 7

Fixed Price Model
Dollar/Mark Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	r_d-r_f	R^2	S.E.	D.W.	Γ
1973.01-1981.12	OLS	-0.474	-0.635	0.593	0.027	-0.007	0.81	0.065	0.55	
		(-6.031)	(-5.156)	(3.574)	(7.034)	(-2.117)				
	CORC	-0.793	0.027	0.044	0.005	-0.001	0.94	0.036	1.90	0.939
		(-8.098)	(0.241)	(0.204)	(0.634)	(-0.650)				
	SUR	-6.230	0.216	0.958	-0.005	-0.011				
		(-17.14)	(10.87)	(14.52)	(-2.225)	(-4.574)				
1982.01-1983.12	OLS	-1.201	0.208	-1.359	0.013	0.013	0.75	0.026	1.33	
		(-6.350)	(0.739)	(-6.309)	(1.701)	(2.177)				
	CORC	-1.025	-0.017	-1.035	0.005	0.010	0.82	0.023	1.94	0.492
		(-7.596)	(-0.085)	(-3.487)	(0.380)	(1.468)				
	SUR	1.091	-0.079	-0.358	0.009	0.008				
		(2.066)	(-4.068)	(-3.753)	(3.272)	(2.817)				
1984.01-1990.12	OLS	-0.929	-0.018	2.548	0.063	-0.111	0.78	0.110	0.66	
		(-15.24)	(-0.362)	(4.538)	(2.714)	(-10.20)				
	CORC	0.182	0.005	-0.074	0.003	0.001	0.98	0.036	2.07	0.992
		(0.085)	(0.414)	(-0.439)	(0.188)	(0.113)				
	SUR	-13.59	0.109	2.681	-0.054	-0.042				
		(-18.61)	(5.121)	(17.32)	(-8.061)	(-8.445)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; π - expected inflation measured by annualized rate of change in the Consumer Price Index; and r- real interest rates measured by short-term money market rates minus expected inflation rate.

sults were either of poor statistical quality, carried the wrong signs, or both. The evidence stored in tables 6, 7, and 8 do not generate any support for the fixed price model. This failure can be attributed to the model's underlying assumptions of foreign exchange market efficiency and perfect capital mobility. Evidence from recent studies seems to be in favor of the covered interest parity and against the uncovered interest parity and, thus, has lead to he rejection of the joint hypothesis of market efficiency and no-risk premium.[3]

The blame for the poor performance of the fixed price model could be placed on the subtractive linear constraint imposed on exogenous variables in order to reduce multicollinearity among them; however, such a constraint may incorrectly imply that domestic and foreign variables have equal but opposite effects on the exchange rate. Additionally, in the case of a subtractive linear constraint, bias in one coefficient can be transmitted to those coefficients with no initial bias. In response to these allegations, both the fixed-price and the flexible-price models were restructured and tested without a subtractive linear constraint format, and the test results showed no noticeable improvement.

The questionability of the long-run stability of the purchasing power parity could be another contributing factor to the empirical failure of the fixed price model. The long-run stability of the purchasing power parity can be tested by using the cointegration technique. According to the purchasing power parity theorem, the inflation rate in the United States and the exchange-rate-adjusted-inflation rate in a foreign country must be cointegrated. Once the cointegration is established, the belief is that capital mobility would eliminate short-run deviations from the purchasing power parity. There has been no solid empirical support for the cointegration of the two inflation series in recently published studies.[4]

C. Portfolio-Balance Model

The empirical results from testing the portfolio-balance model, or equation 9, have been compiled in table 9 through 12. The theoretical implication of the model is that the exchange rate is negatively related to both interest rate differentials as well as foreign bonds held by domestic and foreign residents, and also is a positive function of domestic bonds held by domestic bonds held by domestic and foreign residents. In table 9, all estimated coefficients of the portfolio balance model for the dollar/pound, the dollar/mark, and the dollar/yen over the 1973 1990 period are reported. In general, the results are often

TABLE 8

Fixed Price Model
Dollar/Yen Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	M_d-M_f	Y_d-Y_f	$\pi_d-\pi_f$	r_d-r_f	R^2	S.E.	D.W.	Γ
1973.01-1974.12	OLS	-8.727	-0.637	-0.324	0.026	0.029	0.84	0.023	2.21	
		(-13.16)	(-4.711)	(-2.030)	(8.009)	(5.401)				
	CORC	-7.599	-0.410	-0.314	0.023	0.024	0.88	0.020	1.87	0.141
		(-9.810)	(-2.617)	(-2.444)	(7.399)	(4.717)				
	SUR	-7.215	0.016	0.341	0.003	0.012				
		(-12.64)	(4.616)	(2.669)	(1.363)	(3.024)				
1975.01-1979.12	OLS	-6.750	-0.188	1.913	0.033	0.013	0.83	0.070	0.40	
		(-4.503)	(-0.649)	(4.345)	(7.895)	(1.892)				
	CORC	-4.987	0.046	0.488	-0.017	-0.018	0.97	0.031	1.79	0.982
		(-5.498)	(0.367)	(1.289)	(-1.650)	(-2.096)				
	SUR	-10.37	0.026	1.067	0.000	-0.003				
		(-23.03)	(10.02)	(10.65)	(0.192)	(-1.344)				
1980.01-1990.12	OLS	5.480	2.207	-2.482	0.086	0.006	0.69	0.146	0.86	
		(7.013)	(13.82)	(-7.518)	(8.278)	(1.003)				
	CORC	-4.448	0.027	0.133	0.000	-0.007	0.98	0.035	1.84	0.993
		(-3.358)	(0.413)	(0.631)	(0.061)	(-1.955)				
	SUR	-11.57	-0.008	1.421	-0.015	-0.017				
		(-28.22)	(-2.881)	(16.33)	(-3.929)	(-4.643)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). The subscripts "d" and "f" represent domestic and foreign country, respectively. Independent variables are M - logarithm of money supply; Y - logarithm of industrial production; π - expected inflation measured by annualized rate of change in the Consumer Price Index; and r- real interest rates measured by short-term money market rates minus expected inflation rate.

TABLE 9

Portfolio Balance Model of Exchange Rates
Monthly Data: January 1973-December 1990
(t-statistics in parentheses)

Dependent Variable $\ln S_t$	Estimation Method	Constant	$i_d - i_f$	B_d	B_f	F_d	F_f	R^2	S.E.	D.W.	Γ
Dollar/pound	OLS	0.596	0.001	-0.420	0.590	0.002	-0.004	0.02	0.192	0.06	
		(-26.39)	(0.199)	(-0.643)	(0.913)	(0.447)	(-1.216)				
	CORC	0.543	0.001	0.048	0.188	-0.001	0.000	0.97	0.032	1.87	0.982
		(4.264)	(0.290)	(0.588)	(2.037)	(-1.219)	(0.635)				
	SUR	0.592	0.000	0.008	-0.002	0.000	-0.000				
		(39.63)	(0.281)	(0.064)	(-0.013)	(0.047)	(-0.183)				
Dollar/mark	OLS	-0.790	0.009	-1.282	0.031	-0.000	-0.002	0.03	0.184	0.09	
		(-45.60)	(1.538)	(-2.037)	(0.740)	(-0.037)	(-0.606)				
	CORC	-0.579	-0.001	-0.028	-0.003	-0.000	0.000	0.96	0.035	1.97	0.984
		(-2.499)	(-0.777)	(-0.311)	(-0.595)	(-0.914)	(0.617)				
	SUR	-0.791	0.000	-0.016	0.000	-0.000	-0.000				
		(-58.99)	(0.074)	(-0.195)	(0.041)	(-0.004)	(-0.005)				
Dollar/yen	OLS	-5.387	0.035	-1.590	-0.045	-0.001	0.002	0.19	0.252	0.07	
		(-248.5)	(6.502)	(-1.858)	(-0.534)	(-3.376)	(0.603)				
	CORC	-2.128	-0.005	-0.063	-0.001	0.001	0.001	0.99	0.033	1.77	0.999
		(-0.090)	(-1.800)	(-0.745)	(-0.128)	(1.817)	(1.889)				
	SUR	-5.305	-0.009	0.261	-0.013	0.000	0.000				
		(-250.8)	(-4.256)	(0.772)	(-0.397)	(0.234)	(0.353)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). Independent variables are $i_d - i_f$ - short-term nominal interest rates differential; B_d - dollar-bond holdings of U.S residents; B_f - foreign-bond holdings of the foreign residents; F_d - foreign-bond holdings of U.S. residents; and F_f - dollar-bond holdings of foreign residents.

TABLE 10

Portfolio Balance Model
Dollar/Pound Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	$i_d - i_f$	B_d	B_f	F_d	F_f	R^2	S.E.	D.W.	Γ
1973.01-1974.12	OLS	0.946	0.023	-0.005	0.015	-0.003	-0.008	0.81	0.017	1.68	
		(103.1)	(7.981)	(-0.034)	(0.116)	(-3.151)	(-0.362)				
	CORC	0.953	0.027	-0.062	0.132	-0.003	0.087	0.84	0.016	1.71	0.169
		(105.9)	(8.308)	(-0.392)	(0.904)	(-2.984)	(1.553)				
	SUR	0.909	-0.003	-0.183	0.127	-0.000	-0.017				
		(57.95)	(-2.150)	(-1.063)	(0.864)	(-0.335)	(-0.896)				
1975.01-1976.12	OLS	0.838	0.045	1.579	1.992	0.037	0.010	0.77	0.070	1.29	
		(12.75)	(4.430)	(2.377)	(2.910)	(1.801)	(2.336)				
	CORC	3.653	0.010	0.198	0.282	-0.003	0.002	0.97	0.028	1.89	1.001
		(0.038)	(1.058)	(1.219)	(1.665)	(-0.503)	(1.296)				
	SUR	0.712	-0.005	0.193	1.158	0.027	-0.002				
		(15.48)	(-0.973)	(0.293)	(1.927)	(1.391)	(-0.514)				
1977.01-1980.12	OLS	0.687	-0.019	1.600	-2.506	0.016	-0.004	0.49	0.086	0.91	
		(34.14)	(-3.490)	(2.565)	(-5.022)	(3.441)	(-2.043)				
	CORC	0.960	-0.008	0.176	0.019	0.001	-0.000	0.95	0.027	2.32	0.970
		(2.608)	(-2.608)	(1.258)	(0.133)	(1.215)	(-0.991)				
	SUR	0.501	0.022	0.298	-1.531	0.004	-0.000				
		(24.30)	(11.44)	(0.695)	(-5.635)	(1.193)	(-0.037)				
1981.01-1985.12	OLS	0.465	0.039	1.841	-4.714	-0.011	0.002	0.37	0.149	0.43	
		(15.16)	(4.211)	(1.333)	(-2.060)	(-2.129)	(0.111)				
	CORC	0.293	-0.001	0.181	-0.111	-0.001	0.007	0.97	0.034	2.01	0.944
		(2.556)	(-0.171)	(0.799)	(-0.250)	(-1.631)	(2.394)				
	SUR	0.136	0.029	0.623	-1.981	-0.005	0.003				
		(2.758)	(60663)	(1.023)	(-1.334)	(-1.694)	(0.261)				
1986.01-1987.12	OLS	0.664	0.058	-0.996	0.630	-0.462	0.005	0.86	0.032	1.47	
		(19.44)	(7.246)	(-0.967)	(1.324)	(-5.115)	(0.186)				
	CORC	2.323	0.029	-0.571	0.323	-0.224	0.028	0.92	0.025	2.19	0.996
		(0.048)	(2.483)	(-0.985)	(0.997)	(-2.602)	(1.522)				
	SUR	0.518	-0.009	-2.216	1.117	-0.243	-0.025				
		(12.92)	(-2.081)	(-1.436)	(1.864)	(-1.687)	(-0.651)				
1987.01-1990.12	OLS	0.618	0.016	0.229	3.970	-0.017	-0.110	0.35	0.058	0.29	
		(18.57)	(2.525)	(0.248)	(2.827)	(-0.140)	(-2.148)				
	CORC	0.942	0.025	-0.130	2.443	-0.588	0.034	0.88	0.025	1.35	0.983
		(1.067)	(2.566)	(-0.524)	(4.417)	(-0.974)	(1.401)				
	SUR	0.570	-0.002	-0.209	1.450	-0.035	-0.026				
		(27.50)	(-1.267)	(-0.345)	(1.865)	(-0.440)	(-0.952)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). Independent variables are $i_d - i_f$ - short-term nominal interest rates differential; B_d - dollar-bond holdings of U.S residents; B_f - foreign-bond holdings of the foreign residents; F_d - foreign-bond holdings of U.S. residents; and F_f - dollar-bond holdings of foreign residents.

statistically insignificant or carry an incorrect sign, and in some cases both.

The portfolio-balance model was tested for all three exchange rates in different episodic scenarios, and the results are reported in tables 10, 11, and 12. According to table 10, the OLS's estimated coefficients of the dollar/pound exchange rate equation over the January 1977-December 1980 period appeared with correct signs and were statistically significant. The low level of the R^2 coefficient and D.W. statistics reduce the credibility of the estimated coefficients. The CORC estimation of the dollar/pound equation over the episodes of January 1973-December 1990 show a sign reversal amid improved R^2 coefficients and D.W. statistics. The episodic evaluation of the portfolio balance model for the dollar/mark and the dollar/yen exchange rates produced poor results with low statistical significance and incorrect signs.

A weak link between trade balance and the corresponding exchange rate may be the explanation for the poor empirical performance of the portfolio balance model. There seems to be a dual relationship between current account balances and the exchange rate, which the model is unable to fully capture. On the one hand, a trade restriction may imply a smaller than expected future trade deficit at home and, thus, would result in an appreciation of the home currency. On the other hand, a trade restriction could imply lower imports in the future which, in turn, would increase prices in the home country and a depreciation of the currency in the foreign exchange market. On a related note, there have been studies in recently published literature which have pointed to a poor and unstable relationship between trade balances and the exchange rate.[5] One rather simple explanation for this could be either a data deficiency concerning financial assets denominated in different currencies or an inability to specify a stable asset demand function.

III. SUMMARY AND CONCLUSION

The three models of the "asset market" view were empirically tested for the dollar/pound, the dollar/mark, and the dollar/yen exchange rates, both over a long sample period and for shorter episodic subperiods. Most empirical results generated from testing the models over the 1973-1990 period have been very poor in terms of factors such as predicted signs of coefficients, degree of statistical significance, explanatory power of independent variables, correlation among residual terms, or any combination of these factors. The inconsistencies observed in the empirical evidence could be related to existing doubts concerning the foreign exchange market efficiency and the perfect capital mobility assumption. However, this study finds it difficult to solidly reject the exchange rate analysis under the title of asset market view due to potential implausibility of the efficient market hypothesis, and perfect capital mobility assumption.

Traditionally, the monetarist flexible price model has been perceived as a short-term exchange rate model and the keynesian fixed price model has been considered a long-term exchange rate model. Compared to long-term original results, the empirical evidence obtained from the episodic examination of the flex-

TABLE 11

Portfolio Balance Model
Dollar/Mark Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	i_d-i_f	B_d	B_f	F_d	F_f	R^2	S.E.	D.W.	Γ
1973.01-1979.12	OLS	-0.863	0.034	-0.982	0.035	-0.004	-0.002	0.50	0.102	0.75	
		(-67.89)	(8.650)	(-2.358)	(1.495)	(-1.073)	(-0.671)				
	CORC	-0.651	0.001	-0.017	-0.003	-0.001	0.000	0.94	0.036	1.95	0.962
		(-3.622)	(0.301)	(-0.147)	(-0.524)	(-0.760)	(0.407)				
	SUR	-0.846	0.001	-0.053	-0.001	-0.000	0.000				
		(-52.72)	(1.500)	(-0.618)	(-0.178)	(-0.248)	(0.085)				
1980.01-1990.12	OLS	-0.616	-0.052	-2.228	0.131	0.000	-0.006	0.22	0.183	0.18	
		(-20.54)	(-5.307)	(-1.901)	(0.385)	(0.777)	(-0.898)				
	CORC	-0.644	-0.007	0.033	0.052	-0.000	0.001	0.97	0.035	1.93	0.992
		(-1.631)	(-2.056)	(0.197)	(1.256)	(-0.989)	(0.569)				
	SUR	-0.750	-0.001	-0.004	-0.0149	0.000	-0.000				
		(-34.26)	(-0.639)	(-0.017)	(-0.181)	(0.010)	(-0.009)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). Independent variables are i_d-i_f - short-term nominal interest rates differential; B_d - dollar-bond holdings of U.S residents; B_f - foreign-bond holdings of the foreign residents; F_d - foreign-bond holdings of U.S. residents; and F_f - dollar-bond holdings of foreign residents.

ible price model has produced more favorable results in the cases of dollar/mark and dollar/yen exchange rates. At the same time, evaluation of the fixed price model in an episodic framework did not produce any viable evidence in support of the keynesian theory.

The results summarized in this study appear to indicate strongly that there is an unstable and weak relationship between the exchange rate and the corresponding fundamental determinants. The question whether the cause of such a poor performance can be attributed to the models' structural defects, or to the misspecification or omitted explanatory variables, remains unanswered. A future study is proposed to examine the cointegration between the exchange rate and all determining variables defined in the monetary approach and the portfolio-balance approach models. This is expected to be the ultimate test of the exchange rate models' structural soundness.

TABLE 12

Portfolio Balance Model
Dollar/Yen Exchange Rate
(t-statistics in parentheses)

Estimation Period	Estimation Method	Constant	i_d-i_f	B_d	B_f	F_d	F_f	R^2	S.E.	D.W.	Γ
1973.01-1974.12	OLS	-5.595	0.016	-0.417	-0.141	-0.002	-0.002	0.79	0.027	1.88	
		(-615.7)	(6.209)	(-1.823)	(-1.226)	(-1.816)	(-0.636)				
	CORC	-5.593	0.017	-0.151	0.071	-0.001	0.002	0.85	0.023	2.00	0.090
		(-612.4)	(6.877)	(-0.673)	(0.550)	(-1.207)	(0.441)				
	SUR	-5.587	-0.006	-0.441	-0.091	-0.001	0.002				
		(-276.7)	(-2.666)	(-1.801)	(-0.957)	(-0.818)	(0.487)				
1975.01-1979.12	OLS	-5.537	0.040	0.027	-0.011	0.011	0.000	0.74	0.086	0.30	
		(-400.1)	(11.62)	(0.052)	(-0.340)	(1.574)	(0.164)				
	CORC	-5.232	-0.014	0.106	0.000	0.001	0.000	0.97	0.032	1.76	0.980
		(-13.26)	(-1.655)	(0.923)	(0.000)	(0.735)	(0.512)				
	SUR	-5.518	-0.003	-0.100	-0.002	-0.000	0.000				
		(-234.1)	(-1.655)	(-0.390)	(-0.125)	(-0.099)	(0.187)				
1980.01-1990.12	OLS	-5.121	-0.0154	-5.522	-0.019	-0.001	0.002	0.11	0.249	0.20	
		(-132.5)	(-1.643)	(-3.394)	(-0.063)	(-0.499)	(0.667)				
	CORC	-4.539	-0.005	-0.073	0.008	0.001	0.001	0.98	0.035	1.78	0.994
		(3.236)	(-1.490)	(-0.427)	(0.278)	(1.917)	(1.870)				
	SUR	-5.118	-0.016	0.549	-0.015	0.000	0.002				
		(-148.1)	(-3.798)	(0.683)	(-0.085)	(0.254)	(0.805)				

S.E. is standard error of regression and R^2 is coefficient of determination. Critical values of t-statistics (∞) are 1.645 (95 percent) and 2.576 (99 percent). Independent variables are i_d-i_f - short-term nominal interest rates differential; B_d - dollar-bond holdings of U.S residents; B_f - foreign-bond holdings of the foreign residents; F_d - foreign-bond holdings of U.S. residents; and F_f - dollar-bond holdings of foreign residents.

FOOTNOTES

[1]A detailed discussion of the exchange rate overshooting concept is presented in papers by Jeffrey Frenkel (1983), H. Visser (1989), and Koedijk and Schotman (1990).

[2]MacDonald and Taylor (1992) provide a comprehensive survey of the portfolio-balance approach and the relationship between the current balance and exchange rates.

[3]Studies by Sarkis Khoury (1986), Koedijk and Ott (1987), Soenen and Winkel (1988), and MacDonald and Taylor (1989) have provided somewhat conflicting evidence regarding the efficiency of foreign exchange and significance of risk premia.

[4]Studies by Mark Taylor (1989), Layton and Stark (1990), and Fraser, Taylor, and Webster (1991) have presented empirical evidence from reexamination of the purchasing power parity hypothesis for major exchange rates using the cointegration of the economic time series technique.

[5]The poor and unstable link between exchange rate and current account balances has been noted in studies by Gikas Hardouvelis (1988), Deravi, Gregorowicz, and Hegi (1988), and Hogon, Melvin, and Roberts (1991).

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THE EFFECTS OF BANK FOR INTERNATIONAL SETTLEMENTS-RELATED LENDING TO MEXICO IN COMBINATION WITH IMF, WORLD BANK, BILATERAL, AND PRIVATE LENDING

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I. THE BANK FOR INTERNATIONAL SETTLEMENTS

Reciprocal Currency Agreements

The Bank for International Settlements (BIS) was founded in 1930 and is based in Basle, Switzerland. Its original function of providing for a smooth flow of reparations payments between Germany and its creditors has ended, of course, but its auxiliary function of promoting cooperation between the world's central banks has greatly expanded. Evidence of this can be seen in a broad network of emergency mutual credits (Reciprocal Currency Agreements, RCA's, or swaps) created through the BIS in 1962. These remain extended to be drawn by central banks when foreign exchange is necessary for exchange market intervention, to settle deficits, or for "bridge financing" while long-term loans are being arranged. These swap lines were periodically increased as needed over the years, although there have been few changes since the late 1970's. Mexico was one of the last RCA members to increase the level of its lines (1979) and also the only country for which there is a relatively consistent pattern of drawings that continues through 1990. Dollars were drawn on the credit line with the Federal Reserve System in order to buy pesos in the exchange markets in attempts to avoid depreciation, provide monetary confidence, and promote trade and economic growth.

Direct Lending to the Central Banks of Developing Countries

The BIS has also responded actively and directly to the international debt problem since the early 1980's. It has evolved into a provider of short term liquidity in the form of financial rescue operations during the months that International Monetary Fund (IMF) and World Bank (WB) adjustment programs are being negotiated. This is a relatively new area for the Bank, which has traditionally been known as a sort of "European Central Bank" - twenty-four of its twenty-nine member central banks are European (the other five are the United States, Canada, Japan, Australia, and South Africa). It is politically neutral and lends without conditionality. Credits are arranged either by the BIS directly, or, if the sum is large or if the Bank foresees effects on the central bank community as a whole, loans are provided with guarantees (to take over BIS claims on request) and financial backing (contributions) of groups of member central banks.

The BIS has always been concerned with central bank cooperation towards stable international trade flows and financial relationships in a highly interdependent world. Although BIS credits to central banks have typically been accompanied by little or no publicity in the past, recent involvement in "bridge lending" to developing countries has been well publicized, due the unprecedented nature and scale of these operations. The BIS explains its goal as preventing the collapse of confidence in the international monetary system by providing emergency financial facilities in the short run, while the IMF negotiated longer-term support. The BIS admits that its resources are a liquid element of its member central banks' reserves and not suitable to be "tied up" for long periods of time. It does, however, see for itself a role in helping the IMF to promote long-term adjustment of domestic economies and in providing financial support and banking supervision, given appropriate precautions and limits.

Four developing countries that the BIS has been most involved with are Brazil, Mexico (the subject of this study), Argentina, and Venezuela. These have also been four of the largest users of IMF credit. The Brady plan (Secretary Brady's 1989 initiative to solve the debt crisis through sound domestic policies, improved creditor support, and debt education) urged these two Bretton Woods institutions to work together and "use their resources to help reduce the debt burdens and encourage bank participation in restructuring operations."

There was an increase in the external debt burden of heavily indebted middle-income countries between

1982 and 1985, but improvements in the overall debt situation in the late 1980's. The outlook remains uncertain, though, with many commercial banks reluctant to initiate new lending since the mid 1980's. Thus, the BIS recognizes the growing importance of official funds in debt reduction, used on a case-by-case basis and linked to credible adjustment programs. The BIS operates to encourage access by the developing countries to the international capital markets, as well as to official sources.

The BIS and the IMF serve two different, yet complimentary, functions. BIS membership is composed of a small group of central banks representing industrialized countries, which allows it to reach consensus and act more quickly than the IMF to mobilize short-term funds, usually without traditional conditionality. But in its continuing efforts to address the debt problem, the BIS promotes growth-oriented reforms with monitoring by the IMF and the World Bank in order to increase the flow of additional, longer-term resources to debtor countries. The objective of this paper is to study the effects of Mexican RCA drawings (BIS-related credit), as well as borrowing from the IMF, World Bank, and government and private sources on export volume between 1970 and 1990. Foreign lending provides access to foreign exchange for capital goods imports and other investment leading to increased productivity of resources. Export volume is often considered to be an indicator of growth potential.

II. MEXICO

Introduction (1970-1990)

Despite healthy economic growth, Mexico experienced a trade deficit during the 1970's (to 1982), which was supported by long-term capital inflows and loans. In 1976 the peso was allowed to float, which resulted in massive speculative selling and depreciation pressures. During the 1980's the trade deficit turned to surplus due to oil exports and reduced imports caused by the removal of trade barriers in 1987 and by foreign exchange shortages. Capital outflows and declining private investment accompanied this surplus until the late 1980's.

The result of the Mexican government's free spending of export earnings during the 1970's and heavy borrowing (especially in the private sector) to finance development projects was a worsened external debt position. External debt as a percentage of GDP increased to nearly 50% of GDP by 1982 due to rising interest rates and "capital flights." These problems and the decrease in commercial bank resources available led to official financial rescue packages and concessional lending (the lender sacrifices in rescheduling existing loans, usually in the form of reduced interest rates charged and "stretched" repayments). Restructuring agreements in 1987 and 1988 also included amendments allowing debt/equity conversions (swapping external debt to foreign investors at a discount - for a premium of local currency over the cost of the debt in the secondary market), the sale of existing loans, and exchanges of outstanding debt for collateralized bonds.

President Miguel de la Madrid followed a policy of allowing peso devaluations to promote exports of manufactured goods. To combat the subsequent inflation (CPI average rate of 75% over 1980-1988-), President Salinas began attempting to appreciate the peso against the dollar and reduce state spending when he took office in 1988. He hoped to encourage inflows of foreign investment and reverse the declining growth rate of the 1980's through stabilization of the currency, support of the Free Trade Agreement, renegotiation of the foreign debt, and the privatization of industry. Since 1987 there has been an increase in direct foreign investment and a steady recovery with a GDP growth rate of over 4% in 1990. The debt burden, measured as the ratio of interest payments to exports, was reduced from 41% to 29% ($80 million) by 1990 (and external debt down to 30% of GDP). Foreign exchange reserves were gain accumulated and a surplus was achieved in the capital account, although at the expense of the trade balance. A Brady Plan agreement was signed with a group of commercial banks in 1990.

The Mexican case, although it is still a major debtor, is an example of the possibility of foreign direct investment inflows and economic growth that can result from combining new foreign lending and debt service reduction with a well-designed program of domestic reforms to restore confidence in the economy.

RCA Drawings

The Bank of Mexico began drawing regularly on its line of credit with the RCA system in 1974, although there were episodes of inactivity between 1977 and 1981 and between 1983 and 1985. These additional international reserves are used in efforts to stabilize Mexico's currency, which experienced speculative selling and devaluation pressures, especially during the 1980's. The drawings were also used as "bridge financing" to IMF credit packages under negotiation, and for other liquidity needs. They ware used to avoid the buildup in arrears, or outstanding payments, which

would make rescheduling more difficult. RCA drawings are regarded here as a form of BIS-related credit to Mexico, which was used in combination with lending from other multilateral, bilateral, and private sources.

Direct BIS lending

In August of 1982, Mexico announced that it was bankrupt and owed $81 billion in foreign debts and could not even make its interest payments. Facing an international debt crisis, the U.S. monetary authorities put together a rescue package and the BIS quickly mobilized additional emergency financial assistance by the leading central banks to avoid the collapse of the Mexican external position and market confidence. A loan of $925 million was provided and drawn that Fall as Mexico arranged its stabilization program with the IMF.

After working out a credible adjustment program and financing package through the IMF and the World Bank, another multilateral loan was extended to Mexico in August of 1986. This "near term contingency support facility" was offered in the amount of $1600 million by the BIS ($400 million share with the guarantee of eleven member central banks), the U.S. Treasury (through the Exchange Stabilization Fund, ESF), four Latin American central banks (Argentina, Brazil, Colombia, and Uruguay), and a group of commercial banks. Repayment and liquidation followed in September when Mexico was able to draw on IMF assistance.

By 1987 new financing and rescheduling of debt was necessary due to the deterioration of Mexico's external accounts. A novel addition to the agreements described in the 1986-1987 *Annual Report* of the BIS was the "commitment by lenders to provide new money should there be adverse changes in Mexico's external circumstances."

In its 1989-1990 *Annual Report* the BIS discussed official endorsement of the Brady Plan as the "beginning of a new phase in the debt strategy." It called for official financial support (by the BIS, IMF, and the World Bank) in a case-by-case approach to debt and debt service reduction and the generation of new lending for those debtor nations attempting acceptable economic reforms. The commercial banks were also encouraged to offer innovative options, such as exchanging existing debt for new "Brady Bonds," where the principal is guaranteed by the U.S. Treasury and the interest by the World Bank. Mexico was the first country to reach an agreement with its foreign bank creditors under the new Brady Plan. Also in line with this philosophy, the BIS offered Mexico yet another short-term credit of $2000 million in August, 198. $700 million of this was provided by the BIS directly (with the backing of ten member central banks), the balance by the U.S. monetary authorities and the Bank of Spain. This facility bridged the time period during which Mexico waited for loan payments from the IMF and the World Bank and was repaid by February of 1990.

III. OTHER SOURCES OF FUNDS TO MEXICO

This study tests the effects of BIS-related lending (RCA's) in combination with IMF (began in 1976), World Bank, bilateral (government.), and private lending to Mexico between 1970 and 1990 on export volume. Multilateral (IMF and WB) lending is based on conditionality agreements with respect to credible reform programs to reduce domestic inflation, the government budget, and balance of payments deficits. Appropriate Exchange rate values, money supply levels, and interest rates are encouraged to achieve a sustainable payments position.

The IMF was charged in 1945 with overseeing the international monetary system and smooth flows of trade and finance. It lends to governments, originally in order to provide financial support for temporary balance of payments and foreign reserve problems. The Fund engages in annual consultations with debtor governments with a focus on macroeconomic policies, offering technical assistance and surveillance over exchange rate policies and domestic economic reforms. The goal is still to promote overall economic development, an open trading system, and stability. It is hoped that these efforts will result in increased confidence for investors and other lenders and thus, ensure future repayment of loans. This conditionality is often criticized as creating undue hardships and a too standardized approach. The IMF role in international debt management, as well as its lending volume, has expanded since the 1980's. It intermediates between debtors and creditors to create debt rescue packages and reschedules its own existing loans, while encouraging private lenders to do the same.

The largest and most influential multilateral aid agency, the World Bank, was historically more concerned with long-term development and reconstruction. It usually lends for specific development projects involving capital-intensive physical infrastructure. In the 1980's though, the WB has increased its financing for general categories of imports, or broad support for the balance of payments. It bases its lending on creating conditions for the stable and liberalized growth of trade and appropriate, sustainable macro-

economic policies.

Since the 1970's though, the activities of these two international organizations have begun to converge. They now address wider responsibilities, including the need for collaboration with each other, other international institutions, such as the BIS and the United Nations, and with private international banks. The memberships of the IMF and the WB are similar, much larger than that of the BIS, and well represented by developing countries. Criticisms of both revolve around the question of whether they are able to enforce their conditions, have achieved any real, market-oriented policy reforms, or have made any progress towards solving the debt crisis. Bilateral lending occurs between the governments of two countries, but often through aid agencies. One of the largest donor groups is the Organization for Economic Cooperation and Development. These loans usually target specific, short-term projects and food aid. They typically reflect the donor country's foreign policies and are therefore frequently criticized for having political motivations, such as encouraging specific markets, colonial ties, or having diplomatic and military aims. Lending may even be tied to the purchase of the donor's exports or inputs for projects. Complaints regarding discrimination, lack of coordination and leadership, and inappropriate influence over the borrower's economic policies stem from these criticisms.

Attempting to provide complete details concerning the history of Mexico, the BIS, or the motives, goals, and successes and failures of IMF, World Bank, bilateral, or private lending are beyond the scope of this paper. Effects on specific development projects and sectors are not considered as they are difficult to measure and thus, the conclusions are based on aggregate, yearly amounts of lending.

IV. MODEL, METHODOLOGY, AND RESULTS

Model and Methodology

This paper presents the results of a study of the effects of several forms of lending to Mexico between 1970 and 1990 on its export volume. Export volume (XVOL) was chosen as the dependent variable because it is widely regarded as an economic indicator of a developing country's ability to earn foreign exchange, repay debts, and, thus, its potential to grow, given appropriate domestic policies. Problems and progress are usually measured by comparing foreign debt obligations with export earnings. The independent variables included IMF (IMF), bilateral (BILAT), and private lending (PRIV), as well as RCA drawings (RCA) and interest payments (iPAY) made to these creditors (World Bank lending, the consumer price index, and the exchange rate were dropped as insignificant). Other variables affecting export volume will be included in future studies, although their effects should be captured in the error term in this model.

All debt represents external obligations of the public debtor or private debt that is guaranteed by the public entity. IMF credit represents repurchase obligations with respect to all uses of IMF resources, excluding those resulting from drawings in the reserve tranche. Bilateral lending represents loans from governments, including from central banks and direct loans from official export credit agencies. Debt from private creditors includes bonds and commercial bank lending, as well as credits from manufacturers, exporters, and other suppliers of goods. Interest payments are actual amounts of interest paid in foreign currency, goods, or services to these lenders. These payments are often used as a measure of debt burden in the literature. All data used was annual and in millions of US$ from *The World Bank Debt Tables, Federal Reserve Bank of New York Bulletin, Quarterly,* and *Monthly Reviews*, and *IMF Financial Statistics* (1970-1990).

The coefficients in the following equation were estimated using Time Series Processor (TSP) for ordinary least squares (OLS) regression analysis:

$$XVOL_t = \beta_o + \beta_1 IMF_{t-5} + \beta_2 BILAT_{t-5} + \beta_3 PRIV_{t-5} + \beta_4 RCA_{t-5} + \beta_5 iPAY_{t-1} + \beta_6 MA(5) + E_t$$

where e is a randomly distributed white noise error term.

The null hypothesis is that there is no significant relationship between the different forms of lending and export volume. It was expected that the various sources of lending, coupled with appropriate conditionality and domestic reform programs, would promote export growth and economic strength. It is not usually the levels of resources, but their inefficient use and the burden of the debt service payments that my inhibit growth potential, thus, it was further expected that interest payments would have a negative relation to export volume.

A test for autocorrelation properties (error terms are not randomly distributed) revealed a nonstationarity problem and the need for first differencing of the dependent variable. These results indicated a moving average component in the series and the need for an MA term in the least squares equation to account for the autocorrelation found in the model. First differencing is also a method for dealing with the problem of multicollinearity (explanatory variables are re-

lated), if it exists. There was no evidence of the classic case of all parameter estimated exhibiting high standard errors, low t-statistics, unexpected signs, and a high R^2.

Results

The regression results (with computed t statistics in parentheses below the estimated coefficients) are presented below:

$$XVOL_t = \underset{}{7567.85} + \underset{(3.02)}{5.27IMF_{t-5}} - \underset{(4.03)}{13.22BILAT_{t-5}} \underset{(-1.83)}{}$$

$$+ \underset{(1.41)}{.43PRIV_{t-5}} + \underset{(5.68)}{14.09RCA_{t-5}} - \underset{(-1.83)}{.95iPAY_{t-1}} + \underset{(11.11)}{.93MA(5)}$$

$R^2 = .71 \quad F = 7.16 \quad DW = 1.89$

IMF, BILAT, and PRIV lending variables were lagged five periods (years) due to the fact that these resources are mainly used for longer-term, structural adjustment programs and both IMF and World Bank studies claim that it takes at least a year or two for negotiations and loan approval. After than, it may take up to twelve years to obtain measurable results. Other lag structures were tried with unsatisfactory results. The World Bank variable was insignificant and was dropped to improve the model, probably because the five-year lag was still not enough time to see the effects of World Bank lending. The exchange rate variable also was dropped because of insignificance, probably due to the fact that the rate was fixed through 1976.

Coefficients of IMF and RCA are statistically significant and positive at the 99% confidence level. BILAT and iPAY are significant and negative at the 90% level (explained below). The F statistic is significant at the 1% level. The calculated DW statistic was compared to computed Durbin's h-statistic (required when any form of the dependent variable, such as the MA tern, is used as an independent) and found to be nonsignificant at the .05 level, reflecting the freedom of the residuals from first-order serial correlation.

VI. CONCLUSIONS

RCA drawings were originally meant to serve as an example of central bank cooperation to promote confidence in the international monetary system through availability of emergency reserves. Mexico frequently also used them for "bridge financing" while long-term assistance was being negotiated with the other lenders. This connection explains the fact that, in combination with other sources of funds, RCA effects also took five years to show significant results. The effects had, as expected, a positive impact on the ability to export.

BIS short-term rescue packages are meant to give the debtor nations the necessary time to negotiate with the IMF and the World Bank, as well as with commercial banks. It was not possible to test the effects of the BIS direct bridge credits to Mexico because of their nature - four large lending operations mobilized or provided directly by the BIS during the 1980's. Yet the effects of these efforts are inherent in the test described above due to the fact that they provided the country with the resources to survive in the short-term, while access to longer-term funds was arranged.

IMF disbursements to Mexico (which rose at a stable rate throughout the 1980's) and private sources of credit (which declined again during the late 1980's) also proved to have a positive effect on export volume after a few years. This was due in part to the success of the domestic adjustment program, the restructuring of existing debts, more open trading policies, and new sources of lending (often IMF-induced).

Bilateral lending (which increased at a fairly steady rate during the 1970's and 1980's, rising at a faster rate in the late 1980's) showed a negative effect on exports, probably due to insufficiency or ineffectual uses made of the funds. As mentioned earlier, this source of funds is often more motivated by military or political self-interest than multilateral sources are. Thus, it maybe used inefficiently due to restrictions imposed, instead of for trade-oriented policy, growth, and stability in the long run. Governments also often do not have the same policy of withdrawing financial support if domestic reform conditions are not met.

As expected, the burden of interest payments made to the lenders showed a negative impact on ability to export within one year. For Mexico, interest payments as a percentage of exports had reached over 25% by 1989. Effects on export volume are important because it represents an indicator of sustainable development progress and the ability for future repayment of loans, and thus, the probability of successful renegotiations and future access to capital markets.

It can be concluded from the results of this test that the BIS, in conjunction with the IMF, World Bank, private, and RCA system sources of funds, played a role in Mexico's ability to improve its export volume (4% average annual growth rate between 1982 and 1989). These combined resources of varying maturities were critical in contributing to Mexican economic stability and growth. BIS timely assistance, especially after 1982, helped bridge the negotiation peri-

ods necessary to obtain other crisis financing and to promote confidence in Mexico's domestic situation. It is especially important to continue efforts to cooperate internationally to achieve long-term structural reforms, such as those related to open trade policies, export development, and increased flows to technological know-how. Progress in these areas, along with successful attempts to reduce the debt service burden, should allow developing countries the opportunities for efficient growth.

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GLOBALIZATION OF BUSINESS EDUCATION IN FINANCE

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INTRODUCTION

The United States was forced to confront the global business environment during the decade of the 1980s. The surprising, and for some, threatening reality is that foreign automobile producers now account for one-fourth of the U.S. auto market, Japanese banks control over 40 percent of the bank deposits in California, and entire industries, such as clothing, shoes, and consumer electronics, are now dominated by imports.

In the 1980s, U.S. firms aggressively pursued foreign markets. Exports of U.S. manufactured goods experienced explosive growth. The reduction in the trade deficit during those years occurred not because of our declining preference for imported goods, but because of the much faster growth of U.S. exports. That growth was fueled initially by a decline in the value of the U.S. dollar, and more recently, by an improvement in the quality of U.S. goods.

The hard reality became a shock as many realized that U.S. firms could no longer ignore foreign competition. Firms cannot continue to rely on domestic markets to fill the demand for their goods and services. As we enter the mid-1990s, indicators point to continuing increases in the importance of exports, international trade, and international business. Continuing steps toward unification of the European Economic Community, with the factors of production flowing freely across borders, will increase the economic interdependence of EEC nations, collectively strengthen them, and challenge the U.S.

The seeds of capitalism in the Soviet Union and its former Eastern Block Satellites have opened markets for the U.S. and Western Europe. It also will expose both U.S. and EEC domestic firms to further competition from abroad. As the North American Free Trade Agreement becomes a reality, a market with 380 million consumers in Canada, Mexico, and the U.S. will be open to free trade. The opportunities for international trade, and the accompanying competition, will add urgency to gaining an understanding of globalization.

It is anticipated that economic integration will continue. Nationalism and local domestic politics will continue to slow the process, on-going since the end of World War II, but the eventual division of the world into regional trading blocks continues to be highly likely.

Americans generally have trailed other countries in providing international education. In the Omnibus Trade and Competitiveness Act of 1988, Congress addressed international education, noting that "A nation's international competitiveness requires a strong and effective educational system, particularly in the current era of high technology." This legislation provided specific funding for programs to improve literacy, foreign language instruction, mathematics and science instruction, and dropout prevention. The legislation, however, did not address the need to "improve the curriculum requirements of the students." The purpose of this article is to synthesize approaches and techniques to internationalize the finance curriculum, faculty, and graduates to compete in today's global environment.

This article focuses on factors under the control of business schools and finance department faculty by building upon the topology defined by Cavusgil (1991, pp. 92100). That topology is summarized in TABLE 1, Cavusgil's Components of Internationalization.

TABLE 1

CAVUSGIL'S COMPONENTS OF INTERNATIONALIZATION

1. A comprehensive strategy and agenda.
2. A favorable institutional climate.
3. Allocation of sufficient resources.
4. Appropriate curriculum and instructional materials.
5. Internationalization of faculty.
6. Internationalization of student body.
7. Linkages to the business community.
8. Collaboration with other educational institutions.

The implication for U.S. business schools is clear. They must prepare managers to successfully compete in the global business environment. As obvious as this may seem, the majority of business schools have only recently begun to include international issues in their curricula. Even with curricula that give adequate focus on global business, teaching international issues may be a formidable task. In "A Resource Guide for Internationalizing the Business School Curriculum in Finance", published by the American Assembly of Collegiate schools of Business (9AACSB) and the Consortium for International Studies Education (CISE), the authors state:

> "In the competitive environment of today's global marketplace, business school graduates, more than ever, must understand the international aspects of business. Yet, while most business schools report they have plans to introduce an international dimension into their curricula, surveys reveal few have faculty members trained or prepared to do so. In 1984, only 17 percent of that year's business doctoral candidates had taken any international courses during their graduate studies, making it almost certain that the next generation of faculty members will have difficulty in introducing international content into the courses they teach."

WHY BUSINESS SCHOOLS HAVE BEEN SLOW TO RESPOND TO GLOBALIZATION

There are several reasons why many business schools find themselves hurrying to internationalize their curricula, but two reasons dominate. The first is the surprising speed with which economic and political changes have occurred. The changes were unexpected in their pervasiveness and quickness. In such an environment, it is not surprising that business schools haven't kept pace. Nor is this problem unique to business schools. Many U.S. businesses now find themselves struggling to remain competitive in light of the recent changes in economic systems and trading patterns among nations.

This contrasts sharply with the U.S. experience from 1945 until the 1980s. After World War II, the United States economy experienced explosive growth. In the majority of industries, domestic markets were large enough to meet the supply of goods and services churned out by U.S. firms. Technological expertise, high productivity, and adequate infrastructure made the U.S. the world's premier producer of quality goods. Foreign competition wasn't a major concern for most firms. Foreign markets were an opportunity, not a necessity.

In the 1960s and 1970s, the baby boom population, which was to reach nearly eighty million people by 1965, was entering college and showing its first signs of economic and political power. The age of consumerism was beginning. Domestic demand was sufficient to keep U.S. producers occupied. The U.S. still had advantages in cost, technology, and productivity compared with foreign competitors. Even Japan, now the epitome of production efficiency, in the late 1960s was still an underdeveloped country with a reputation for producing cheap, poor quality imitations of U.S. goods.

The weakness of the U.S. dollar further insulated the U.S. The dollar had sunk to historical lows against many currencies in 1978-1979, making imported goods relatively expensive in the U.S. The effect was *de facto* protection of domestic markets against foreign competition. At the same time, exports were attractively priced to firms in other countries. Increased export activity and foreign investment resulted.

But that all changed in the mid-1980s. The dollar had reversed its fall in the early 1980s, and by 1985, had reached historical highs against many of the same currencies against which it had been so weak just six years earlier. Imports flooded the United States. Domestic firms, protected from serious foreign competition for so long, could not longer ignore competition from outside the country.

Coinciding with the strengthening of the dollar came the industrialization and economic takeoff of the Pacific Rim nations. The U.S., with its relatively open markets, represented the largest market on Earl. It is not surprising that Pacific Rim exporters flooded the U.S. with products.

A second dominant factor explaining the slow response of business school curricula to globalization is the lack of strong signals indicating the need for change. Enrollment growth in business schools had been strong for nearly a quarter of a century. Not only has that rapid growth focused attention on acquiring resources to serve greater and greater numbers of students, but it also sent a signal that all must be well with the status quo. The curriculum did not seem to be broken, so it was not fixed.

By the end of the 1980s, however, business, political, and education powermakers realized that there was worldwide competition both in domestic markets, and in foreign markets where the U.S. had a strong position. If the U.S. were to maintain its prominent economic position, there would have to be more focus on global education.

Beginning in 1990, business school enrollments began dropping at the undergraduate level. At the graduate level, enrollment growth rates in MBA programs softened. Critics suggested that dissatisfaction with the curricula may have contributed to this trend.

Considering the surprising speed of these changes,

faculty lack of global education and perspective, and a self-satisfied attitude in business schools, it is no wonder, then, that many business schools are unprepared to teach their students how to successfully compete in the global environment. They are not much different than many businesses. Changes have come so quickly that both must now play catchup.

WAYS OF INTERNATIONALIZING THE FINANCE CURRICULUM.

How can a school's finance curriculum keep pace with the needs of this increasingly global economy? The burden is on faculty and administrators to internationalize the curriculum. The task is especially difficult because many academicians are ill-prepared to meet the challenge. Like many business leaders, many academicians find themselves ill-prepared for a global economy, and now must search for new paths to success.

In Cavusgil's topology (see TABLE 1), Components 3, 7, and 8 are under the purview or partial purview of business school deans. Components 4, 5 are under the purview of both business schools and finance departments.

The following list of suggestions may help faculty and administrators implement these components, thereby preparing students to be successful managers in the global environment.

A. Stay Current with Research

Several academicians have either published articles, or are completing research, describing the degree to which business schools have internationalized their programs. Some of the research attempts to garner a consensus about what the curriculum should look like. Finance faculty and administrators will find it helpful to stay current with this research and let it serve as guide to curriculum changes. The *AACB/CISE Resource Guide* can serve as a starting point. Included in the *Guide* is a bibliography of international finance by subject area.

B. Expand International Exchange Programs

Many schools already have exchange programs in place. In most cases, however, frequently the emphasis is on curricula, students, and faculty from the liberal arts and humanities. These programs can be expanded for finance majors to include emphasis on the economic systems, markets, financial infrastructure, and business environments of the countries visited. Students could spend time at large banks, nonfinancial businesses, and securities firms and exchanges to learn more about how the national economies function. They would learn about problems foreign firms face in making trade-offs between risk and return.

The exchange programs need not be limited to students. Many finance faculty also would benefit from an exchange program. They would gain firsthand experience in the countries they visit, and students in business schools in the U.S. would be exposed to the knowledge and experiences of visiting professors from foreign countries, a broadening experience for both faculty and students.

Bringing foreign faculty to your institution for time periods ranging from a week through a whole semester offers many instructional opportunities. Those opportunities can include teaching segments of several courses, to teaching a stand-alone course, to conducting professional development seminars for faculty and companies.

C. Internships with International Firms

Finance majors seeking a better understanding of how global markets affect businesses can serve as interns in the international departments of multinational businesses. While this suggestion is much easier to implement at schools located near home offices of large corporations, it is not impossible for other schools. A large and growing number of moderate-sized businesses are engaged in international commerce. If the faculty, administration, and business school advisory boards support the idea, this obstacle can be overcome.

D. Emphasize International Aspects of Finance Courses

In many finance courses the international chapter is saved for the last class, time permitting. Often time runs out. Many textbooks, by implication, contribute to the problem. International finance is presented in a single optional chapter, often at the end of the book. That format almost ensures that global issues won't be covered. This may have been fine prior to the 1980s, but it falls short in the 1990s finance department. Faculty must agree to emphasize the international aspects of each finance course they teach, not just the end, but throughout the course.

It may be helpful to select textbooks that integrate international concepts throughout the chapter rather than adopting those books that highlight

the topic with a single chapter. This lessens the likelihood of skipping material. To further emphasize the importance of international finance and enhance student learning, selected articles and cases highlighting international problems and their solutions can be used to supplement most finance courses.

In addition, the more familiar finance faculty are with global aspects of the courses they teach, the easier it will be for them to weave multinational examples and anecdotes into their classes. Exchange programs described above also would help familiarize faculty who lack strong backgrounds in global business.

E. Broaden General Education Curricula

At schools where the general education curriculum already includes a wide spectrum of elective courses, finance faculty advisers can encourage students to select courses in foreign languages, foreign cultures, world history, world geography, comparative political systems, and international economics. Where the general education program does not include this flexibility, business school faculty must help broaden the perspective of their campus colleagues. In addition, students can be encouraged to apply their major's elective credits to international courses.

F. Minor in International Business

AACSB-accredited business schools typically have a minimum of three faculty focusing upon an area if it is labeled a "major". The ability to hire three internationally trained faculty is beyond the reach and faculty distribution of many business programs. Schools without the requisite mass may instead want to consider adding a minor or emphasis. A minor could be especially attractive to finance majors wishing to broaden their knowledge of our global economy. The combination of a finance major with an international business minor may be attractive to many employers. Additionally, an international business minor with a financial focus maybe e attractive to students from across the camps.

G. Use Business Experts

Many managers who are experts in the international aspects of their businesses enjoy making presentations to students. They can be utilized as executives in residence, guest lecturers, faculty advisors, etc. However they are used, sharing their experiences and insights with faculty and students can be beneficial to both.

H. Use the Talents of the Finance Faculty

It is an unusual finance department that does not have a professor with a college degree from a foreign country. In fact, at some schools, foreign-born faculty may be in the majority. They can be a rich source of knowledge about foreign cultures, economies, and what it takes to be a successful manager in our global economy.

Those who have recruited at the Financial Management Association meetings know that, over the past few years, the majority of new finance Ph.D.'s are from foreign cultures. Schools wishing to strengthen their international expertise have the opportunity to hire new faculty from wide a variety of cultures. These faculty often are prepared to teach international finance courses. They can serve as resources for students and their faculty colleagues. Finance faculty should also utilize the talents of international faculty in other areas of their business schools who can serve as resources to finance faculty.

I. Support Faculty Research and Development in Global Issues

It is obvious that faculty are more likely to do a better job of teaching international aspects of their courses when they have the expertise to do so. Central administrations and who provide strong financial support for faculty research and development in global issues will signal, encourage, and enable faculty to develop that expertise. Often research in global business issues comes with a high price tag. Visits to foreign countries are often necessary. Without a commitment to funding, this most important form of faculty development can be only partially successful.

J. Require That All Finance Majors Take an International Finance Course

Perhaps this is the most obvious recommendation. If we want our finance students to compete successfully in the global environment, they need to know more about international finance than the fragmented bits they pick up in other finance courses. Requiring them to take an international finance course will tie together and expand concepts touched upon in other courses.

K. Encourage Faculty Consulting for Firms Engaged in International Trade

Consulting for firms engaged in international trade can keep faculty up to date with global problems facing businesses. The consultant's knowledge and expertise is likely to grow as a result, thereby leading to a better quality and an increased amount of scholarly activities.

L. Attend Workshops and Conferences on Global Business

This can be a great way to learn, become motivated, and share experiences with others interested in global business.

M. Implement Geographic Area Studies Programs

An area studies program is a concentrated study of a specific country. In a typical program, a mixture of students and business executives attend a special, intensive program, learning a country's culture, language, and business environment. At the end of the course work, the program culminates in a visit to the country for two to three weeks.

N. Faculty Can Join International Business Organizations

Ideas and experiences can be shared in international organizations such as the Academy of International Business, FMA, and the Academy of Management. Additionally, faculty in metropolitan areas can be encouraged to join professional groups which focuses on international issues, and to work with internal departments in banks.

O. Build an International Business Mentality Among Faculty

Faculty and students collectively must think internationally as second nature. This requires the support of accounting and economics professors who are the first to teach business school students in their classes. Finance faculty must insure that the core course and follow-up electives build upon this foundation and utilize that opportunity for international exposure. Faculty teaching business core courses, together with the finance faculty, can embed an international mentality throughout the student body.

P. Capitalize on International Students

Most schools have international students, either in their regular degree programs or as exchange students. Often, American faculty do not ask these students to share their experience and thoughts. Foreign students may sit quietly in class, hardly ever asked to contribute. For some this is the result of being a student in a foreign country. For others, this quiet behavior is part of their culture. Finance faculty should endeavor to have them contribute, by questioning them, asking them to make presentations, assigning them to work on formal team projects, and inviting their participation at informal faculty-student interaction settings. Faculty must be considerate and sensitive to each student's culture and personality in deciding which approach will best enable the international student to contribute. Most international students are delighted to share their experience, knowledge, and pride in their home country.

CONCLUSION

Several suggestions were described to help finance departments internationalize their curricula. It's likely that most schools already employ many of them. Some of the recommendations may not be feasible at all schools. The hope is that the suggestions will focus attention on a systematic approach to getting the job done. The pace at which the world is becoming more economically interdependent is accelerating. Students need to be prepared to compete. And as faculty, it is our responsibility to prepare them.

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OPEC'S TERMS OF TRADE: A COMPARISON OF THE SEVENTIES WITH THE EIGHTIES

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INTRODUCTION

The history of the Organization of the Petroleum Exporting Countries, OPEC, contains numerous surprises. When it was founded in 1960, little attention was given to its existence. At that time, OPEC was almost powerless relative to the giant multinational oil companies with which it negotiated. In addition, there was mistrust among OPEC members, and there was international opposition to the existence of OPEC and its operation as a cartel.

This weak position slowly reversed. Between 1960 and the early 1970's the demand for oil, relative to supply, increased sharply. As a result of the Arab oil embargo, other countries began to realize the cartel's power. Thereafter, until the early 1980's, the cartel enjoyed historic and unprecedented success. In 1980 few believed that the cartel would be weakened in the foreseeable future. Then came the sharp increase in supply that caused the price of oil to drop, weakening the cartel.

The rise and decline of the OPEC were not predicted, at least at the times when they happened. Some economists, basing their proposition on the theory and history of cartels, anticipated the fall of OPEC under several conditions.[1] These conditions were met in the early 1980's and OPEC's tremendous power began to diminish. The weakness of OPEC measured by the downward trend of the prices of oil started in 1983.

The nominal price of crude oil and annual percentage changes are shown in Figures 1, and 2, and Table 1.[2] These data show that from 1970 to 1982 the nominal price of oil increased every year. The sharpest price increase, over 261 percent, occurred in 1974. Between 1983 and 1988 prices declined each year except in 1987. The sharpest decline was in 1986 when prices fell by over 48 percent. The table and figures show the upward trend of oil prices and rising cartel power between 1970 to 1982, and the downward trend thereafter.

As OPEC oil is priced in United States dollars, changes in the exchange rate of the dollar against other currencies have an impact on the purchasing power of OPEC members vis-á-vis other countries whose currencies appreciated, and a strong dollar does the opposite.

In the early seventies, before the Arab oil embargo and the full realization of OPEC's power as a strong cartel occurred, OPEC negotiated a collective agreement with the multinational oil companies to offset the effect of the weak dollar against an arithmetical average of a basket of nine major currencies: The German mark, the Japanese yen, the Belgian, Swiss and French francs, the British pound, the Italian lira, the Netherlands guilder, and the Swedish kroner. This basket was called the Geneva I basket.

Later on, in 1973, OPEC and the oil companies agreed to amend the Geneva I basket by adding two more currencies. This new currency composite, consisting of the nine currencies of the Geneva I basket plus the Australian and the Canadian dollar, was called the Geneva II basket. But later, when OPEC consolidated its full cartel power, it unilaterally raised the price of oil without official link to currency or currency basket.

This research attempts to: (1) measure the impact of changes in the value of the dollar vis-á-vis other currencies on the purchasing power of OPEC members for 1970 to 1989. Four different measures (the Geneva I, the Geneva II, a trade weighted basket and the Special Drawing Right (SDR) of the International Monetary Fund (IMF) are used for this purpose; (2) calculate an inflationary measure applicable to OPEC as a trade-weighted average of the export price index of industrial countries; and (3) combine these two measures with the changes in the prices of crude oil to calculate the terms of trade of OPEC with the industrial countries.

The terms of trade, and each of its variables individually, reflect the economic gains or losses to OPEC members.[3] The magnitude of these gains or losses over time, as measured by different criteria, are important to policy makers, investors, importers, and public in general in OPEC and industrial nations.

The results of this study suggests that the terms of trade of OPEC in the seventies improved significantly, while in the eighties it declined. We first introduce

Figure 1
Price of OPEC Oil

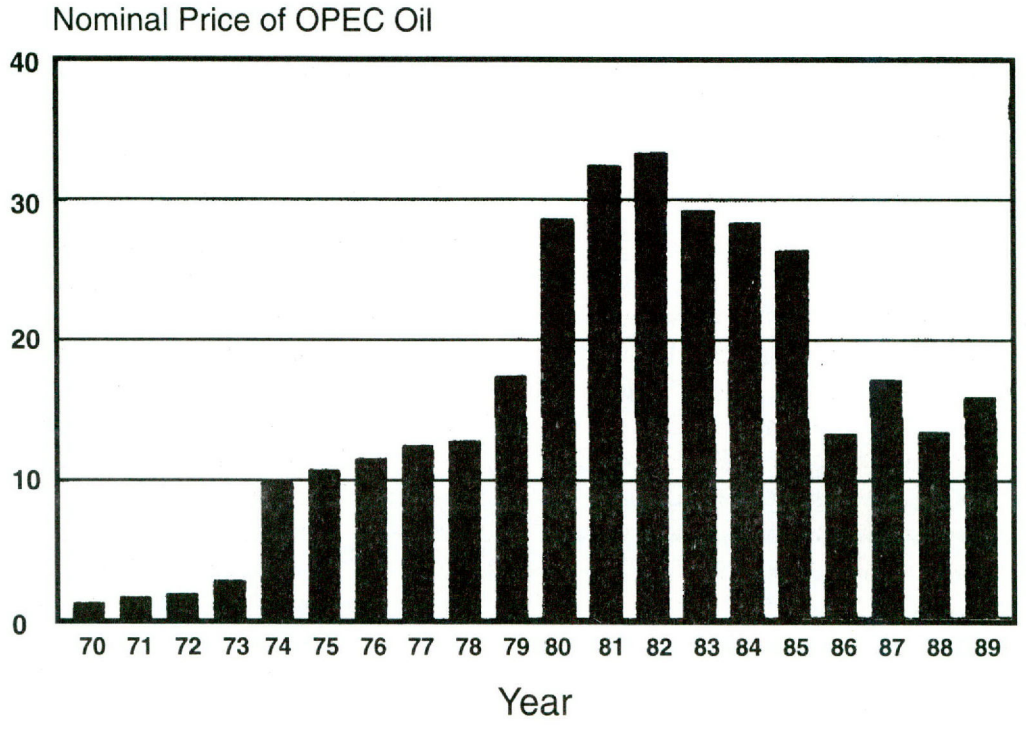
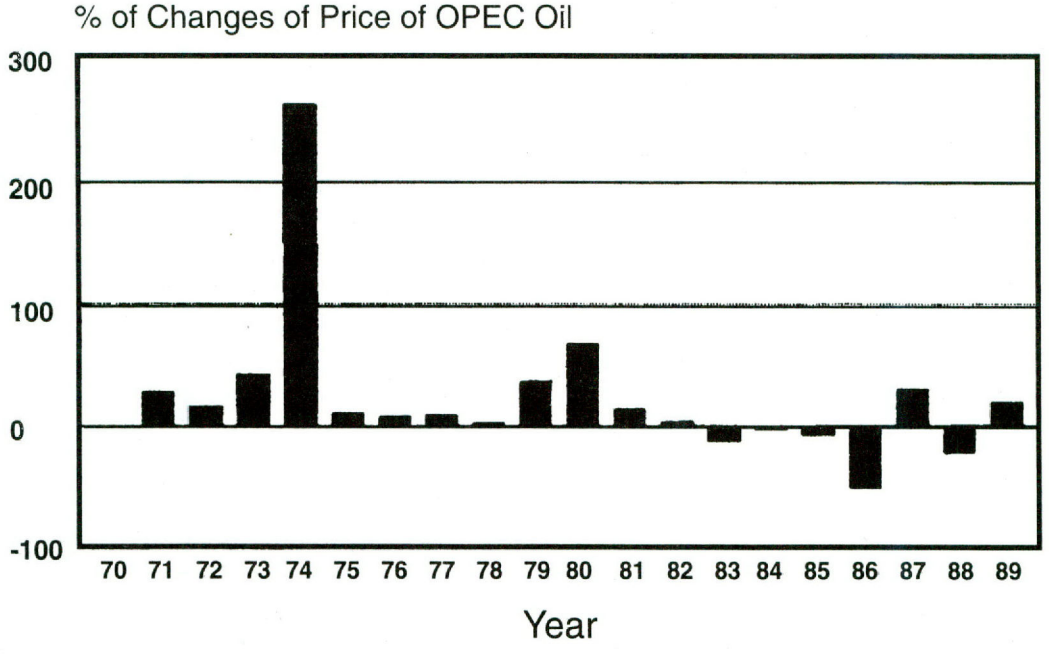


Figure 2
Percent of Changes of Price of OPEC Oil



1970 to 1984: Price of Saudi Arabian
1985 to 1989: Price of Dubai Bench Mark

Table 1

Price of OPEC Oil,
Value of the U. S. Dollar by Different Baskets
Measures, and Trade Weighted Export Price Index: 1970-89

Year	Price of OPEC Oil		Value of the Dollar in Terms of 4 Baskets (%)1				Trade Weighted EPI	
	U.S.$	% Chge	Gen I	Gen II	Trade	SDR	% Change	EPI
70	$1.30	---	-0.03	-0.30	0.18	0.00	4.77	104.77
71	1.65	26.92	-2.45	-2.22	-1.34	-0.30	5.54	110.57
72	1.90	15.15	-8.04	-6.29	-5.94	-7.62	9.30	120.85
73	2.70	42.11	-9.56	-5.97	-6.43	-8.93	19.17	144.02
74	9.76	261.48	2.28	1.78	3.65	-0.87	24.11	178.74
75	10.72	9.84	7.25	5.47	10.83	-0.95	11.03	198.46
76	11.51	7.37	1.56	0.41	0.31	5.17	-0.89	196.69
77	12.40	7.73	-2.45	-2.15	-2.29	-1.11	9.35	215.08
78	12.70	2.42	-11.46	-8.42	-9.66	-6.75	14.70	246.70
79	17.26	35.91	-5.36	-4.36	-2.84	-3.10	14.53	282.55
80	28.67	66.11	-0.61	-0.34	0.04	-0.73	13.36	320.30
81	32.50	13.36	20.78	17.31	13.96	10.38	-2.59	312.00
82	33.47	2.98	14.84	11.36	11.19	6.81	-3.67	300.55
83	29.31	-12.43	9.83	7.00	5.33	3.27	-3.03	291.44
84	28.47	-2.87	11.18	9.38	7.95	4.29	-2.66	283.69
85	26.46	-7.06	3.70	1.67	2.76	0.95	-0.08	283.46
86	13.08	-50.57	-23.01	-19.05	-18.78	-13.45	16.15	329.24
87	16.94	29.51	-14.45	-11.83	-11.10	-9.27	11.53	367.20
88	13.22	-21.96	-3.41	-2.36	-3.71	-3.78	6.31	390.37
89	15.70	18.76	7.44	5.84	5.85	4.85	-0.19	389.63
C.S.[2]		444.76	-1.97	-3.07	-0.04	-21.14	146.74	
Avg	15.99	22.24	-0.10	-0.15	0.00	-1.06	7.34	
S.D.	10.26	-35.83	10.20	8.12	7.93	5.87	8.06	

1. The Geneva I basket consists of the currencies of Japan, Germany, France, U.K, Belgium, Italy, Netherlands, Switzerland, and Sweden; all currencies have equal weights. The Geneva II basket consists of the currencies of the Geneva I, plus the Australian and the Canadian dollar; all currencies have equal weights. The Trade basket consists of the currencies of the U.S., Japan, Germany, U.K., France, Italy , Netherlands, Belgium, and Denmark; their weights are proportional to their exports to OPEC. SDR baskets consists of 16 currencies of major countries for 1974-80, and 5 currencies of U.S., Japan, Germany, U.K., and France since 1980; their wights are proportional with the size of each country's size of trade in the world.

2. C.S. = Cumulative Sum; Avg = Annual average; S.D. = Standard Deviation.

the methodology of calculating the variables of the terms of trade.

THE MODEL

In this section, the methodologies for measuring changes in the price of the U.S. dollar against other currencies, changes in the prices of imports to OPEC from industrial nations, and of the terms of trade are presented.

Model of the Impact of the Strength of the Dollar

It is required to identify currencies and their weights that should be used to measure the impact of the changes in the exchange rate on the purchasing power and terms of trade of OPEC. Four different currency baskets are used for this purpose.

Generally, to measure the effect of the value of the dollar against other currencies, assume E_i, represents the exchange rate of country i's currency in terms of the U.S. dollar. The annual percentage change of each currency in the basket, $\%DE_i$, can be calculated by

$$\%DE_i = (E_{il} - E_{i0}) * 100 / E_{i0} \bullet \quad (1)$$

where i = 1, 2, 3,.....n, and represents the number of currencies in the basket.

The annual average changes in the exchange rate of N currencies again the dollar as a currency basket measure is

$$\%D\ (Bkt) = \sum_{i=0}^{N} \%DE_i / N \quad (2)$$

In equation (2) E_i represents the exchange rates of the dollar against nine currencies in the Geneva I basket (N=11).

The third composite, called the trade basket, is adapted to measure the impact of the changes in the value of the dollar in terms of other currencies and is based on the relative size of OPEC's trade with the industrial nations. The trade basket is, therefore, a weighted average of the changes in exchange rates. The highest weight is assigned to the country with the highest exports to OPEC, and the lowest weight is assigned to the country with the lowest exports to OPEC. Accordingly, the trade basket consists of nine currencies of the United States, Japan, Belgium, Denmark, France, Germany, Great Britain, Italy and the Netherlands. Thus, the trade basket can be measured as follows:

$$\%D\ (Trd\text{-}Bkt) = \sum_{i=0}^{N} (Exp_i / T\text{-}Exp) * \%DE_i \quad (3)$$

Here Trd-Bkt is the trade basket measure, D represents the annual percentage change, Exp is exports from each industrial nations to OPEC, and T-Exp is the total exports from all industrial nations to OPEC. According to this basket, the changes in the value of the dollar are adjusted by the relative exports of each industrial nation to OPEC.

Finally, the changes in the special Drawing Rights (SDR) basket is simply the percentage changes in the SDR as follows:[4]

$$\%D\ (SDR\text{-}Bkt) = (SDR_1 - SDR_0) * 100 / SDR_0 \quad (4)$$

Model of the Inflationary Impact

The second factor which affects the terms of trade of OPEC is the inflationary impact on OPEC imports. A weighted average composite of the export price indices, EPI, from the industrial countries is used. That is,

$$II = \sum_{i=1}^{N} (1 - EP_{Ii+1}/EPI_i) \times (Exp_i/T\text{-}Exp) \quad (5)$$

II is the weighted average of the changes in the export price index and Exp is the value of exports of each industrial country to OPEC, and T-Exp is the value of the total exports of those countries to OPEC.

Model of the Terms of Trade

Based on these four different basket measures, the changes in the terms of trade of OPEC is measured as follows:

$$\%D\ (TOT) = \%DP - \%D\ (Bkt) - D(II) \quad (6)$$

Again %D represents the annual percentage change, TOTO is the terms of trade, P is the price of OPEC's crude oil, Bkt is the value of the dollar against each of those four basket of currencies, and II is the trade-weighted average of the changes in the export price index of the nine major industrial countries.

RESULTS OF THE MEASUREMENTS

Measurement of the Strength of the Dollar

From equation 2, changes in the value of the dollar in terms of the Geneva I are calculated and their results shown in Table 1 and Figure 3.

Accordingly, in the early 1970's the purchasing power of OPEC, in terms of the currencies in this composite, declined by over nine percent due to the weakness of the American dollar. Between 1974 and 1976, the trend was reversed in favor of OPEC. From 1977 to 1980, the dollar again showed weakness. Suddenly in 1981 the dollar strengthened by over 20 percent relative to the currencies of this basket, and that positive trend continued until 1985. Starting in 1986, the dollar declined significantly by 23 percent, remaining weak throughout 1988. In 1989, the dollar gained by over seven percent. The cumulative sum of this basket for 1970 to 1989 shows a total loss of 1.97 percent, an annual average loss of 0.10 percent, and a standard deviation of 10.20 percent.

Similarly, from equation 2, the impact of the changes of the value of the dollar according to the Geneva II basket are measured and their results are shown in Table 1. The path of this measure followed very closely that of the Geneva I composite. Comparing these two, it can be seen that the signs of changes in their values are all the same.

The major difference between these two baskets is that the Geneva II basket exhibits less volatility of value, with a standard deviation of 8.12 percent compared to 10.20 percent for the Geneva I measure. This difference is due to the fact that the Geneva II has two more currencies than the Geneva I. However, the Geneva II shows a larger cumulative loss of 3.07 percent compare to a loss of 1.97 percent for the Geneva I.

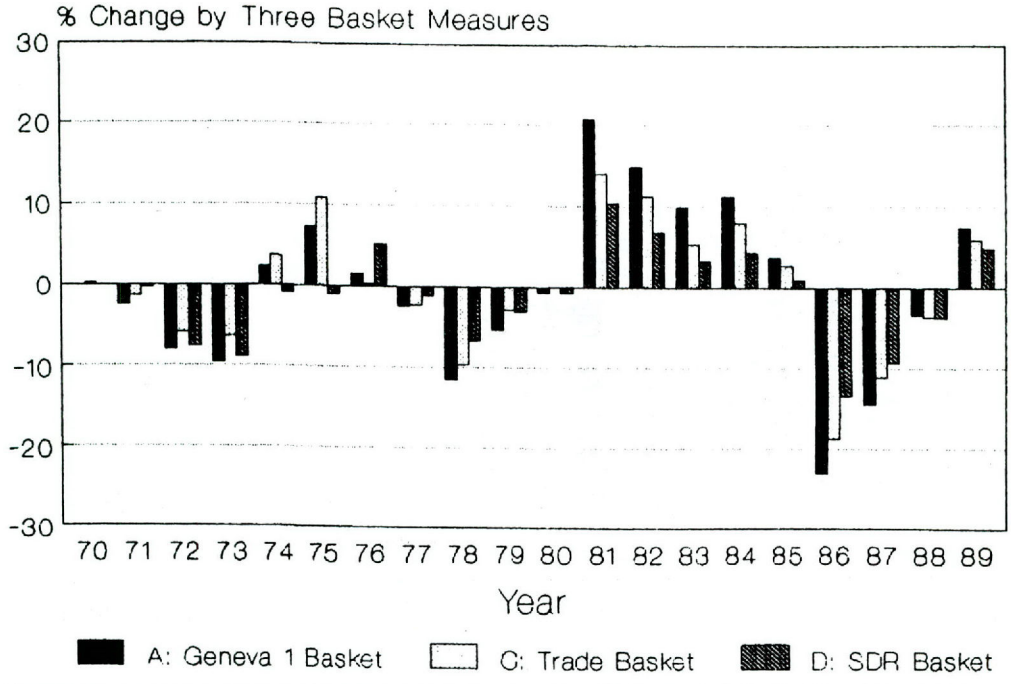
From equation 3, the trade currency composite are measured and shown in Table 1 and Figure 3. Again, the value of this basket followed those of the Geneva I and Geneva II, with the same signs of movements, with the exceptions of 1970 and 1980. In these two years the trade basket showed a strong dollar and gains for OPEC, whereas those of the other two baskets showed a weak dollar and thus losses to OPEC.

For the whole period, the average changes of the value of this basket were almost zero, with a standard deviation of 7.93 percent. Again, the difference between this basket and the Geneva I and the Geneva II is due to the differences of currencies and weights in these baskets. While the dollar is included in the trade basket and with the highest weight, it is not included in the other two baskets.

Finally, the changes in the value of the SDR against the U.S. dollar is used as another are calculated, and the results are shown and compared with other measures in table 1 and Figure 3. According to the SDR

Figure 3

Changes of the Value of the Dollar by Three Baskets



basket measure in 1974 and 1975, the U.S. dollar appeared weak; whereas, according to the other three baskets for the same two-year period, the dollar appeared strong. It should be noted that the gap between the SDR basket and the other three is relatively large in those two years. The reason for these differences id due to the currencies and corresponding weights of the currencies in them. Specifically, that results from the U.S. dollar dominating the SDR, but is not included in the Geneva I and Geneva II baskets.

The cumulative changes of the value of the dollar by the SDR basket for the whole period is a loss of 21.14 percent, an average annual loss of 1.06 percent, with a standard deviation of 5.07 percent. Note that the variation of the value of this basket is the lowest among the four composites.

Measurement of the Inflationary Impact

Equation (4) is used for the measurement of the inflationary impact on OPEC, and their results are shown in Table 1 and Figure 4. Based on this inflationary measure, the highest increase, over 24 percent, was in 1974 and the largest decline, 3.67 percent, was in 1982. For the entire period from 1970 to 1989, this index increased by an annual average rate of 7.34 percent, with a standard deviation of 8.06 percent.

Measurement of the Terms of Trade

Using equation (6) the terms of trade for the inflationary impact, measured by the trade-weighted export price index, the price of crude oil, and four different measures of the value of the dollar, are measured and shown in Table 2. Two of these measures are also shown in Figure 4. Accordingly, the largest increase in the terms of trade of OPEC, 236.5 percent, occurred in 1974 as measured by SDR basket.

While the terms of trade measured by the four baskets followed the same paths, in 1975 and 1983 there are discrepancies between the results by the SDR and those of other three. In those two years the SDR measure of the terms of trade was reduced by 2.14 and 6.13 percent respectively, while by the other three measures they improved.

The cumulative changes, C.C., annual average changes, and the standard deviation of the terms of trade of OPEC for these four measures are also shown in Table 2. These results suggest that between 1970 to 1989, OPEC improved its terms of trade by 278 percent, measured by the SDR basket. That is an annual average of 13.9 percent. For the same period the variation of the terms of trade of OPEC was between the standard deviation of 57.1 (by the SDR basket) to 58.7 percent (by the Geneva I basket).

Figure 4
Changes of Trade Weighted Export Price Index

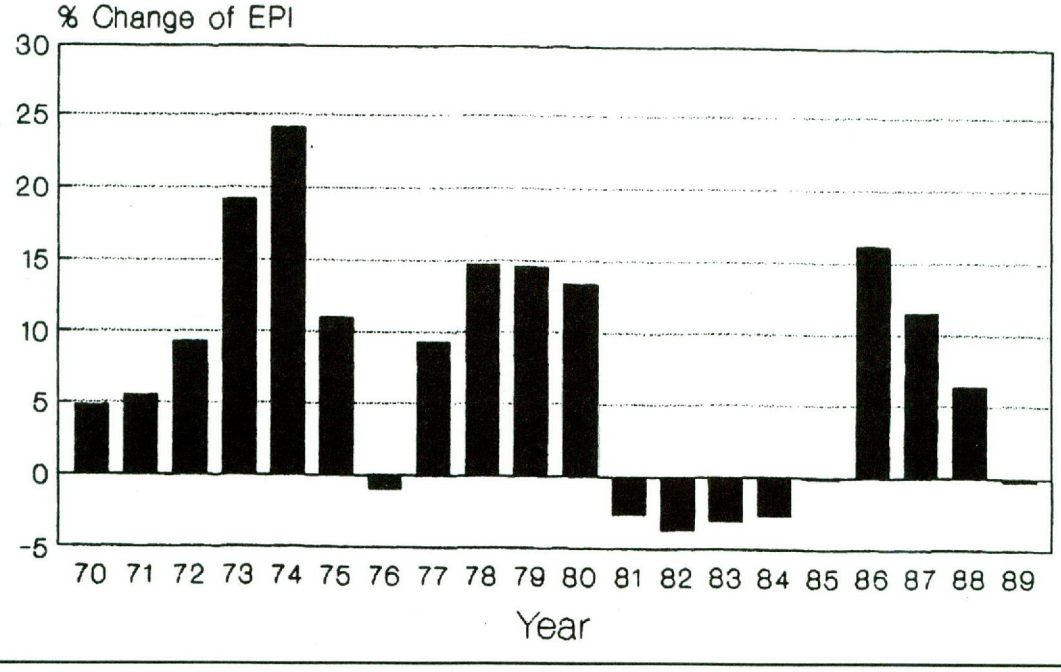


Table 2

Annual and Cumulative
Percentage Changes of the Terms of Trade
of OPEC by Four Different Basket Measures, 1970-89

Year	Genv 1		Genv 2		Trade		SDR	
	A. C.	C. C.	A. C.	C. C.	A. C.	C. C.	A. C.	C. C.
70	-3.23	-3.23	-3.51	-3.51	-3.04	-3.04	-3.21	-3.21
71	18.93	15.7	19.16	15.65	19.79	16.75	21.08	17.87
72	-2.19	13.51	-0.44	15.21	-0.17	16.58	-1.77	16.10
73	13.38	26.89	16.97	32.18	16.17	32.75	14.01	30.11
74	239.65	266.54	239.16	271.34	240.84	273.59	236.50	266.61
75	6.06	272.60	4.28	275.62	9.29	282.88	-2.14	264.47
76	9.82	282.42	8.67	284.29	8.45	291.33	13.42	277.89
77	-4.06	278.36	-3.77	280.52	-3.96	287.37	-2.73	275.16
78	-23.74	254.62	-20.7	259.82	-22.38	264.99	-19.03	256.13
79	16.01	270.63	17.02	276.84	18.44	283.43	18.28	274.41
80	52.14	322.77	52.41	329.25	52.74	336.17	52.01	326.42
81	36.74	359.51	33.27	362.52	29.88	366.05	26.33	352.75
82	21.50	381.01	18.02	380.54	17.62	383.67	13.46	366.21
83	0.42	381.43	-2.40	378.14	-4.17	379.50	-6.13	360.08
84	10.98	392.41	9.18	387.32	7.79	387.29	4.09	364.17
85	-3.28	389.13	-5.31	382.01	-4.17	383.12	-6.03	358.14
86	-89.72	299.41	-85.77	296.24	-85.69	297.43	-80.17	277.97
87	3.53	302.94	6.15	302.39	6.72	304.15	8.70	286.67
88	-31.68	271.26	-30.64	271.75	-31.94	272.21	-32.06	254.61
89	26.39	297.65	24.79	296.54	24.98	297.19	23.80	278.41
C.C.	297.65		296.54		297.19		278.41	
Avg	14.88		14.83		14.86		13.92	
S.D.	58.71		58.11		58.47		57.17	

* A. C. = Annual Change; C. C. = Cumulative Change; Avg = Annual Average; S.D. = Standard Deviation.

SUMMARY AND CONCLUSIONS

Four different baskets were used to measure the impact of changes in the value of the dollar vis-á-vis other currencies. The weak dollar of the early seventies caused a reduction in the purchasing power of OPEC against other industrial nations. On the other hand, during the early eighties OPEC gained from a strong dollar.

The impact of higher prices of goods imported by OPEC was measured by the export price index of the major industrial nations, weighted by each nation's exports to OPEC. The sharpest increase in this inflationary measure occurred in 1974, by 24 percent, and its steepest decline happened in 1982, by 3.67 percent.

Combining the effect of the strength of the dollar, the effect of inflation or deflation on OPEC as a measure of overall gain or loss to OPEC, and changes in the price of OPEC oil, the terms of trade of OPEC were calculated for 1970 to 1989. Based on these results, the largest increase in the terms of trade of OPEC was 236 percent, in 1974, and the largest reduction in the terms of trade of OPEC was 80 percent in 1986. What will happen to the terms of trade of OPEC in the future depends on changes in the price of oil, the strength of the dollar, and change in export price index of the industrial nations in the future.

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NOTES

I am grateful to an unanimous referee for his constructive suggestions. The usual disclaimer applies.

[1]For example, see Adelman (1981).

[2]For 1970 to 1984 the price of Saudi Arabian crude, and for 1985 to 1989 the Dubai bench mark are used.

[3]The terms of trade among countries reflect the impact of changes in price and exchange rates on import and export revenues. There are several measures for the terms of trade. The most widely used is called "net barter" terms of trade. According to this criterion, if trade between two countries is balanced, then by definition.

$$P_x \bullet Q_x = P_m Q_m \quad \text{or}$$
$$P_x / P_m = Q_m / Q_x$$

where P_x and P_m are the prices of exports and imports and Q_x and Q_m are the quantities exports and imports respectively. The ration of P_x/P_m is called the "gross barter" terms of trade. The higher either of the ratios is for a country, the more that country is able to import for any quantity of exports. If for the same quantity of exports, A_x, a country can import more (fewer) commodities, its terms of trade improves (depreciates), other things being constant. In this study P_x/P_m is used for the measurement of the terms of trade (TOT). The change (D) in this ratio over time is transformed into a dynamic measure as d (TOT) = %D (Price of oil as OPEC's exports)-%D (Prices of Imports).

[4]The Special Drawing Right (SDR) was created formally on January 1, 1970, by the International Monetary Fund (IMF) for the purpose of increasing international liquidity. One SDR equaled one United States dollar, and had the same fixed gold content of 0.8886 grams. The floating exchange rate system which started in 1973 caused the value of the dollar and, consequently, the value of the SDR, which was in terms of the dollar, to fluctuate widely vis-á-vis other currencies. Furthermore, the value of the SDR, which was linked to the dollar, dropped due to the depreciation of the dollar in terms of other major currencies. As a result, there was growing support to convert the value of the SDR in terms of a basket of major currencies rather than to only one currency, the dollar. It was believed that the change should make the SDR relatively "stable." Consequently, the IMF adopted the method of valuing the SDR in the market value of a basket of 16 currencies. In July 1977 two of the currencies in the SDR basket was replaced with two other currencies. In January 1981 the SDR was simplified into five currencies of the United States (42%), Germany (19%), France, Japan, and the U.K. (each 13%).

APPLICATION OF NEURAL NETWORKS TO STATISTICAL PRODUCTION/INVENTORY FORECASTING

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KYUNGDOO TED NAM, University of Texas of the Permian Basin

INTRODUCTION

A time series forecasting model is used to identify the historical pattern of data on a particular variable at successive time periods and extrapolates this pattern into the future. Time series forecasting occurs in a variety of production/inventory control applications. As an example, in production scheduling, forecasting the demand for each product line is important for production-operations managers because it allows them to plan production schedules and control inventory (2). Accurate forecasting in the production-inventory control process improves the manager's decision making about what products should be produced, in what quantities, and when they should be produced (9, 16).

There are a variety of time series forecasting techniques currently being utilized, including moving average, exponential smoothing, Box-Jenkins, and linear regression - (7, 8, 14). However, these techniques have several specific disadvantages. First these techniques require assumptions about the underlying function or model. For example, exponential smoothing depends upon the geometrically decreasing weight assumption (3). Second, past observations often contain patterns that are difficult to extract and, as a result, the modelbuilding process can become very complex (9). Third, there is no way of being certain that the choice of a given model or technique provides the best result. For example, in the Box-Jenkins technique, there is not one single Box-Jenkins model, but many different Box-Jenkins models (2). Therefore, managers frequently rely on a combination of these models or techniques when making decisions, which results in a wider range of possible options, and introduces subjectivity into the process. Fortunately, the availability of computer-intensive statistical techniques has increased with the improved capabilities of computer systems, and has provided a more sophisticated and more precise option.

In recent years, neural networks have emerged as an alternative to classical statistical methodologies. Neural networks are computer-based simulations of living nervous systems with a mathematical basis (12). According to Wasserman (18), neural networks learn from experience, generalized from previous examples to new ones, and abstract essential characteristics from noisy and incomplete inputs. In addition, neural networks do not require the same assumptions about the underlying distribution as classical statistical methodologies. The nonparametric nature of neural networks ensures success even if the data are incomplete or corrupted.

This work presents an example to illustrate and compare the performance of neural networks with that of exponential smoothing and regression analysis techniques for production/inventory forecasting.

NEURAL NETWORK MODELS

Neural networks developed as a result of the quest of artificial intelligence (AI). These networks are also called artificial neural systems, connectionist systems, neurocomputers, parallel distributed processing models, adaptive systems, and self-organizing systems (4, 12).

Neural networks

A neural network is a computer model that attempts to duplicate the functionality of the human brain in an analogous manner (13). A neural network is comprised of simple processing elements, called neurons, that interact with each other using weighted connections. A typical neural network has three layers of neurons: input layer neurons, hidden layer neurons, and output layer neurons. Input values in the input layer are weighted and passed to the hidden layer. Neurons in the hidden layer produce outputs based on the sum of the weighted values passed to them. In the same way, the values in the hidden layer are weighted and passed to the output layer to produce the final results. The neural network learns by adjusting the interconnecting weights. When the outputs produced by the neural network are compared to desired outputs, the connecting weights are adjusted to the direction of the desired outputs (for

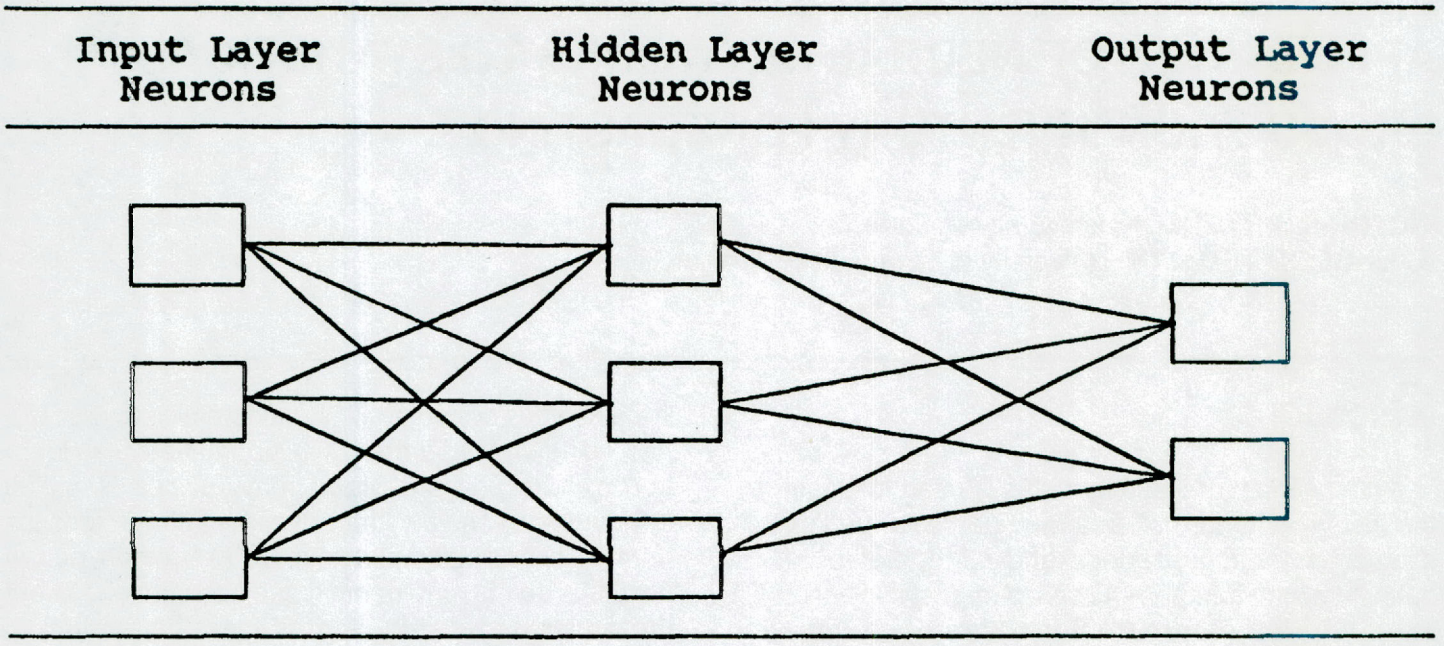

Fig. 1. A neural network

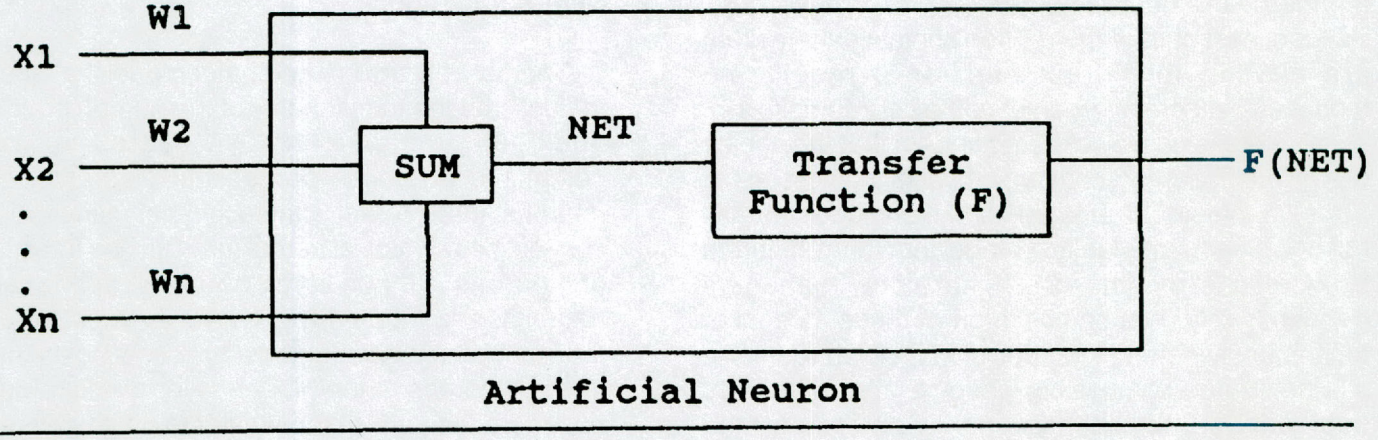

Fig. 2. Artificial neuron

example, see (13, 15, 17, 18). Figure 1 should a fully connected feed-forward neural network. This network is "fully connected" because all processing elements in any one layer are connected to all processing elements in the next higher layer.

The Artificial Neuron

Figure 2 shows the activities that take place at the artificial neuron. The process of computing that takes place in a neural network can best be understood by examining these activities. Let x_1, x_2, ... x_n be the inputs and w_1, w_2k, ... w_n represent the associated weights. Total input signal, NET, is defined as NET = $(x_1w_1 + x_2w_2 + ... + w_nx_n)$. NET is then transformed by a transfer function F to produce the neuron's output signal , F(NET). There are a variety of transfer functions available (12). The sigmoid function is the most widely used among this group and is defined as continuous, S-shaped, and is a monotonically increasing function. Finally, F(NET) is compared to the desired output.

Training Neural Networks

There are two main phases in the operation of a neural network - training and testing. Training is the process of adjusting the connection weights in response to the amount of error that the neural network is generating. Testing is the process that examines if the neural network has generalized over the data set rather than memorizing the sample. Various algorithms have been developed to train neural networks (11,12,13,18) but the most widely used technique to train neural networks is back propagation takes the following steps (18).

1. Apply the input data to the network input.
2. Compute the output of the network.
3. Compare the output to the desired output.
4. Compute the error between the network output and the desired output.
5. Adjust the weights of the network in a way that minimizes the error.
6. Repeat steps 1 through 5 for each vector in the training set until the error for the entire set is acceptably low.

The benefits of neural networks in production/ inventory management

Our work into the neural network approaches for statistical production/inventory forecasting applications is motivated by the limitations of the traditional statistical approaches. In contrast with traditional statistical approaches, the neural network approaches may prove advantageous when (1):

- Underlying distributions are unknown or generated by nonlinear processes.
- Model assumptions are violated.
- A large number of attributes describes the inputs.
- Noise or distortion complicates analysis.
- The chosen model becomes inappropriate.
- On-line decision-making is needed.

Also, neural networks do not require predetermining the structural form of the model. For example, in statistical forecasting, there are many different statistical models that can be selected for a particular problem. In the neural networks, only input and output data are needed for training. Furthermore, neural networks may prove appropriate to many statistical production/inventory problems when a classical statistical technique is either unavailable or inappropriate. For example, neural networks should prove appropriate for optimizing raw material orders, scheduling machine maintenance, production scheduling, determining quality of products (e.g., identifying defective items), product inspection, quality control, process control, fault detection and diagnosis, predicting an important property of the product, selecting parts on an assembly line, complex production/inventory forecasting, and other applications involving statistical analysis such as regression analysis, statistical forecasting, and classification.

AN EXAMPLE

Collection of data

This work uses a published real data set (5) that provides the monthly milk production in pounds per cow for the period January 1962 through December 1975. We use this data to illustrate the application of neural networks and to compare the performance of neural networks with that of exponential smoothing and regression analysis. A time plot of the monthly milk production data shows an overall upward trend with seasonality. Two sets of data are prepared, one for training and the other for testing the neural network. The milk production data for the period 1962-1974 were used to train the neural network. Data for the year 1975 were used to test the neural network

Table 1. Performance of neural networks for the different numbers of hidden neurons

Number of Hidden Neurons	MAD on Testing Data
1	25.36
3	27.76
6	**18.16**
12	20.57
20	18.18
30	19.12

Table 2. Performance of neural networks (12-6-1) for the different learning rates and momentums

Learning Rate	Momentum	MAD on Testing Data
0.1	0.0	18.25
0.1	0.9	18.16
0.6	0.0	21.63
0.6	**0.9**	**12.61**

** 12-6-1 means 12 inputs, 6 hidden neurons, and 1 output

Table 3. Effect of training time (12-6-1) for the different learning rates and momentums

Learning Rate	Momentum	Training Time of Network
0.1	0.0	11:53
0.1	0.9	02:10
0.6	0.0	06:37
0.6	**0.9**	**01:19**

** 00:00 means 00 minutes and 00 seconds

model. The predictive capabilities of neural networks, exponential smoothing, and regression analysis techniques are compared on the basis of the mean absolute deviation (MAD). The MAD is the average of the absolute values of each residual. We used the Friedman test to obtain the statistical evidence of the difference in the MAD values from the three forecasting approaches. The Friedman test provides a statistical test that compares the absolute value of the residuals and does not require distributional assumptions about these deviations.

Exponential smoothing and regression analysis models

The SAS PROC FORECAST procedure is used for exponential smoothing and the SAS PROC REG procedure for regression analysis.

Selection and training of neural network models

A back propagation learning algorithm is appropriate for the neural network model in this work because it is based on solid mathematical principles and has produced a number of successful applications. The back propagation neural network is training using NeuroShell 4.1, by Ward Systems Group, Inc. (17). NeuroShell permits the user to interact with the learning process.

The common three layer neural network models are utilized with a single hidden layer. In this work, we use a model with twelve input neurons (eleven dummy variables and one time variable) in the input layer and one output neuron in the output layer. Eleven dummy variables are created to indicate the monthly seasonal effect and one time variable (1-168) reflects the trend effect. The primary drawback of

Table 4. MAD of testing data set

Month	Actual Value	Neural Network (12-6-1)	Exponential Smoothing	Linear Regression
Jan.	834	831.0	859.2	871.2
Feb.	782	794.1	858.9	834.5
Mar.	892	879.8	858.6	927.5
Apr.	903	898.2	858.4	944.5
May	966	962.6	858.1	1007.2
Jun.	937	937.8	857.8	980.7
Jul.	896	889.8	857.6	932.1
Aug.	858	842.7	857.3	891.3
Sep.	817	800.9	857.0	850.5
Oct.	827	802.1	856.8	855.3
Nov.	797	769.0	856.5	826.1
Dec.	843	826.5	856.2	864.0
MAD		12.6	45.7	36.1
Friedman test (p-value < 0.01)				

the back-propagation network is the requirement that a user have sufficient expertise to train the neural network. This expertise is required to decide the number of hidden layer neurons, learning rate, and momentum. The hidden layer neurons support the nonlinear function from input layer to output layer, learning rate is used to adjust the weights for correcting the errors, and momentum is used to smooth learning. The selection of these factors are problem dependent and, at this time, there are no fixed rules for specifying their values.

This work includes a series of experiments to determine the number of hidden neurons, learning rate, and momentum, Table 1 shows the results of experiments conducted with networks containing six different neurons in a single hidden layer with 0.1 learning and 0.9 momentum. After we determined the optimum number configuration for the number of hidden neurons of each network, we experimented with different learning rates and momentums. We experimented with a learning rate of 0.1 and 0.6, and with a momentum of 0 and 0.9 (see Table 2 and 3). Tables 1 and 2 show the final network structure we selected in bold. This structure was 12-6-1 with learning rate of 0.6 and a momentum of 0.9

Results

Table 4 shows the forecasting ability of the neural network, exponential, and regression models in the testing data for the year 1975. Examination of the MAD value indicates that the performance of the neural network is superior to that of exponential smoothing and regression analysis. The Friedman test indicates that the MADs for the testing data sets of the neural network, exponential smoothing, and linear regression are significantly different at the 0.05 percent levels. Multiple comparisons support the contention that the performance of the neural network model is superior to exponential smoothing and linear regression for this data.

SUMMARY

The costs associated with manufacturing make accurate forecasts of the demand for finished goods a critical skill for managers (6). The above example shows that neural networks provide considerable potential as an alternative to statistical production/ inventory forecasting techniques. Also, neural networks offer a new and potentially less problematic approach to problems that are appropriate for statistical analysis.

As shown in Table 1, the network was affected by the number of neurons in the hidden layer. The result suggests that as the number of neurons in the hidden layer increases, the performance of the neural network model improves. However, we found that the addition of more than six neurons impaired the performance of our neural network model or did not improve its performance significantly. As shown in Table 2, the learning rate and momentum did influence the performance of the networks greatly. Also, the learning rate and momentum affected the training time for networks. For example, in Table 3, the smaller the learning rate and/or the momentum, the greater the training time.

While it was not the intent of this work to define the conditions that make neural networks advantageous, our example shows that neural networks offer an alternative to statistical production/inventory control techniques. Defining the limitations of this alternative is a much needed area for future research. For example, we will investigate the limitations of neural networks to better define the criteria for selecting the number of hidden neurons, learning rate, and momentum of the neural networks. This will assist in removing the uniqueness of neural network solutions as a limiting factor in their application. In spite of these limitations, the example we provide above suggests that further exploration into the application of the neural network models and research into their limitations and advantages is a promising area for future study. This work also shows that, in spite of the need for future research to better define their applicability, neural networks are currently appropriate for applications in production/inventory control.

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A MULTIPLE DISCRIMINANT ANALYSIS OF PUBLIC GOLF COURSE CHOICE INTENTIONS

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INTRODUCTION

Golf is a $20 billion industry in the U.S. and is expected to reach $40 billion by the year 2000 (Symonds 1989). While the National Golf Foundation (hereafter abbreviated as NGF) predicts that 3650 new golf courses will have opened by the year 2000 (NGF 1989), the nature of the golf industry is rapidly changing. The number of new membership golf courses is growing at a much slower rate than the number of new public or pay-as-you play courses (Hick 1989).

Yet despite golf being the fastest growing sport in the U.S. (Nelson 1990) and recognizing that there are over 23 million golfers presently in the U.S. (NGF 1989), little is known about golf course choice intentions. In fact, no research appears to have empirically or conceptually examined the attributes of golf courses or their operations which might be expected to influence choice intentions. This knowledge gap apparently applies to private as well as public courses. Thus, a significant amount of marketing is undertaken each year by golf course marketers in the absence of solid research on behavioral intentions. Consequently, marketers rely on intuition and subjective judgment when developing and implementing marketing campaigns for public courses. Considering this situation, it is herein suggested that the voluminous research on choice intentions for other product/service offerings and the general marketing literature provide a reasonable foundation for new research which models public golf course choice intentions. This effort would also be consistent with the many researchers who have called for extensions of the choice framework to other product/service categories (e.g., McFadden 1986).

PURPOSE

The purpose of this study is to develop a model of public golf course choice intentions. Specifically, this study examines the attributes thought to influence the choice of public golf courses by U.S. golfers. Choice intentions is hypothesized to be a function of four factors: the accessibility of the course, the physical attributes of the course itself, the individual people directly influencing the golfer, and the extra facilities available to the golfer at that course. Multiple Discriminant Analysis will be employed to investigate whether a group of attributes, which constitute four golf course factors, is able to discriminate between low and high public golf course choice intentions to return golfers.

LITERATURE REVIEW

Models of Choice Intentions

Marketing models have been a popular method of predicting choice intentions of a wide array of offerings. Such offerings include: retail outlets (e.g. Gensch 1987), mode of transportation (e.g., Gensch 1985), college (e.g. Chapman and Staelin 1981), living residence (e.g., Silver 1988), consumer products (e.g., Louviere and Henscher 1983), nondurables (e.g., Jones and Zufryden 1982, wagers (e.g. Batsell and Lodish 1981), solar heating (e.g., Berkowitz and Haines 1984), health care (e.g., Hauser and Urban 1977), banking services (e.g., Flath and Leonard 1979), telecommunications services (e.g., Green 1978), sporting event attendance (e.g., Richard and Allaway 1993), musical groups (e.g., Batsell 1980), consumer durables (e.g. Amemiya and Nold 1975), and which offering to inspect (e.g., Meyer 1982).

While there are many possible specifications of choice intentions models, there are several generally accepted principles that are applied to the many possible specifications (Cooper and Nakanishi 1983). First, choice offerings are described as combinations or bundles of Attributes. Second, consumers (e.g., golfers) evaluate offerings in terms of some or all of the attributes. Third, these attributes are combined in some manner to form the utility of each offering for each consumer. Fourth, consumers are assumed to be utility maximizers choosing the offering with the highest utility. Finally, attributes of the consumer (e.g., demographics) can be included in the model to account for differences between consumers.

Golf Course Choice Intentions

While the aforementioned discussion suggests that many offerings have been the focus of choice intentions studies, there is a paucity of literature dealing with public golf course choice intentions. The only empirical studies on golf course consumers in general have been conducted by Piper (1990) and the NGF (1989).

Piper (1990) investigated the relationship between the demand for public golf courses and several demographic variables. Income and age were found to have an inverse relationship with demand for public courses (as opposed to private, membership courses).

The NGF is responsible for the vast majority of empirical research on U.S. golfers. Much of these results are contained in the 1989 Golf Consumer Profile (MGR 1989). Two-thirds of golfers surveyed cited price (i.e., greens fees) as the single most important factor in deciding on which golf course to play. Other attributes found to influence choice intentions were the number of other golfers on the course, the distance to the golf course from home, and the speed of play. While the NGF study of U.S. golfers is useful, the results are only descriptive in nature. In addition, the golf course general manager and the golf course professional are left with only a rudimentary understanding of the attributes thought to influence choice intentions.

METHODOLOGY

Attributes

The process suggested by Churchill (1979) was utilized to generate a services of attributes thought to influence public golf course choice intentions. An initial pool of attributes was generated though discussions with golfers, golf professionals, and a review of the relevant literature. Churchill's (1979) iterative process of attribute development, testing, and deletion was utilized to develop a relevant and manageable set of 17 attributes. The attributes appear in Table 1 (note that the attributes appear in the groupings derived from a subsequent Factor Analysis and not in the order they appear in the questionnaire).

Ratings on each of the attributes were assessed using ten point response scales anchored by "Strongly Disagree" (0) and "Strongly Agree" (9). Choice intentions was measured by the item:

Table 1
Attributes And Notation

SPEED	The speed of play is to my liking.
PRICE	The price of play is reasonable for a course of this quality
TEETIME	Getting convenient tee times is not a major problem
LOCATE	The course is conveniently located for regular play
LONG	The course is not too long in terms of yardage.
LAYOUT	The course layout fits my style of play (e.g., width, hazards, etc.).
GREENS	The condition of the greens are excellent.
FWAYS	The condition of the fairways are excellent.
HARD	The course difficulty is appropriate for my level of play.
OTHERS	The attitude of the other golfers is friendly.
DESIGNER	The course was designed by a well known designer (e.g., Pete Daye, Jack Nicklaus, etc.).
PRO	The golf pro has helped me improve my game.
RESPECT	The course was recommended by someone I respect.
FOOD	The restaurant or food service is excellent.
AMENITY	The course has several amenities such as a pool, tennis courts, etc.
SHOP	I enjoy shopping at the pro shop.
PRACTICE	The practice facilities are excellent.

"If given the opportunity, would you play the course again?" As such, choice intentions was a binary dependent variable with responses: Yes=1 and No-

0. Golfers who responded "Yes" to the question constituted the high choice intentions to return group of golfers while golfers who responded "No" constituted the low choice intentions to return group.

Questionnaire Administration

The final version of the questionnaire was administered by personal interviews at a large Southeastern airport. Care was taken to ensure that the interviewers went to their designated locations on different days of the week and different times of the day to attempt to obtain a representative cross-section of the market.

A systematic sampling procedure was employed by the interviewers. The interviewers were instructed to survey every tenth person seated in the interviewers' designated areas. Response rates averaged 85 percent. This seemingly high response rate is not surprising given the interviewing environment. Most of the respondents were waiting for a flight or to meet someone at the airport. Several respondents expressed the view that they would complete the questionnaire since they had little else to do but wait. The personal interviews yielded 241 usable questionnaires.

Respondents were asked to fill out a four page questionnaire. One section consisted of a series of items designed to gather the name and location of the last public golf course played, choice intentions, and a set of 17 evaluative attributes concerning the named golf course. The evaluative attributes in this section were scrambled. The second section consisted of a standard demographic profile of respondents. The self-administered questionnaire required approximately 10 minutes to complete.

RESULTS

Reliability And Factor Structure

Following Parasuraman, Zeithaml, and Berry (1988), the 17 attributes thought to influence public golf course choice intentions were subjected to a

Table 2
Reliability And Factor Analysis Results

Factor/Attribute	Coefficient Alpha	Factor Loadings F1	F2	F3	F4
ACCESS (F1):	0.7801				
SPEED		0.4381	0.1874	0.2055	0.2579
PRICE		0.7056	0.1326	0.0716	0.2552
TEETIME		0.6710	0.0175	0.1818	0.1159
LOCATE		0.4148	0.0191	0.1637	0.0941
COURSE (F2):	0.7424				
LONG		0.0704	0.3069	0.1990	0.2505
LAYOUT		0.1812	0.3427	0.1625	0.2637
GREENS		0.0377	0.6654	0.1359	0.1362
FWAYS		0.1236	0.6127	0.1805	0.0337
HARD		0.1593	0.3864	0.0830	0.0640
PEOPLE (F3):	0.7997				
OTHERS		0.0219	0.0982	0.6104	0.0792
DESIGNER		0.0511	0.0162	0.5783	0.0380
PRO		0.1749	0.1219	0.5475	0.0719
RESPECT		0.0101	0.0105	0.6204	0.0316
EXTRAS (F4):	0.7491				
FOOD		0.0579	0.0670	0.1476	0.4424
AMENITY		0.0850	0.0361	0.0485	0.5482
SHOP		0.2591	0.0670	0.2398	0.3439
PRACTICE		0.0300	0.1204	0.1656	0.3741

Common Factor Analysis and an oblique rotation. The criterion used to generate factors was the average communality extracted as suggested by Hair, Anderson, Tathan, and Black (1992). The results of the Factor Analysis appear in Table 2. The resulting four factor solution explained 77.60 percent of the variance. No cross loadings equaled or exceeded 0.3000 providing support for convergent and discriminant validity of the attributes.

While there was no *a priori* determination of how the attributes should load, the resulting solution was intuitively appealing. The factor names and interpretations were suggested by how the attributes loaded on the factors. The ACCESS factor appears to represent the ability of the golfer to play the course., The COURSE factor appears to represent other individuals who directly or indirectly influence the golfer. Finally, the EXTRAS factor appears to represent the "associated facilities" of the golf course.

The alpha values for each factor also appear in Table 2. The alpha values associated with each factor all exceeded 0.7000. These findings lend support that the attributes comprising each factor share a common core (Churchill 1979). The item-to-total correlation did not suggest further deletion. While it was hoped that the alpha values might be higher, the attributes did exhibit acceptable levels of reliability for an exploratory study (Nunnally 1978).

Factor Derivation

Factor scores (i.e., linear combinations of attributes) for each golfer were determined using Gorsuch's (1974) Sum Scoring Method. For each attribute, the highest associated loading was used to determine the factor with which the attribute has the strongest relationship. Each attribute was then standardized and weighted by the appropriate standardized scoring coefficient. The score for a given factor (for each golfer) was then formed by summing the standardized, weighted observed values corresponding to the attributes with high loadings on that factor. The scores assigned to each golfer on the four factors were used as explanatory variables in the subsequent analysis.

Multiple Discriminant Analysis Results

Multiple Discriminant Analysis (MDA) is a multivariate technique that investigates which

Table 3
Discriminant Analysis Results

Factor	Standardized Coefficient	Loading	Univariate F Ratio
ACCESS (F1)	0.9604	0.8922	148.9554[a]
COURSE (F2)	0.4083	0.5353	53.6124[a]
PEOPLE (F3)	0.2903	0.4165	32.4644[a]
EXTRAS (F4)	0.0707	0.2043	7.8136[a]
Wilks' Lambda	0.5609[a]		
Canonical Correlation	0.8109		
Canonical R^2	0.6577		
Hit Ratio:			
Estimation (n=241)	0.8550		
Holdout (n=54)	0.8127		
Press' Q Statistic:			
Estimation (n=241)	124.8200[a]		
Holdout (n=54)	53.6862[a]		

[a]=significant at the 0.01 level.

explanatory variables (e.g., attributes) are best able to "discriminate" between or classify observations (e.g. , golfers into groups (e.g., low vermis high intentions to return group). In this study, MDA was employed to investigate whether a group of explanatory variables, which constitute four golf course factors, is able to discriminate between low and high public golf course choice intentions to return golfers. These explanatory variables were the four linear combinations (i.e., factors) of the 17 attributes derived from Factor Analysis. Each of the factors is hypothesized to contribute positively (i.e., possess a positive and significant coefficient) to the discriminating power of the MDA model.

The coefficients of the MDA model were estimated using the data of all 241 respondents. Table 3 presents the MDA model results. Wilks' Lambda (F=46.1868, p=0.0001) suggests that the discriminant function is significant. In other words, the four factors appear to discriminate in the classification of low intentions to return golfers and high intentions to return golfers. In addition, the Canonical R^2 indicates that 65.77 percent of the variance in the dependent variable can be explained by the four factors.

Classification Accuracy

The true test of a model's diagnostic usefulness is evidenced by its classification accuracy. Classification accuracy results also appear in Table 3. The classification accuracy (i.e., hit ratio) for the estimation data set exceeds the proportional chance criterion (C_{pro}) of 0.6250 (Hair, Anderson, Tatham, and Black 1992). For the holdout data set, the MDA model correctly classifies approximately 81 percent of the golfers.

Another measure of classification accuracy is Press' Q statistic (Hair, Anderson, Tathan, and Black 1992). Press' Q Statistic is significant for both the estimation (chi-square=124,8200, p<0.0001) and holdout (chi-square=53,6862,p<0.0001) data sets. Collectively, these results suggest that the MDA model with four factors appears to classify golfers well for both data sets.

Individual Factors

Univariate F ratios, standardized coefficients, and loadings from the MDA output were utilized to assess the contribution of the four factors. These results appear in Table 3. Univariate F ratios (simple ANOVA's) suggest that all the factors are significant on a univariate basis at the 0.05 level.

However, loadings are considered as the preferred diagnostic for assessing the statistical significance of the explanatory variables (Hair, Anderson, Tatham, and Black 1992). Loadings greater than or equal to 0.3000 are considered significant (Hair, Anderson, Tatham, and Black 1992). Three of the four factors have significant loadings (i.e., ACCESS, COURSE, PEOPLE).

An examination of the coefficients also suggest that the signs of all of the factors agree with their *a priori* signs. It appears that ACCESS, COURSE, and PEOPLE are important for discriminating between low and high intentions to return golfers. In terms of order of importance, ACCESS appears to be the most important discriminator. ACCESS is followed by the COURSE and PEOPLE factors in decreasing order of importance. The EXTRA S factor is not significant at the 0.05 level.

The ACCESS factor represents the ability of the golfer to play the course (e.g., price and tee times). The COURSE factor represents the physical characteristics of the golf course itself (e.g., greens and fairways). The PEOPLE factor appears to represent other individuals who directly or indirectly influence the golfer (e.g., golf pro and other golfers).

LIMITATIONS

This study is not without limitations. First, the analysis was performed on a diverse group of public golf courses. The evaluation of the factors influencing public golf course choice intentions (i.e., the factors able to discriminate between groups of golfers) may vary by "type" of public golf course (e.g., high priced courses versus low priced municipal courses).

Second, this study assumes a homogeneous group of respondents. No attempt was made to examine possible differences between various demographic segments of the market in their evaluation of the factors thought to influence public golf choice intentions.

Finally, the reduction of 17 attributes to four factors results in the lack of "actionability" of the factors. In other words, one can only examine the influence of a factor on the dependent variable of interest and not the impact of the individual attributes on the dependent variable. This is the result of each factor being a linear combination of the attributes that load on the factor.

CONCLUSIONS

Several significant conclusions can be drawn from this research. It appears that golfers utilize multiple factors when choosing a public golf course. In other words, multiple factors are able to discriminate

between the two groups of golfers. In addition, there appears to be support for three factors influencing public golf course choice intentions. While three factors exert a significant influence on choice intentions, the ACCESS and COURSE factors appear to be most critical.

The consideration of the ACCESS and COURSE factors as most important by the golfers should not come as a major surprise. These results suggest that public course users are relatively more concerned with the actual golf facility and its convenience than with the social aspects, ancillary activities, or associated facilities.

The ACCESS factor was found to exert the most influence on choice intentions. Since the sample was derived primarily from golfers who are employed and may have limited leisure time, the need to gain access to a course at a convenient time appears reasonable. It also seems logical that the price attribute loaded on the ACCESS factor since the cost of playing at a particular course functions as a screening variable. Higher prices are conjectured to limit demand to those willing or able to pay. In other words, access is denied to those unwilling or unable to pay the required price.

Since golfers who play at public courses might be expected to be primarily interested in playing golf (and less concerned with the social aspects, ancillary activities, or associated facilities), it is understandable that the COURSE factor was the second most significant consideration. This factor, comprised of the physical attributes of the course itself, should be important to the individual whose main concern is "playing a round of golf."

While significant, the PEOPLE factor exerted significantly less influence on choice intentions. This result also suggests that public course users are more concerned with playing golf than socializing afterwards or interacting with the golf pro.

The encouraging reliability and validity of the 17 attributes thought to influence public golf course choice intentions should facilitate further research on this topic at the academic and managerial levels. To the extent that golf course marketers find the 17 attribute questionnaire diagnostically useful, four guidelines are offered which should assist in the development and alteration of their marketing strategies:

(1) *Course-Type Analysis.* The aforementioned analysis was performed on public golf courses in general. As such, results should not be generalized to specific types of golf courses. Specially, differences in factor importance may exist between public and private courses, high-priced public courses and low priced courses, etc. However, the same questionnaire and methodology can be easily applied to specific types of courses. As a result, the marketer would gain insight as to the most important factors influencing choice intentions.

(2) *Segment-Specific Analysis.* The 17 attribute questionnaire can be administered to several segments of golfers based on differences in demographics, psychographics, etc. Segment-specific analysis would allow the marketer to investigate the differential influence of the factors across segments of golfers.

(3) *Competitive Analysis.* By asking golfers to complete the 17 attribute questionnaire on several competitor public golf courses, the results can be used to evaluate and compare strategies relative to several competitors.

(4) *Temporal Analysis.* The 17 attribute questionnaire can be administered periodically to track change (or lack of change) in golfer evaluations over time. As such, marketers can evaluate the effectiveness of strategies over time.

Clearly, public golf course users represent an identifiable segment of the golf market who consider certain attributes when choosing a course. The findings of this study suggest that public golf course marketers should be concerned with several significant factors in their marketing effort, but should primarily concentrate on providing the maximum convenience, value, and a challenging quality course if they are to meet the needs of the market.

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THE EFFECT OF FIRM SIZE ON PROBABILISTIC JUDGEMENT IN AUDITING

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INTRODUCTION

Audit judgment is a cognitive process. That is, auditors express opinions based upon investigations that inevitably involve subjective judgments. However, research investigating audit judgment suffers from a major handicap in that actual cognitive processes cannot be observed directly. To date, cognitive research in auditing studies have focused upon particular aspects of audit judgment and have been conducted within specific metaphors of the underlying process. Metaphors are used in the form of "as if" models of the judgment process. This approach has revealed particular aspects of audit judgment at the expense of achieving a more systematic knowledge of auditing. To obtain this systematic knowledge, two of the questions that need to be answered are:

1. What forces are at work in developing a corporate culture?
2. How does the corporate culture of an audit firm condition the judgments of individual auditors? [Hogarth, 1991].

A public accounting firm's size may affect its development of a corporate culture. That is, larger firms tend to have more structure and more bureaucracy which could limit professional autonomy in that organizational rules may substitute for professional judgment. On the other hand, smaller firms tend to be less bureaucratic with fewer standard operating procedures, leaving accountants in these firms freer to use their own judgment [Goetz et al, 1991]. Additionally, firm size has previously been found to impact upon local-cosmopolitan and bureaucratic perceptions of accountants [Schroeder, and Imdieke, 1977]; actuaries perceptions of the risk of legal liability [Schultz and Gustavson, 1978]; perceived independence [Shockley, 1981], and organizational-professional commitment and central life interest [Schroeder, Reinstein and Schwartz, 1992]. This study investigates the impact of public accounting firm size on the auditors' probabilistic judgment.

PURPOSE AND MOTIVATION

Audit judgment is the process of forming an opinion or conclusion. In a typical engagement, the auditor must assess the reasonableness of a client's financial statements given imperfect and incomplete information. Ashton [1982] has categorized audit judgment and decision making into four basic types of activities:

1. Evaluations or judgments of current information.
2. Predictions of future outcomes.
3. Assessments and revisions of probabilities that particular outcomes will occur.
4. Choices among alternative courses of action.

Audit judgment research attempts to understand, model and test theories of auditor judgment in order to improve the consistency, efficiency and effectiveness of auditors; gain insights into the general principles of cognition by studying actual judges; and find ways to supplement or replace certain audit tasks that might be better suited to nonhuman intervention [Watkins, 1987]. Audit judgment research is based upon the theoretical perspective and research methods of cognitive psychologists, economists, decision theorists, and others concerned with how people make decisions [Ashton and Willingham, 1988]. Considerable research using this perspective has been conducted on how well auditors formulate and make decisions [See, for example, Ashton, 1982, 1983; Libby and Lewis, 1982].

The basic goal of audit judgment research is to evaluate audit decision making in order to determine decisions which need improvement. Thus, the research is concerned with how decisions are made, how well they are made, how other variables of interest impact on decision making, and ways of making decisions better. Examples of results from audit judgment research are: (1) While auditors often are relatively accurate in repetitive decision situations, room for improvement exists because they do not always (a) perceive correctly the relevance of information used in decision making, or (b) use

relevant information in a consistent fashion. (2) Although individual auditors have been found to make reasonable, consistent decisions over time, different auditors using the same evidence often tend to make markedly different decisions [Ashton and Willingham, 1988].

The decision process encompasses three significant phases: intelligence, design and choice [Simon, 1960]. The intelligence phase, which is the major concern of the study reported herein, concerns the definition of the problem under consideration and the collection of the data [Abdolmohammadi, 1987]. Auditor judgment is required in this phase of the decision process as discussed by Libby and Libby [1989]:

> The human judge selects the relevant cues, defines their measurement scales, determines the relevant criterion and provides inputs into the model in the form of component rates of cue values.

Previous research also indicates that auditors use decision strategies, known as heuristics, when selecting and measuring cues [Biddle and Joyce, 1982]. One of the accountant's primary functions is the process of supplying or using information for decision making. Studies show a lack of good decision skills, which suggests that, in order to cope with complex decision-making environments, simplifying strategies (heuristics) are employed that can produce biases when making decisions [Cohen and Paquette, 1988]. Duchon, Ashmos, and Dunegan [1991] believe that in an effort to be rational, managers apply heuristics to complex or non-routine decisions. Shields, Solomon and Waller [1987] note that auditors are less prone to bias than most other experimental subjects, probably because their knowledge is organized to maintain internal consistency. Heuristics may be valuable tools when they enable auditors to make efficient decisions, but heuristics also may lead to systematic errors when relevant information is ignored.

Firm size has been found to be an important intervening situational variable in several studies of public accounting firms [Schroeder and Imdieke, 1977; Schultz and Gustavson, 1978; Shockley, 1981; Schroeder and Verreault, 1987]. These studies have tended to indicate that organizational and professional commitment and decision making are affected by organizational (firm) size. This paper investigates the possibility that an auditor's use of cues is affected by the size of the employing public accounting firm. The discussion is organized as follows:

1. Discussing the concept of heuristics and biases.
2. Discussing the concept of firm size as an intervening variable.
3. Presenting the research methodology.
4. Presenting the results.
5. Presenting the summary and conclusions.

HEURISTICS AND BIASES

How do auditors cope with uncertainty? Undoubtedly, they, like other people, rely on rule of thumb procedures (heuristics) to reduce cognitive strain in probabilistic inference tasks. All of the types of decision identified by Ashton [1982] are potentially susceptible to the effects of using judgmental heuristic that may be used to simplify the cognitive requirements for judgment and decision making. Heuristic may be beneficial to the extent that they reduce the amount of time and effort needed to make judgments. However, the danger is that the auditor may not know that heuristic are being employed and biased decisions may result.

There have been at least 40 studies of heuristic and biases reported in the accounting literature [Shanteau, 1989]. These studies are based on the following two conclusions summarized by Hogarth, [1975]: (1) Humans have limited information processing capacity [Newell and Simon, 1972], and (2) the nature of the judgmental task determines to a great extent the decision strategies which they employ [Einhorn and Hogarth, 1981]. Previous research on judgmental decision making frequently assumed that individuals employ the Bayes' Theorem model. That is, the decision maker's beliefs are revised constantly upon the receipt of new information. However, Kahneman and Tversky [1972b] theorized that individuals are not Bayesian in their evaluation of evidence. A series of papers by these authors, Tversky and Kahneman [1971, 1973, 1974, 1977], and Kahneman and Tversky, [1972a, 1972b, 1973] focused on the development of representations of human judgment decision strategies, termed heuristic, that are descriptively more powerful than Bayes Theorem. Kahneman and Tversky formulated and empirically tested two heuristic that they believe provide more accurate descriptions of human judgment that does Bayes' Theorem. They are: (1) anchoring and adjustment, and (2) representativeness. These heuristic also have been tests on auditors and the two studies discussed below found that they provided at least a partial explanation of behavior.

Anchoring and Adjustment

Judgments made in accordance with the anchoring and adjustment heuristic are hypothesized to result from the following process [Biddle and Joyce, 1982]:

1. An initial value or starting point (the anchor) which seems appropriate to the decision maker is selected. (Just how the initial value is selected is not clear.)

2. The anchor is adjusted to take into account new information. This adjustment is typically in the appropriate direction but is insufficient in magnitude.

Joyce and Biddle [1981] developed a series of experiments to test for anchoring and adjustment and concluded that [p.41]: "The results of these experiments indicate that auditors sometime make judgments that are in violation of normative principles of decision making."

In the experiment of interest to this study, auditors were asked to estimate the extent of executive-level management fraud. The subjects were divided into two conditions and provided an anchor in the form of the following question:

Form A (Condition 1)
Based on your audit experience, is the incidence of executive-level management fraud more than 10 in each 1,000 Big Eight clients?

Form B (Condition 2)
Based on your experience is the incidence of executive-level management fraud more than 200 in each 1,000 Big Eight clients?

Representative and Protectiveness

Representativeness may be described as the tendency to judge the probability that item A comes from population B on the basis of the degree to which A is perceived to be similar essential characteristics to B [Biddle and Joyce, 1982]. Although the use of the representativeness heuristic possesses a certain intuitive appeal, its use can lead to judgments of probability that are inappropriate. That is, since the sole criterion is perceived similarity, other relevant considerations may be ignored.

Ijiri and Kaplan [1971] suggested that auditors may follow the objective of protectiveness in sampling. Auditors following this objective will select items that maximize the dollar value audited in variable sampling and attempt to examine a large proportion of the sample in attribute sampling. This strategy also may result in inappropriate probability judgments because a simple preference for large samples does not in itself insure that the sample error rate is within the allowable population error rate at the desired level of confidence.

Uecker and Kinney [1977] designed an experiment to examine the extent to which practicing CPAs employed the representativeness and protectiveness heuristic in the evaluation of sample outcomes. The subjects were presented with an audit situation involving a test of controls. Five pairs of sample outcomes based upon the audit situation were presented. For each pair, the subjects were asked to select the sample result that provided better evidence that the population error rate did not exceed 5 percent. For each pair, the sample results were selected so that one outcome provided adequate evidence that the population error rate was less than the critical rate at a 95 percent level of confidence (the upper limit discussed in SAS No. 1). The other sample outcome provided inadequate evidence at a 90 percent level of confidence (the lower limit discussed in SAS No. 1).

Three of the five pairs of cases were designed to detect whether the respondents employed the representativeness heuristic in evaluating sample outcomes. Respondents utilizing the representativeness heuristic will tend to ignore sample size and focus upon the sample error rate in making their judgments. That is, if the sample size is ignored, the sample with the smaller error rate would appear to provide the better evidence that the population error rate is less than 5 percent. The other two cases were included in an attempt to detect whether or not the respondents were basing their judgments on a strategy of a preference for large samples - the protectiveness heuristic. For these cases, the smaller sample provides the better evidence that the population error rate is less than 5 percent.

Uecker and Kinney [1077] reported that 54 percent of the auditors made at least one error of representativeness, and 37 percent made at least one error of protectiveness. Additionally, 74 percent of the subjects responded incorrectly to at least one of the five cases, and 56 percent of the subjects responded incorrectly to at least two of the five cases. These results led Uecker and Kinney to conclude that although the subjects did not consistently employ either the representativeness or the protectiveness heuristic, the problem of subjectively evaluating sample outcomes may be a significant one for a large number of CPAs.

The authors of the two experiments described above indicated that heuristic and biases could

account for part of—but not all—deviations from normative behavior; consequently, other uncontrolled factors may have affected the results of their experiments. Kinney [1986b], noted that predictions of a dependent variable in any experiment may be caused by three factors: the independent variable, prior influence factors, and contemporaneous factors. One possible prior influence factor that has been ignored is the size of the public accounting firm.

FIRM SIZE

Considerable attention has focussed on the impact of accounting firm size on various phenomena. A U.S. Senate subcommittee studied the degree of concentration in large public accounting firms [United States Senate, 1976]. The American Institute of Certified Public Accountants [1078] also questioned the impact of accounting firm size by stressing that smaller firms may be replaced because they are less well known even though they provide equally quality services. Several studies have also found that firm size to be an intervening variable of interest in may areas. For example, firm size has been found to impact upon professional autonomy [Lengerman, 1971], local-cosmopolitan and bureaucratic perceptions of accountants [Schroeder, and Imdieke, 1977], actuaries perceptions of the risk of legal liability [Schultz and Gustavson, 1978], perceived independence [Shockley, 1981], disclosure preferences [Wright, 1983], audit withdrawal decisions [Schroeder and Verreault, 1987], firm-wide dimensions of communication [Gregson, 1990] and probabilistic judgment [Schroeder, Reinstein and Schwartz, 1992]. The development of a corporate culture also may be affected by the size of a public accounting firm. That is, larger firms tend to have more structure and more bureaucracy which could limit professional autonomy in that organizational rules may substitute for professional judgment. On the other hand, smaller firms tend to be less bureaucratic with fewer standard operating procedures, leaving accountants in these firms more free to use their own judgment. Furthermore, small firm accountants may tend to look more toward the profession as a source of influence since their firms are less likely to possess "stand-alone" identity and credibility than large firms [Schroeder and Imdieke, 1977; Goetz *et al*, 1991]. Consequently, it can be hypothesized that the accountants in smaller firms may be more inclined to use judgment and less inclined to rely on heuristic than their counterparts in other sized firms.

RESEARCH METHODOLOGY

The research was undertaken by means of a two-part questionnaire: (1) The anchoring and adjustment instrument developed by Joyce and Biddle [1981]. (2) The representativeness and protectiveness instrument developed by Uecker and Kinney [1977]. A copy of the questionnaire is included in the Appendix.

The study surveyed individuals in various sized public accounting firms. Firms were stratified according to the following criteria suggested by Schroeder and Imdieke [1977, p.41]:

Large - "Big Eight" (now Big Six) firms
Medium - Other national and regional multi-office firms
Small - Local one office firms with two or more partners

Additionally, Gibbins [1984, p. 107] suggests that an auditor's experience produces prestructured guides to judgment. The experience of individuals in public accounting firms is closely associated with their position in the firm; therefore, the data were also stratified to determine if differences existed between the normal professional staff positions of junior, senior, manager and partner. Consequently, each research question was analyzed on the basis of both organization size and position in the firm.

For comparative purposes, the statistical tests used to detect the use of heuristic and biases for the overall group responses are identical to those used by the original authors of each study. The anchoring and adjustment case contains two conditions, and the subjects were randomly assigned to one of the two conditions. Overall differences between the responses to the two conditions were assessed by using the "T" test for the difference between means. In the representativeness case, subjects' responses were analyzed by the frequency of errors using a Chi^2 analysis. This analysis compares the actual results with expected random results to determine if differences exist.

A sample of public accountants at all positions in the various sized firms were required to investigate the research questions to be addressed. Therefore, obtaining a sample with the required attributes was more important than obtaining a random sample. Additionally, if a random sample of practicing certified public accountants were to be used for this study, it would be necessary to compile this list stratified by both firm size and position in the firm. Such a list does not exist and the time and cost necessary to compile such a list would be prohibitive.

As an alternative to a random sample of the entire populations, this study used cluster sampling in the Detroit, Greater Philadelphia and El Paso areas.[1] Cochran has discussed the use of cluster sampling:

> There are two main reasons for the widespread application of cluster sampling. Although the first intention may be to use the elements as sampling units, it is found in many surveys that no reliable list of the elements in the population is available and that it would be prohibitively expensive to construct such a list.

The subjects were selected by using the "contact person" technique [Schroeder and Verreault 1987], where a stratified sample of large, medium and small public accounting firms in a particular area are identified, and a contact person in each firm is asked to designate a number of audit staff professionals to participate in the study. Questionnaires are then delivered to the contact person who distributes them to those participating in the study. Each respondent completes the questionnaire and returns it in a sealed envelope to the contact person, who then returns all of the completed questionnaires to the researchers.[2] The individual responses were stratified by firm size and position in the firm. The total usable responses by experiment were: anchoring and adjustment - 383, representativeness and protectiveness - 367.[3]

The specific research questions addressed in this study, and a description of the method of analysis for each question follows.

Anchoring and Adjustment

1. How do the results of the current study on the anchoring and adjustment heuristic compare with the results reported by Joyce and Biddle?

2. Does firm size have an association with the use of the anchoring and adjustment heuristic?

3. Does position in the firm have an association with the use of the anchoring and adjustment heuristic?

The potential impacts of: firm size and position in the firm on the use of the anchoring and adjustment heuristic were analyzed by use of a randomized block analysis of variance mode. In using this model, firm size and position in the firm are blocks and the anchor is the treatment. The dependent variable is the estimated amount of fraud. Finally, Tukey's HSD test was used to investigate significant overall effects.[4]

Exhibit 1
Results of the Anchoring and Adjustment Experiment Overall and by Firm Size

	Condition 1	Condition 2	t value	P
Overall Results	n=176	n=196		
Mean	47.356	60.209		
Standard deviation	72.376	113.205		
t			1.314	
p				<0.021
Large Firm Results	Condition 1 n=60	Condition 2 n=72	t value	P
Mean	21.223	53.194		
Standard deviation	32.252	64.643		
t			-3.726	
p				<0.001
Medium Firm Results	Condition 1 N=60	Condition 2 N=69	t value	P
Mean	32.656	66.478		
Standard deviation	39.814	82.866		
t			-3.019	
p				<0.031
Small Firm Results	Condition 1 n=56	Condition 2 n=55	t value	P
Mean	61.661	91.224		
Standard deviation	138.312	152.503		
t			.970	
p				<0.335

Exhibit 2
Results of the Anchoring and Adjustment Experiment by Position
Partner

	Condition 1	Condition 2	t value	P
Overall Results	n=33	n=48		
Mean	21.424	69.875		
Standard deviation	21.606	157.053		
t			-2.109	
p				<0.401
Large Firm Results	Condition 1 n=13	Condition 2 n=10	t value	P
Mean	11.692	27.000		
Standard deviation	13.332	20.440		
t			-2.173	
p				<0.042
Medium Firm Results	Condition 1 n=8	Condition 2 n=12	t value	P
Mean	27.500	35.250		
Standard deviation	33.488	35.059		
t			-0.497	
p				<0.627
Small Firm Results	Condition 1 n=12	Condition 2 n=26	t value	P
Mean	27.917	102.346		
Standard deviation	16.301	208.019		
t			1.812	
p				<0.083

Exhibit 3
Results of the Anchoring and Adjustment Experiment by Position
Manager

Overall Results	Condition 1 n=37	Condition 2 n=50	t value	P
Mean	35.378	57.678		
Standard deviation	39.600	46.277		
t			-0.366	
p				<0.716

Large Firm Results	Condition 1 n=20	Condition 2 n=25	t value	P
Mean	21.750	30.480		
Standard deviation	28.713	28.466		
t			-1.017	
p				<0.316

Medium Firm Results	Condition 1 n=10	Condition 2 n=21	t value	P
Mean	25.900	51.570		
Standard deviation	31.855	62.876		
t			-1.508	
p				<0.143

Small Firm Results	Condition 1 n= 7	Condition 2 n= 4	t value	P
Mean	87.857	108.838		
Standard deviation	33.750	19.738		
t			1.279	
p				<0.245

Exhibit 4
Results of the Anchoring and Adjustment Experiment by Position
Senior

Overall Results	Condition 1 n=60	Condition 2 n=54	t value	P
Mean	58.450	63.981		
Standard deviation	132.420	60.551		
t			0.291	
p				<0.771

Large Firm Results	Condition 1 n=13	Condition 2 n=22	t value	P
Mean	32.077	59.773		
Standard deviation	56.684	55.666		
t			-1.406	
p				<0.173

Medium Firm Results	Condition 1 n=25	Condition 2 n=17	t value	P
Mean	42.240	81.471		
Standard deviation	45.363	79.565		
t			2.201	
p				<0.05

Small Firm Results	Condition 1 n=22	Condition 2 n=15	t value	P
Mean	92.182	50.333		
Standard deviation	207.728	37.391		
t			0.923	
p				<0.365

Exhibit 5
Results of the Anchoring and Adjustment Experiment by Position
Junior

Overall Results	Condition 1 n=46	Condition 2 n=44	t value	P
Mean	25.978	102.159		
Standard deviation	32.286	107.638		
t			-4.505	
p				<0.001

Large Firm Results	Condition 1 n=15	Condition 2 n=15	t value	P
Mean	19.285	98.867		
Standard deviation	98.867	102.563		
t			-2.979	
p				<0.002

Medium Firm Results	Condition 1 n=16	Condition 2 n=19	t value	P
Mean	26.481	89.263		
Standard deviation	38.732	116.186		
t			-2.222	
p				<0.037

Small Firm Results	Condition 1 n=15	Condition 2 n=10	t value	P
Mean	31.667	131.660		
Standard deviation	37.361	103.253		
t			-2.935	
p				<0.015

Exhibit 6
Frequency of Errors Made on Each Case

Representativeness

Case Number	1	3	5	Total Errors
N	367	367	367	1,101
Number of errors	150	77	178	405
Percent of total	40.9	21.0	48.5	36.8

Protectiveness

Case Number	2	4	Total Errors
N	367	367	734
Number of errors	116	105	221
Percent of total	31.6	28.6	30.5

Exhibit 7
Type and Frequency of Errors

	Type of Error: Representativeness	Protectiveness
Number of subjects making at least one error	211	138
Percent of total making at least one error	57.5	37.6

Number of errors

Total errors	0	1	2	3	4	5
Number of subjects	66	59	164	71	6	1
Percent of total subjects	18.0	16.1	44.7	19.3	1.6	0.3
Cumulative percent	18.0	34.1	78.8	98.1	99.7	100.0

Exhibit 8
Tabulated Errors by Firm Size

Representativeness

Group	0	1	2	3	Total
Large firm subjects	47	13	35	31	126
Medium firm subjects	56	23	29	23	131
Small firm subjects	53	32	23	2	110
Total	156	68	87	56	367

Chi square

p <0.001

Protectiveness

Group	0	1	2	Total
Large firm subjects	91	10	25	126
Medium firm subjects	77	13	41	131
Small firm subjects	61	14	35	110
Total	229	37	101	367

Chi square

p <0.075

Exhibit 9
Tabulated Frequency of Errors by Firm Size

Number of Errors Per Subject	0	1	2	3	4	5	Mean
Large firm subjects	20	13	61	30	2	0	1.849
Medium firm subjects	22	22	54	29	3	1	1.855
Small firm subjects	24	24	49	12	1	0	1.486

ANOVA
F 4.925
p <0.009

Tukey's HSD Probabilities

Firm Size/ Firm Size	Large	Medium	Small
Large	1.000		
Medium	0.999	1.000	
Small	0.018	0.015	1.000

Exhibit 10
Tabulated Errors by Position

Representativeness

Group	0	1	2	3	Total
Partners	42	15	15	4	76
Managers	33	7	28	15	83
Seniors	39	21	24	23	107
Juniors	42	25	20	14	101
Total	156	68	87	56	367

Chi square 23.820

p <0.006

Protectiveness

Group	0	1	2	Total
Partners	37	6	33	76
Managers	56	8	19	83
Seniors	75	11	21	107
Juniors	61	12	28	101
Total	229	37	101	367

Chi square 14.471

p <0.026

Representativeness and Protectiveness

4. How do the results of the current study on the use of the representativeness heuristic compare with the results reported by Uecker and Kinney?

5. Does firm size have an association with the use of the representativeness heuristic?

6. Does position in the firm have an association with the use of the representativeness heuristic?

The potential impacts of: firm size and position in the firm on the use of the representativeness heuristic were separately analyzed by using Chi^2 analysis.

RESULTS

Anchoring and Adjustments

The overall and stratified results of the anchoring and adjustment experiment are reported in Exhibit 1. The overall mean responses are Condition 1 -47.356 and Condition 2 - 60.209. The difference between the means was statistically significant ($p < .021$) and is consistent with the use of the anchoring and adjustment heuristic. That is, the starting point provided in the two conditions apparently affected the judgment of the subjects.

When the results are stratified according to the respondent's firm size, somewhat different results are obtains. The mean responses from large firms are: Condition 1 - 21,223, Condition 2 -53.194. The difference between these means is statistically significant ($p < .031$). The mean responses for the subjects from medium firms are: Condition 1 - 32.656, Condition 2 - 66.478. The difference between these means is statistically significant ($p < .001$). The mean responses from the subjects from small firms are Condition 1 - 66.661, Condition 2 - 91.224. This difference was not statistically significant ($p < .335$). The lack of significant t-values for small firms arises from large standard deviations.

Exhibits 2 - 5 contain the stratified anchoring and adjustment results by position in the firm. These results indicate that most of the overall result is explained by differences in the junior group responses, and that these differences were significant for all three firm size groups.

The results of the anchoring and adjustment experiment reported herein differ from the results reported by Joyce and Biddle [1981] (Condition 1 - 1652 and Condition 2 - 43.11). However, they provide further evidence that auditors employ the anchoring and adjustment heuristic which may lead to emphasizing the use of some cues over others and focusing attention on the cues that are furnished to the exclusion of other cues.[4]

Representativeness and Protectiveness

The tabulation of the frequency of errors made on each of the representativeness cases is presented in Exhibit 6. The frequency of errors varied from case to case. This finding, which indicates that the auditors considered both sample size and error rate in making their choices, is similar to the findings report by Uecker and Kinney [1977]. Only a minority of the auditors consistently employed either the representativeness or protectiveness heuristic. Of the 367 respondents, 77 consistently selected the sample with the lower error rate and 56 consistently selected the larger sample.

These findings are also consistent with Uecker and Kinney's [1977] suggestion that auditors use a model of information processing that requires some minimum sample size before choosing on the basis of sample error rate. This procedure is consistent with a lexicographic model of choice in which sample size is the dominant order attribute. In a lexicographic model of choice, preference between attributes is determined by the utility magnitude for the most important attribute [Tversky, 1972].

The type and frequency of errors is presented in Exhibit 7. Our results are consistent with those reported by Uecker and Kinney [U & K] [1977]. Exhibit 7 indicates that over 57 percent of the subjects made at least one error of representativeness as compared to 54 percent reported by U&K. Additionally, over 82 percent of the subjects responded incorrectly to at least one of the five cases, and over 65 percent responded incorrectly to at least two of the cases. U & K reported that 74 percent of their subjects responded incorrectly to one of the cases and 57 percent responded incorrectly to at least two of the five cases.

The stratified firm size results for representativeness and protectiveness are shown in Exhibit 8. These results are tabulated by the number of errors for each heuristic and tested for significance by using Chi^2 analysis. The results from Exhibit 8 indicate that the three groups differed significantly on the representativeness heuristic ($p<0.001$), and that the auditors from large and medium sized firms were more likely to make errors than those from the small firms. However, no significant between-group difference was found for the protectiveness heuristic.

The stratified representativeness and protectiveness results are further analyzed in Exhibit 9 by tabulating the frequency of errors for all cases.

Since analyzing these data by the Chi^2 technique was not possible because six of the cells had an expected value of less than 5, an average error rate per respondent was computed over the possible ratio scale values of 0 - 5 errors per subject. The mean error rates for the five cases are: large firm - 1,849, medium firm - 1,855, small firm - 1,486, indicating that the auditors from large and medium sized firms erred more frequently than the auditors from smaller firms. A one-way ANOVA indicated that the difference between means was significant ($p<0.009$). A subsequent examination of the data using Tukey's HSD indicated that the overall difference was attributed to differences between the small firms, and the large and medium sized firms. These results lend additional support to the theory that CAP firm size impacts on an auditor's use of cues and judgment.

The tabulated frequency of errors by position in the firm are contained in Exhibit 10. These results indicate that the four groups differed significantly on the representativeness heuristic ($p <0.006$) and protectiveness heuristic ($p <0.026$). However subsequent examination of the data indicated that no apparent pattern of between-group difference existed.

SUMMARY AND CONCLUSIONS

The primary purpose of this study was to ascertain if CPA firm size effects their auditors' probabilistic judgment, focusing on the areas of biases and heuristic. While several previous studies analyzed separately the impact of audit firm size and of biases and heuristic on the audit process, this is the first study to examine both items. Prior studies indicate that smaller firms tend to rely on individual judgment and an unstructured audit technology, with larger firms relying on differing levels of audit structure [Schroeder and Imdieke, 1977].

The results of the present study indicate that the individuals employed by smaller CPA firms tended to use heuristic and biases less frequently than did their counterparts from regional and national firms. This finding, however, did not vary by the position held across the three types of firms sampled. Thus, for example, while managers in local, regional and national firms used different cognitive, audit practices, their results were similar to staff employees of these same firms.

A possible explanation for the firm size results could be firm-wide staff selection, retention and promotion policies. That is, smaller firms might be attracting different types of individuals than their medium and large firm counterparts. Individual firm's audit technologies could also affect their employees' ability to use professional judgment. That is, regional and national firms tend to use more structured audit approaches, and a structured audit approach has been found to impact on the use of professional judgment [Schroeder, Reinstein and Schwartz, 1992]. Future research could examine these possibilities and further measure audit structures of various sized CPA firms-especially as audit technologies become more widespread.

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NOTES

1. Subject responses were examined for differences by geographic location and no significant differences were detected.

2. This technique has resulted in an almost 100% response rate in previous studies. The CPA firms contacted are generally cooperative, and requiring the questionnaires to be collected by a senior person in the firm virtually assures that they will be completed by the subjects. Additionally, allowing the questionnaires to be returned in a sealed envelope reduces the likelihood that the subjects' responses will biased because of a few that they will be reviewed by a member of their firm.

3. A total of 388 responses were received. Five respondents did not complete the anchoring and adjustment experiment and 21 did not complete the representativeness and protectiveness experiment. Since no reason to believe that the failure to complete one experiment by a subject affected the outcome of the other experiment existed, all completed responses to each experiment were used in the analysis.

4. This tendency was more prevalent in large and medium sized firms than in small firms.

APPENDIX
THE QUESTIONNAIRE

Anchoring and Adjustment

Form A

It is probably true that many cases of management fraud go undetected even when competent annual audits are performed. The reason, of course, is that generally accepted auditing standards are not designed specifically to detect executive-level fraud. Please give your own estimate of the prevalence of executive level fraud.

1. Based on your audit experience: Is the incidence of significant executive-level management fraud more than ten in each 1,000 clients? (e.g. one percent) audited by CPA firms. (Circle a or b).

   a. Yes, more than ten in each 1,000 clients have significant executive level management fraud.

   b. No, fewer than ten in each 1,000 clients have significant executive level management fraud.

2. What is your estimate of the number of audit clients per 1,000 that have significant executive level management fraud? (Fill in the blank below with the appropriate number.)

   ____in each 1,000 audit clients have significant executive-level management fraud.

Form B

Form B is identical to Form A, except that Question 1 of Form B says 200 (20 percent), instead of 10 (one percent) of 1,000 clients.

1. Based on your audit experience: Is the incidence of significant executive-level management fraud more than 20 in each 200 clients? (e.g. two percent) audited by CPA firms. (Circle a or b.)

   a. Yes, more than 20 in each 200 clients have significant executive level management fraud.

   b. No, fewer than 20 in each 200 clients have significant executive level management fraud.

2. What is your estimate of the number of audit clients per 200 that have significant executive level management fraud? (Fill in the blank below with the appropriate number.)

____in each 200 audit clients have significant executive-level management fraud.

Representativeness and Protectiveness

Assume that you are working on the audit of a small company and examining purchase invoices for the presence of a "received" stamp. The omission of the stamp is thus an error. The population is composed of approximately 4,000 invoices which were processed by the client during the current year.

You decide that an error rate in the population as high as five percent would not require any extended audit procedures. However, if the population error rate is greater than five percent you would want to extend the audit.

In each case below, circle the letter of the sample (A or B) which, in your judgment, provides better evidence that the error rate in the population is five percent or less. (Assume that each sample observation is selected at random.)

Case	Sample	Number of invoices examined	Number of errors found in sample	Percentage of invoices in error
1.	A	75	1	1.3
	B*	200	4	2.0
2.	A*	100	1	1.0
	B	125	3	2.4
3.	A*	150	2	1.3
	B	25	0	0.0
4.	A	225	7	3.1
	B*	200	4	2.0
5.	A*	250	6	2.4
	B	100	2	2.0

Note: Cases 1, 3, and 5 test for the representativeness heuristic; cases 2 and 4 test for the protectiveness heuristic.

*Correct response

FOOTNOTES

[1]Subject responses were examined for differences by geographic location and no significant differences were detected.

[2]This technique has resulted in an almost 100% response rate in previous studies. The CPA firms contacted are generally cooperative, and requiring the questionnaires to be collected by a senior person in the firm virtually assures that they will be completed by the subjects. Additionally, allowing the questionnaires to be returned in a sealed envelope reduces the likelihood that the subjects' responses will be biased because of a few that they will be reviewed by a member of their firm.

[3]A total of 388 responses were received. Five respondents did not complete the anchoring and adjustment experiment and 21 did not complete the representativeness and protectiveness experiment. Since no reason to believe that the failure to complete one experiment by a subject affected the outcome of the other experiment existed, all completed responses to each experiment were used in the analysis.

[4]This tendency was more prevalent in large and medium sized firms than in small firms.

CHANGING ECONOMIC STRUCTURE OF THE SOUTHWEST

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INTRODUCTION

From 1969 to 1989, the real GNP of the United States grew at an annual average rate of 2.8 percent. By comparison, the real GSP of the Southwest[1] increased at a faster rate of 3.2 percent. The breakdown of the period shows that the economy of the region enjoyed substantial growth in the 1970s. Between 1969-1979 the real GSP of the Southwest grew at 4.5 percent per year compared with a 2.45 percent growth for the nation as a whole. In the 1980s the economy of the Southwest grew at only 1.95 percent per year compared with a 3.2 percent growth of the real GNP. The sluggish growth of the region in the 1980s was because of the collapse of the energy sector which adversely affected oil producing states in the region.

Examination of the growth rates of the major sectors reveals that except for mining, the percentage increase in output was considerably larger in the southwest than in the nation (see chart 1). The sector that showed the highest percentage increase in the region was service (5.4 percent) followed by manufacturing at 4.97 percent. While the service sector also ranked first in the nation as the fastest growing sector (4.22 percent), the average growth rate of manufacturing in the nation was only 2.95 percent.

With the fluctuation of the energy sector identified as the primary cause of the Southwest region's economic instability, the region's oil producing states underwent significant structural changes. Table 1 provides changes in the industrial structure of the U.S. and the Southwest. There are two important elements of change in the region's economy from 1969-1989. One is the decline in importance of mining in the total output of the region. The share of mining in the total output dropped from 25.13 percent in 1969 to 12.48 percent in 1989. The second element is the increasing importance of manufacturing for the region's output growth and industrial structure. In 1969, the manufacturing sector contributed 13.5 percent of the region's total output, but by 1989, the share of manufacturing sector in the region's output increased to 18.56 percent, and was larger than the share of any other sector. Other sectors that exhibited significant increases were transportation and public utilities, trade, finance, insurance and real estate, and services.

Understanding these long term economic trends and the relationship between the states and the national economy is important not only for making effective state policy, but also to attract prospective industries into the region.

This paper addresses output trends in the Southwest using dynamic shift share analysis. The Sukar, Bhattacharya, and AlDiab (1994) model used for this study followed Marquillas (1972) in reformulation of the classical shift share model. In order to capture continuous structural changes, the model used the dynamic shift share version similar to Barff-Knight (1988). Section II briefly describes the shift share technique. In section III, the results of the shift share analysis of the major economic sectors and 20 two-digit SIC manufacturing subsectors are discussed. Section IV presents the summary and conclusion.

METHODOLOGY

This study uses the dynamic shift share model of Sukar, Bhattacharya, and AlDiab (1994) in reformulating the classical shift share model which has the following limitations: (1) it does not take into account the changes between the base year and the terminal year, (2) the industrial mix effect and competitive effect are interwoven, and (3) it is a simple accounting procedure that lacks theoretical underpinnings. The Sukar et. al. dynamic shift share model accounts for year to year changes; the interwoven effect is avoided by redefining the competitive effect and creating a new shift share component, the allocative effect; and regression analysis is used to explain the factors responsible for the competitive effect. The revised version of the dynamic shift share model is of the form:

CHART 1
AVERAGE ANNUAL PERCENTAGE CHANGE IN OUTPUT 1969-1989: SOUTHWEST AND THE UNITED STATES

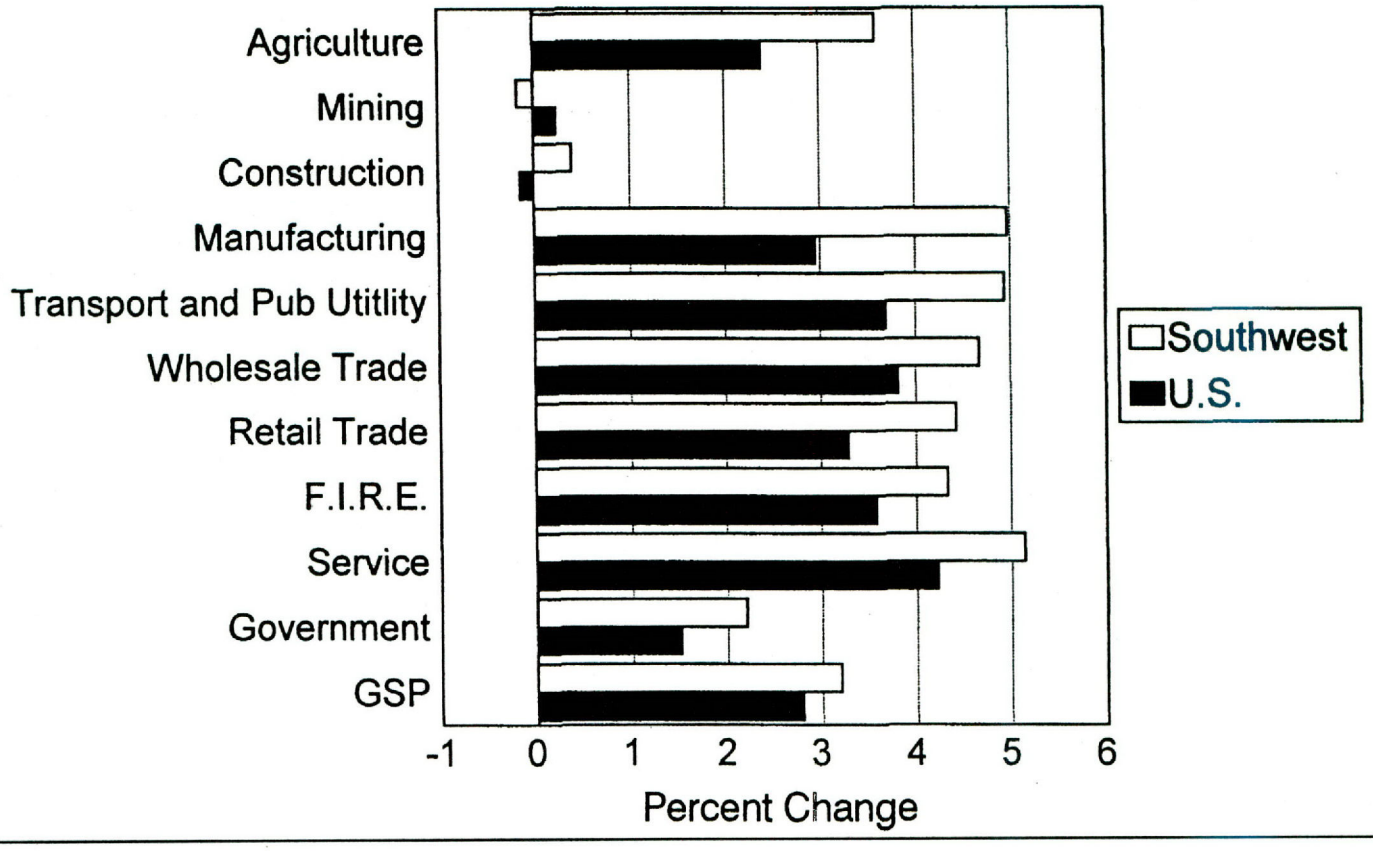

TABLE 1. Contribution to Gross Product by Sector
Southwest and United States 1969-1989

Sector	1969				1989			
	Southwest		USA		Southwest		USA	
	Percent of Total	Rank	Percent of Total	Rank	Percent of Total	Rank	Percent of Total	Rank
Agriculture	2.44	10	2.72	10	2.43	10	2.43	10
Mining	25.12	1	5.38	9	12.48	3	3.08	9
Construction	7.01	7	7.66	7	3.87	9	4.34	8
Manufacturing	13.50	2	22.40	1	18.57	1	22.50	1
Transportation and Utilities	8.00	6	8.36	6	11.14	5	9.74	6
Wholesale Trade	5.15	9	6.22	8	6.57	8	7.38	7
Retail Trade	7.48	7	8.88	5	9.37	7	9.98	5
F.I.R.E.	9.70	4	13.11	3	11.88	4	14.63	3
Services	9.3	5	12.02	4	13.57	2	15.80	2
Governmment	12.22	3	13.24	2	10.11	6	10.14	4
Total	100		100		100		100	

$$V_{ij}=N_{ij}+K_{ij}+C_{ij}+a_{ij} \quad (1)$$

where:

$$N_{ij}=E_{ij-1}g_n \quad (2)$$

$$K_{ij}=E_{ij-1}(g_{in}-g_n) \quad (3)$$

$$Cij=E^*_{ij}(g_{ij}-g_{in}) \quad (4)$$

$$a_{ij}=(E_{ij-1}-E^*_{ij})\ (g_{ij}-g_{in}) \quad (5)$$

$$E^*_{ij}=Ej\frac{E_{in}}{E_n} \quad (6)$$

V_{ij} = total effect or total growth in output
N_{ij} = national effect on industry i region j
E_{ij} = income in industry 1 region j during the base period

g_n = growth of national income

K_{ij} = industrial mix effect on industry i region j

g_{ij} = growth rate of industry i in the national

C_{ij} = competitive effect

E^*_{ij} = E_j (E_{in}/E_n) is the homothetic output, which is the level of output industry i region j would have if the region and the national had the same proposition of their output in the industry.

g_{ij} = growth rate of industry i in region j

a_{ij} = allocation effect

E_{in} = national output of industry i

E_n = national output

The national effect (N_{ij}) represents the growth or decline of industry due to the national economic performance. The industrial mix effect (K_{ij}) represents the effect of specialization of output in sectors where the rate of growth at the national level is fast or slow, and the competitive effect (C_{ij}) measures the contribution due to the competitive edge of a region j in that particular industry and the allocative effect (a_{ij}) measures whether the region specializes in a sector where it has a competitive advantage. The total effect or total output growth (V_{ij}) is given by the sum of the four components.

The allocative effect together with the competitive effect tell whether the region specialized in those industries in which it had a competitive advantage or disadvantage (Herzog and Olson, 1977). A region specializes in a sector where it has a competitive advantage if (E_{ij-1} - E^*_{ij}) <0 and ($h_{ij}g_{in}$)>0. It does not specialize in a sector where it has a competitive disadvantage if (E_{ij}-E^*_{ij}) <0 and ($g_{ij}g_{in}$)<0. Finally a region specializes where it has a competitive disadvantage if (E_{ij}-E^*_{ij}) >0 and ($g_{ij}g_{in}$)<0.

EMPIRICAL RESULTS

Table 2 presents the shift share analysis for the Southwest GSP for 1969-1989 period. Data for the study was obtained from the Bureau of Economic Analysis annual estimates of real GSP for the U.S. and the Southwestern states. During this period, the output gain of the Southwest was $191.3 billion dollars. This change in output was associated with the national growth and competitive forces in the region. The industrial mix and the allocative effects were both negative in the period under review.

The shift share analysis of the major industrial sectors indicates that all sectors recorded positive national effects. In terms of industrial mix effect, four sectors, agriculture, mining, construction and government, recorded negative effects. In particular, the mining sector experienced the largest decline in industrial mix effect. The shrinking of the Southwest mining sector during the 1980s is blamed on the slump in the oil and gas sectors. Among the sectors that showed the highest positive industrial mix effect in the Southwest were services, followed by transportation and public utility, and finance, insurance and real estate.

The competitive effect shows whether the subsector in the region is growing at a faster rate than the industry rate for the nation. By conducting shift share analysis it is possible to ascertain where the Southwest competitive advantages are stronger. Except in mining, all sectors of the Southwestern states recorded positive competitive effects. The largest increase in competitive effect was in the manufacturing sector ($25.7 billion) followed by the transportation and public utilities ($7.2 billion) and services ($5.9 billion) sectors.

In view of the remarkable competitive effect of the manufacturing sector, the dynamic shift share analysis was applied to the 20 two-digit SIC subsectors of manufacturing. The results of the analysis are presented in Table 3. As expected, the national effects of all 20 subsectors were positive. In terms of the industry mix, seven of the manufacturing subsectors showed positive changes. The largest positive

TABLE 2. SHIFT SHARE ANALYSIS OF MAJOR ECONOMIC SECTORS IN THE SOUTHWEST, 1969-1989
(Millions of Dollars)

Sector	National	Industry Mix	Competitive	Allocation	Total Change
Agriculture	4354.15	-1139.44	2086.49	-666.20	4635
Mining	32814.1	-33406.90	-945.106	-2363.11	-3901
Construction	10644.98	-9876.86	162.47	-431.59	499
Manufacturing	28056.81	1703.38	25684.46	-8791.66	46653
TPU	17203.44	4062.45	7216.90	-279.79	28203
Wholesale	11313.83	3505.83	1381.75	-496.40	15705
Retail Trade	15925.65	3314.57	3730.56	-913.79	22057
F.I.R.E	22573.59	3899.53	5343.28	-4274.4	27542
Service	21125.02	9729.49	5939.03	-1544.54	35249
Government	19435.27	-9836.37	6072.14	-965.04	14706
Total	183446.84	-28044.32	56671.97	-20726.52	191347.97

TABLE 3. SHIFT SHARE OF MANUFACTURING SUBSECTORS IN THE SOUTHWEST, 1969-1989
(Millions of Dollars)

Sector	National	Industry Mix	Competitive	Allocation	Total
Fab.Metal Prdct.	1919.39	-678.01	2178.59	-966.95	2453
Mach. Exc. Elec.	4244.21	5920.89	3689.42	-1755.51	12099
Elec./Eltrnc.Equip	2239.17	2010.52	4977.88	-2478.58	6749
Durable Goods	15053.12	2003.69	20575.04	-8696.85	28935
Lmbr./Wood Prdct.	690.64	128.58	317.23	-285.45	851
Furntr./Fixtures	240.11	-48.76	-8.42	0.069	183
Stn./Clay./Glass	1182.02	-687.98	1020.72	-249.76	1265
Prim.Metal Prdct.	1262.06	-2649.7	4002.92	-2023.28	592
Paper/Allied Prdct.	540.26	-83.13	821.92	-563.05	716
Printing/Publishing	1200.63	-399.23	1077.85	-580.25	1299
Chem./Allied Prdct.	3322.46	1372.98	153.07	43.49	4892
Petroleum/Coal Pro.	4262.19	1739.87	-255.134	-368.93	5378
Food/kindered Prdct	2075.37	-361.93	1817.09	-768.52	2762
Textile Mill Prdct.	90.29	-29.25	-121.18	109.13	49
Apprl./Other Text.	659.03	-161.24	572.79	-296.58	774
Motor Vhcls./Equip	516.23	-315.49	3893.54	-3250.29	844
Transp. Equip.ExclV	1880.92	39.64	0.136	-74.70	1846
Instr./Rel. Prdct	499.77	20.48	1309.83	-787.08	1043
Misc. Manuf. indust	379.11	-18.09	1389.81	-736.82	1014
Non Durable Goods	13003.43	-902.37	7410.58	-1794.63	17717
Rubr./Misc. Plstcp	770.69	390.84	1150.76	-546.28	1766
Lthr./Lthr. Prdct.	80.92	-153.91	554.53	-400.54	81
TOTAL	28056.55	1101.32	27985.62	-10491.48	46652

changes were observed in sectors such as machinery, excluding electrical, chemical, and petroleum.

The results of the shift share analysis for the manufacturing subsectors of the Southwest indicated that all subsectors except furniture and fixtures, and petroleum and textile mill products posted positive competitive effects the manufacturing subsectors that showed the highest competitive advantage were fabricated mill products, machinery excluding electrical, electrical and electronic equipment, primary metal industries, and motor vehicle equipment.

The allocation effect was used with the competitive effect to detect whether specialization in industries with competitive advantage was taking place. The fact that the allocative effect for most of the manufacturing subsectors was negative meant that the region was not specializing in sectors where it had a competitive advantage.

This study also examines the shift share analysis for major sectors and 20 two-digit manufacturing subsectors of the individual Southwestern states. Table 4 provides the shift share analysis of manufacturing and non-manufacturing sectors of the Southwestern states.

In the non-manufacturing sector all four Southwestern states recorded positive national effects. The industrial mix effect was negative for all the states. The major contributing factor for this was that the mining sector experienced a severe adverse industrial mix effect. Among the Southwestern states, Texas had the largest negative industrial mix effect ($22.2 billion) followed by Oklahoma ($4.6 billion) and New Mexico ($2.0 billion). Other non-manufacturing sectors that showed negative industrial mix effects in all the states were agriculture, construction and government. The industrial mix effect of transportation and public utilities, trade, finance, insurance and real estate, and service were positive for all the Southwestern states.

Shift share analysis for individual states also indicated that Oklahoma had a competitive advantage in agriculture, but the negative allocative effect for this sector would mean that the state was not specializing. New Mexico had a competitive advantage in all nonmanufacturing sectors except the service sector. Arizona had a competitive advantage in all non-manufacturing sectors but no specialization was detected in transportation and public utilities, F.I.R.E., and wholesale trade. Texas had a competitive advantage in all non-manufacturing sectors except construction. As in the other Southwestern states, Texas was also not utilizing its competitive advantage.

In the manufacturing sector, the national effect and the industrial mix effect were positive for all the Southwestern states. The magnitude of the competitive effect also showed that manufacturing was where all the states had a high competitive advantage. In addition, all the Southwestern states enjoyed more competitive advantage in durable goods industries than in non durable goods. Yet, in all cases, the allocative effect was negative and the states were not utilizing their competitive advantage.

Table 4. Shift Share Analysis of Output in the Southwestern United States

	NG	IG	CE	AE	Total
Manufacturing					
Oklahoma	3217.18	172.00	2231.01	-1147.19	4473
Texas	21660.27	1303.84	16620.37	-4743.49	34841
New Mexico	557.88	48.45	2925.21	-2285.54	1246
Arizona	2621.49	179.08	5373.44	-2081.01	6093
Non-Manuf					
Oklahoma	20072.38	-4557.61	-3740.48	-3570.3	8203.99
Texas	109538.3	-22213.3	22975.4	-7910.3	102390
New Mexico	8099.82	-1963.97	1303.45	-873.31	6566
Arizona	16100.06	-233.11	10734.26	31.79	26633

SUMMARY AND CONCLUSION

The economies of the Southwestern states underwent significant structural changes in the past two decades. The two sectors that experienced major changes were mining and manufacturing. The share of mining in the total output of the region dropped from 25 percent in 1969 to 12 percent in 1989. Still, the mining sector remained relatively more important in the region than in the nation.

Using the shift share model, the change in total output was decomposed into various components. The model used was the Sukar, Bhattacharya and AlDiab (1994) model, which followed Esteban Marquillas (1972) in modifying the shift share version similar to Barff and Knight (1988) to account for year to year changes. The results of the analysis indicate that the Southwestern region had a positive competitive effect in all major sectors except mining. The largest competitive advantage was shown in the manufacturing sector.

Similar analyses were made for 20 two-digit SIC classifications of the manufacturing sector. The results show that the region has more competitive advantage in the durable goods subsector. However, the allocative effects for most of these subsectors were negative implying that the region was not specializing in sectors where it had a competitive advantage.

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END NOTES

[1]According to the U.S. Department of Commerce Classification, the Southwest economic region consists of the states of Texas, Oklahoma, New Mexico and Arizona.

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   - iii. First page should begin with an abstract not exceeding 100 words
   - iv. Tables, figures, and references should be on separate sheets for typesetting purposes. Tables and figures should be used only when they contribute significantly to an understanding of the text. References are to be listed numerically at the end of the article, corresponding to the superscript numbers within the body of the manuscript.

2. A cover letter should be used and include the following information:
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   - ii. DOS or ASCII text files

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