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HOW PAKISTANI INDUSTRIES RESPOND TO LOCAL AND WORLD BUSINESS CYCLES

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ABSTRACT

This study aims to investigate the impact of local and global business cycles on different sectors of Pakistani industry, using annual time series data of sales and profits on ten major nonfinancial industries over the period 1976–2017. The sensitivity of Pakistani industry to local and and global business cycles remains largely unaddressed. This paper has estimated the exposure of each industry with respect to local and global GDP using the seemingly unrelated regression (SUR) estimator. The results indicate that the industrial sector in Pakistan is largely nondiversified and is vulnerable to local and global recession. The cement, chemicals, engineering, fuel and energy, and transport and communication sectors are found to be procyclic with respect to local GDP growth, while the cement, chemicals, fuel and energy, paper and board, sugar, textiles, and transport and communication industries are found to be noncyclic with respect to global GDP growth. From our analysis of the financial sector, it is found that exchange companies, investment banks, and mutual funds provide a safe haven from the risk of global recession for business and investors, since these industries are countercyclic to global business cycles.

Contribution/Originality: This study contributes to the existing literature in the sense that, to the best of our knowledge, no previous study has investigated the impact of global business cycles on local industries in Pakistan. It explores the understanding of potential interactions between local and global business cycles and the various industrial sectors of that country.

1. INTRODUCTION

Industries involving the production of durable goods are generally considered to be negatively affected more by business cycles than those producing nondurable goods, since it is easier to delay purchase of the former during recession; consumers can readily cut discretionary expenditure on durable goods. During recessionary periods a company's management faces the difficult decisions of cutting nonessential expenditure and laying off staff. Investment in the cyclic firm having high beta is exposed to nondiversifiable risk, and investors demand extra premium for holding the stock of such firms. Revenue forecast can be obtained based on the estimated exposure of industries to both local and global business cycles. Such information on business cycle sensitivities also helps to formulate business agglomerations in diversification of business cycle risk. Knowledge of business cycle responsiveness also helps future graduates in their career choice. Therefore, assessment of whether firms and industries are cyclic or otherwise is important for business managers, investors, policymakers, and the general

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public. Knowledge of the global business cycle sensitivities of industries is also important for the balance of payments, employment, and quality of life of the countries involved. Gauging the extent to which local industries are affected by both local and global business cycles is therefore an important empirical task. In today's age of globalization, exporting and importing industries alike are potentially affected by global business conditions. Little attention has been paid to the impact of global shocks on different sectors of Pakistani industry. This study intends to bridge this gap by analyzing the sensitivity of various industrial sectors in Pakistan to global and local shocks originating due to Real Business Cycles (RBCs). In addition, very few firms can be classified as purely domestic due to the greater integration of the economies of both developing and developed countries. Reviewing the literature, Lien (2010) notes that estimation of business cycle sensitivities had not been a primary objective in the relevant literature. However, owing to the theoretical and practical importance of this topic, serious study is warranted. Literature on emerging markets is scarce regarding local business cycle exposure for industry. To our knowledge, no study has yet investigated the extent to which industries in developing countries are exposed to both local and global business cycles. In this paper, we estimate the exposure/sensitivity of sales and profitability of major industries in Pakistan to local and global business cycle conditions, measured by respective GDP growth rates.

The industrial sector is the main driver of Pakistan's exports and employs a labor force of around 11.5 million (CIA World Fact Book, 2017). Cotton-based textile and garment industries account for about 66% of Pakistan's export revenue. Pakistan's industrial output and profitability have experienced ups and down throughout history owing to various local and global economic shocks.

Using annual time series data of sales and profits on ten major nonfinancial industries over the period 1976–2017, this paper has estimated the output exposure of each industry with respect to local GDP growth and global GDP using the seemingly unrelated regression (SUR) estimator. The results indicate that some industries in Pakistan, including cement, chemicals, engineering, fuel and energy, and transport and communication, are seen as procyclic with respect to local business cycles and hence are vulnerable to business risk originating from local economic downturn. On the other hand, the cement, chemicals, fuel and energy, paper and board, sugar, textiles, and transport and communication industries are found to be noncyclic with respect to global GDP growth. From analysis of the financial sector, it is found that exchange companies, investment banks, and mutual funds provide a safe haven against global recession risk for business and investors, since these industries are countercyclic to the global business cycle.

The industrial sector is of great importance for the economic development of any country. A well-functioning and efficient industrial sector is a major source of employment. Economic development in an economy has historically been gauged by the extent of shift from agriculture to industry. Prime examples of this include South East Asian economies, which have witnessed impressive levels of economic development due to their greater emphasis on a strong and productive industrial sector. Pakistan's industrial sector is a major contributor to employment and aggregate output: in 2009 the industrial sector contributed 20.3% of GDP in Pakistan. According to data produced by the CIA World Fact Book (2017), Pakistan's labor force numbered around 57.2 million, of which 20% were employed in the manufacturing sector. Pakistan's major industries included cement, fertilizer, sugar, paper and board, fuel and energy, tobacco, chemicals, engineering, food, and textile and apparel manufacturing. The industrial sector in Pakistan is, however, very concentrated: for example, around 66% of Pakistan's export revenue comes from cotton-based textile products and garment manufacturing industries.

Many studies have investigated integration of the local and global economy using aggregate economic output. However, an economy comprising several constituent sectors of manufacturing industries is also very important. Very few studies have examined the impact of global business conditions on disaggregated industry. Our research aimed to fill this gap for the developing country, namely Pakistan. We hope this study will provide a basis for further research in this direction, and also for case studies in other developing and developed countries.

Berman and Pfleeger (1997) define an industry as either cyclic or procyclic if its output increases over a boom period and decreases during a recession. Countercyclic industries are the opposite, flourishing during recessions. Those industries that are not affected by business cycles are termed noncyclic. Figure 1 shows the historical pattern of GDP growth (right) and the growth of a particular procyclic industry (i.e., the engineering industry) (left) for Pakistan.
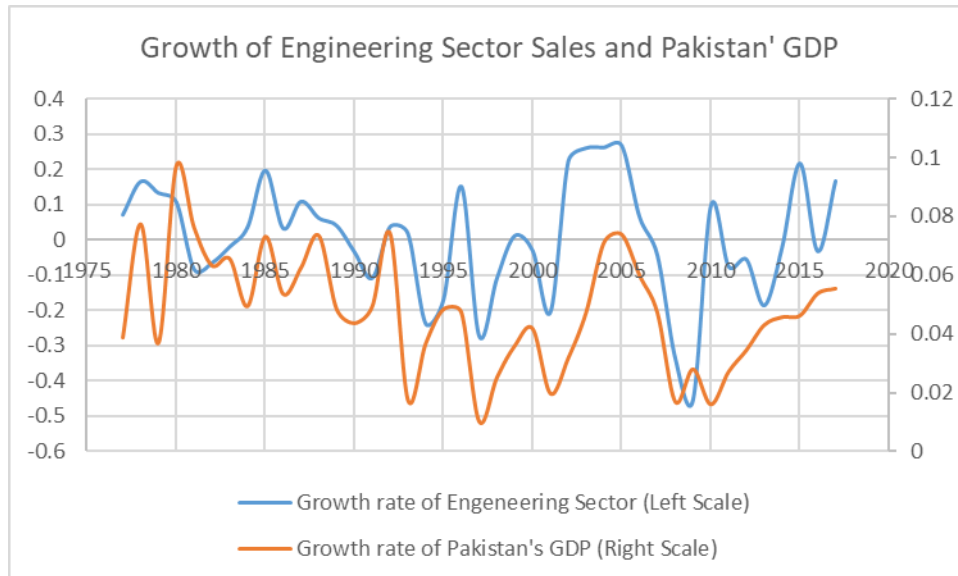

Figure 1. Historical pattern of growth rates of Pakistan's engineering sector sales and Pakistan's real GDP growth.

Peterson and Strongin (1996) and Knudsen (2019) provide several explanations for the variation in business cycle sensitivity of durable and nondurable goods. First, there are differences in the intertemporal substitutability of demand for durable and nondurable goods. Second, durable goods are investment goods that are highly cyclical (e.g., due to the presence of financial constraints and internal finance being procyclical over the business cycle). Third, small changes in customers' desired stock of durable goods lead to large percentage changes in the demand for such products. Fourth, investments in durable goods involve some irreversibility so the value of the delay option increases during recession, which magnifies the negative drop in demand for such products.

In this paper we consider ten major industries in Pakistan, namely cement, chemicals, food, engineering, fuel and energy, paper and board, sugar, textiles, tobacco, and transport and communication. Following this introduction, section 2 gives a brief review of the literature. Section 3 discusses the data sources and their descriptive statistics while section 4 describes the methodology and results for the nonfinancial sector. Section 5 provides an analysis of the financial sector and section 6 concludes.

2. LITERATURE REVIEW

This section reviews published work related to the issue under study in this paper. The issue of estimating the sensitivity of industrial output, employment, and pricing behavior to business cycle fluctuations has been investigated in several studies.

A US study by Berman & Pfleeger (1997) investigated the sensitivity of US industries to business cycle fluctuations over the period 1977–2005, using industrial employment and final demand as the main variables representing the industry. The relations between the business cycle and industrial output were measured by finding the correlation between these variables. They concluded that both employment and final demand are highly correlated with business cycles in industries such as household furniture, motor vehicles and equipment, retail trade, and carpets and rugs. Neither employment nor final demand is highly correlated with business cycles in industries

such as drugs, educational services, insurance carriers, and food. While employment is highly correlated with the business cycle, the final demand is not in industries such as pluming and nonelectric heating equipment; stone, clay, and miscellaneous mineral products; millwork, plywood, and structural members; screw machine products, bolts, and rivets; and iron and steel foundries.

Noh & Baek (2020) in a recent study probed the RBC theory with financial frictions for a small open economy by estimating an RBC model using data from Argentine. They evaluated the likelihood of the nonlinear model using the Gaussian mixture filter (GMF). From the results of quadratic approximation, they estimated that the quadratic RBC model in the presence of financial frictions is appropriate for identification of the parameters of the nonstationary productivity shock process. The authors found that the quadratic model accounted for Argentinian economic fluctuation by assigning a dominant role to nonstationary productivity shocks. They concluded that the observed data favor the quadratic benchmark RBC and financial frictions models over linear models. Furthermore, risk factors were found to play an important role in capturing economic downturn and the countercyclical trade balance.

In an IMF working paper, Lee (2019) explored the channels of external shock transmission in Korean industry, focusing on the significance of vertical integration and trade linkages using industry-level international input–output data. His results indicate that external country shocks are transmitted to Korean industry primarily through Korean export linkages, while domestic shocks have larger downstream effects than upstream. His findings indicate that external/domestic shocks in some key industries are transmitted through vertical and trade linkages that might cause fluctuations in the overall economy.

Andrea, Galeotti, & Manera (2017) studied the impact of oil supply shocks on the output growth of selected Mediterranean countries. They used the growth of real gross value added as a proxy for economic activity and estimated the effects of oil supply shocks on the whole economy, as well as for specific industries. They showed that the response of real gross value-added growth is a statistically significantly negative for energy importers. This result holds for both aggregate economies and selected industries. The study further found that the impact of oil supply shocks is positively related with the extent of energy dependence in the Mediterranean countries of the European Union.

Iqbal & Baig (2017) investigated the impact of external shocks of each G7 country and China on various macroeconomic variables of Pakistan, including manufacturing sector growth. They used a canonical correlation method on monthly data form January 1970 to April 2016 to estimate the impact of shocks from G7 and China on Pakistan in the short run. They found that the Pakistani economy was connected with different countries through widely varying channels. Industrial production growth had linkage with the USA and Japan only. A shock from other countries had no significant effect on Pakistani industry.

In another US study, Peterson & Strongin (1996) investigated why some US industries were more cyclical than others. Using data on 296 manufacturing industries defined at the four-digit SIC code level over the period 1958–1986, they examined the relationship between an industry's cyclicality and demand, supply, and market structure characteristics. They concluded that durable goods industries are on average three times more cyclical than nondurable goods industries and, within the former, the proportions of variable and quasi-fixed factors, market concentration, and labor hoarding appear to be important determinants of this cyclical behavior.

The focus of Hornstein (2000) was on how the comovement of various US industries had contributed to the aggregate business cycle over the period 1950–1991. Using the sensitivity of industry employment to aggregate employment and interindustry pairwise correlations as two different measures of industry comovement, he found that correlation of individual industries with aggregate employment was positive and strong for all industries. Similarly, he found that positive pairwise cross-industry correlations are also much more frequently observed than negative correlations. His main conclusion was that comovement of individual industries contributes to the aggregate business cycle. In particular, monetary policy was found to be the main source of business cycles.

A similar study was conducted in the USA by Shea (2002), who argued that short-run interindustry comovement may be due to either common shocks or complementarities that propagate shocks across sectors. He examined the pattern of comovement among 126 disaggregated US manufacturing industries using annual data from 1958 to 1986. His main finding was that industries that cluster together in space also tend to comove together through time, and that the comovement associated with correspondence accounts for a large fraction of aggregate volatility.

Stockman (1988) investigated the sources of disturbances to fluctuations in the growth rate of industrial production in seven European countries and the USA over the period 1964–1984. His main aim was to determine the proportions of variation in output growth that could be attributed to industry- and nation-specific shocks. For measurement of the former, he estimated the adjusted annual national effects of individual European countries relative to the USA and then computed the correlation of each these effects with the others. For measurement of industry-specific shocks, he computed the correlation between the growth rate of the aggregate industrial production index and adjusted national effects. He concluded that a substantial proportion of changes in national aggregate industrial production growth rates could be attributed to industry-specific disturbances that are common across nations, while a substantial proportion of changes in national output could also be attributed to nation-specific disturbances that are common in industry.

Among non-US evidence is a recent study by Konovalova & Maksimov (2017), who conducted an analysis of Russian industry over the period 2003–2013, and of Canadian industry over the period 1981–1997. Their objective was to assess how durable and nondurable goods industries react to business cycles. They found that in Canada, both types of industry were equally sensitive to business cycles while in Russia the average estimated value of the degree of cyclicality was higher for durable goods industries than for nondurable. They found that the asymmetrical reaction to expansion and recession tendencies in the economy was common to both countries.

Wang (2010) conducted an analysis of the business cycle features of UK GDP sectors with regard to trends, cycles, and growth over the period 1955–2002. He examined the behavior of UK GDP sectors through decomposing the series data into trend and cycle components according to the method of Kalman (1960). He found that the service sector was least subject to business cycles. The largest impact of shocks on growth was found in the manufacturing sector, which is more technology intensive and sensitive than other sectors. Next in size were the sectors electricity, gas, and water supply, transport, storage and communication, distribution, hotel, catering, and repairs.

Machin & Reenen (1993) conducted an analysis of UK companies on how aggregate demand shocks shape firm-level profitability. They estimated models of profitability using firm-level panel data from 709 UK manufacturing firms between 1972 and 1986. They found that firm-level profit margins are determined by both firm-specific factors (market share, margins from previous periods) and industry-level characteristics (in particular, concentration), and concluded that firm-level profit margins are strongly procyclical, dipping considerably in the 1980–1981 recessionary period.

For a particular industry (i.e., the tourism industry). Wong (1997) conducted an analysis of international tourist arrivals in Hong Kong over the period 1975–1995. He argued that, despite the turbulence associated with worldwide recessions, tourism continues to play an important role in generating significant foreign earnings. He used a linear model containing a sine function to capture both boom and recessionary periods of the business cycle. He concluded that, during the growth phase of the cycle, there was higher demand for travel while in the recessionary phase there was a drastic downward effect on travel expenditure.

Lien (2010) surveyed existing knowledge about how and why industries differ with respect to the impact of recessions and credit crunches. He aimed to map the causes of the crises and the subsequent real economic downturn, and to identify and analyze the consequences for restriction of needs and ability, as well as those for long-term economic growth, in Norway and other Western countries. The study concluded that there are numerous

factors involved in why industries differ with respect to the impact of recessions and credit crunches, among which are demand for durable and nondurable goods, competition from low-cost substitutes, high growth late in a boom, ripple effects, proportions of fixed and variable costs, labor hoarding, product differentiation, external vs. internal finance, and productivity consequences (short- and long-run effects).

Braun & Larrain (2005) argued that industries which are more dependent on external finance are hit harder during recession. In particular, they claimed that higher-dependency industries located in countries with poor financial contractibility and whose assets are softer or less protective of financiers are more strongly affected in recession. They tested their claim with a dataset consisting of yearly production observations of 28 manufacturing industries in over 100 countries from 1963 to 1999. To test the effects of recession and external finance dependence on industrial growth, they calculated a linear regression model with the annual growth rate of each industry in each country as the dependent variable while recession, external finance dependence, and size(t - 1) (the share of a country's total manufacturing value added corresponding to that in the previous year) as independent variables. They concluded that industries more heavily reliant on soft assets are hit harder during recession.

Cecchetti & Kashyap (1996) argued that in some countries production virtually shuts down over one summer month, alongside differences in the timing of aggregate cyclical fluctuations. They analyzed data from 11 industries in 19 OECD countries over the period 1975–1994 and calculated the correlation of each country's seasonality with total OECD data. They found that the wide volatility in production was accounted for by seasonal shifts, but that these were not very highly correlated across countries.

Chand & Sen (1998) conducted an analysis of Indian industries over the period 1973–1988 on how international trade effects domestic markup. They defined the relationship between trade exposure and domestic market power in two ways: first, they developed a simple methodology to test the effects of price and quantity competition from abroad on domestic pricing via a simple markup technology. Second, they defined the effects of trade liberalization on the domestic market power of firms in Indian manufacturing using panel data from 30 industries over the period 1973–1988. They concluded that exposure to increased trade within Indian manufacturing over that period had a procompetitive effect on domestic pricing.

Esposito and Esposito (1971) conducted an analysis of 76 Internal Revenue Service (IRS) industries over the period 1958–1965 on how foreign competition influences the profitability of domestic industries. They claimed that the status of potential competition has a significant influence on the pricing behavior of firms and thus concluded that foreign competition, represented by the level of imports, exerts a significant and negative effect on industry profit rates while less restrictive trade policies encourage more competitive pricing behavior in domestic industry.

Marchetti (1999) investigated the markup of price over marginal cost in Italian manufacturing locations over the period 1977–1995. The model he used for the investigation was proposed by Hall (1988), with several extensions and modifications. He concluded that the relationship between markup and business cycles varies significantly across sectors and, accordingly, found no evidence of a clearcut relationship between markup and economic fluctuations for the manufacturing sector as a whole.

Roura & Abarca (2001) conducted an analysis on the fluctuations in the Spanish economy over the period 1970–1998 and compared these to tendencies observed in the USA and some European countries. The focal point of the comparison was the behavior of the service sector and its possible contribution to stabilization of business cycles. To measure the magnitude of fluctuations and their levels compared to global business cycles, the authors calculated both volatility and relative volatility, finding that the main stylized facts of the Spanish economy match the empirical evidence of the literature on business cycles.

3. DATA SOURCES AND THEIR DESCRIPTIVE STATISTICS

Presented below are annual time series data on dependent variables (e.g., sales and net profit) collected from various issues of the State Bank of Pakistan's document Financial Statement Analysis of Joint Stock Companies, for

the period 1976–2017. Nominal local currency sales and profitability are converted to actual US dollar values by dividing nominal sales by the consumer price index of each year and then expressing this real value in US dollars. Data on the exchange rate and consumer price index were obtained from international financial statistics. Data on GDP for Pakistan and the rest of the world were obtained from the World Bank (https://data.worldbank.org).

Table 1. Descriptive statistics of industrial sales growth rates.

| Industry	Mean	Median	Max.	Min.	St. dev.	Skewness	Kurtosis	JB	*P*-value
Cement	1.632	1.868	32.767	-33.101	13.425	-0.242	3.447	0.744	0.689
Chemicals	0.987	0.216	22.325	-19.794	9.993	0.079	2.849	0.081	0.959
Engineering	0.559	1.865	26.825	-45.335	16.545	-0.565	3.192	2.251	0.324
Food	-1.374	-2.453	36.376	-36.886	15.661	0.178	3.149	0.255	0.879
Fuel and energy	0.829	0.764	36.470	-27.245	13.422	0.233	3.101	0.390	0.822
Paper and board	-1.020	-1.981	50.762	-43.149	15.386	0.654	5.770	16.042	0.000
Sugar	-2.740	-3.628	32.420	-26.703	13.498	0.606	3.027	2.516	0.284
Textiles	-1.681	-0.145	23.756	-29.060	12.005	-0.109	3.017	0.082	0.959
Tobacco	-5.850	-2.238	19.501	-106.21	21.042	-2.895	14.091	-267.47	0.000
Transport and communication	-2.204	-2.827	36.786	-32.002	13.210	0.335	4.206	3.257	0.196

Table 1 presents the descriptive statistics of sales growth for each of the nonfinancial industries computed over the sample range under study, from 1976 to 2017. The results show that the sales growth rates of Pakistani industries underwent high fluctuations, as indicated by their much higher standard deviations than the means. The cement, chemicals, engineering, and fuel and energy industries experienced positive average growths rates in their sales. Over the sample period under study, average growth of the sectors food, paper and board, sugar, textiles, tobacco, and transport and communication declined. Except for the paper and board and tobacco industries, the normality of industrial sales growth distribution is not rejected (at the 5% significance level), as indicated by the Jarque–Bera test. It is observed that the cement industry was found to have the highest average annual growth rate while the tobacco industry experienced the lowest.

Table 2. Descriptive statistics of industrial profit growth rates.

Industry	Mean	Median	Max.	Min.	St.	Skewness	Kurtosis	JB	*P*-value
Cement	3.858	1.169	121.427	-162.096	55.272	-0.356	3.950	2.412	0.299
Chemicals	1.218	-0.793	29.741	-26.012	14.967	0.096	2.225	1.087	0.580
Engineering	0.285	-0.462	39.984	-48.416	21.534	-0.048	2.646	0.229	0.081
Food	2.773	2.955	48.344	-74.803	22.955	-0.558	4.867	8.086	0.017
Fuel and energy	2.382	0.962	56.690	-38.817	23.134	0.538	2.717	2.210	0.346
Paper and Board	0.222	-4.171	81.735	-70.657	29.552	0.608	4.779	7.938	0.018
Sugar	-3.371	-5.835	84.354	-83.314	35.000	0.059	3.069	0.032	0.983
Textiles	-2.451	-0.154	60.614	-78.448	30.419	-0.455	3.324	1.600	0.449
Tobacco	-1.132	-0.921	57.238	-78.547	25.128	-0.462	4.693	6.359	0.041
Transport and communication	-3.871	-5.452	116.367	-123.601	45.813	0.217	4.146	2.553	0.278

Table 2 presents descriptive statistics for the annual growth rates of net profit for those industries over the sample period. Similar to sales growth, we observed relatively high fluctuations in the profit growth of all industries, as evident by the high ratio of standard deviation to mean. The cement, chemicals, engineering, food, fuel and energy, and paper and board industries underwent positive mean growth in their profits, while sugar, textiles,

tobacco, and transport and communication show negative mean growth rates. Normality of profit growth distribution is not rejected (at the 5% significance level), except for the food, paper and board, and tobacco industries.
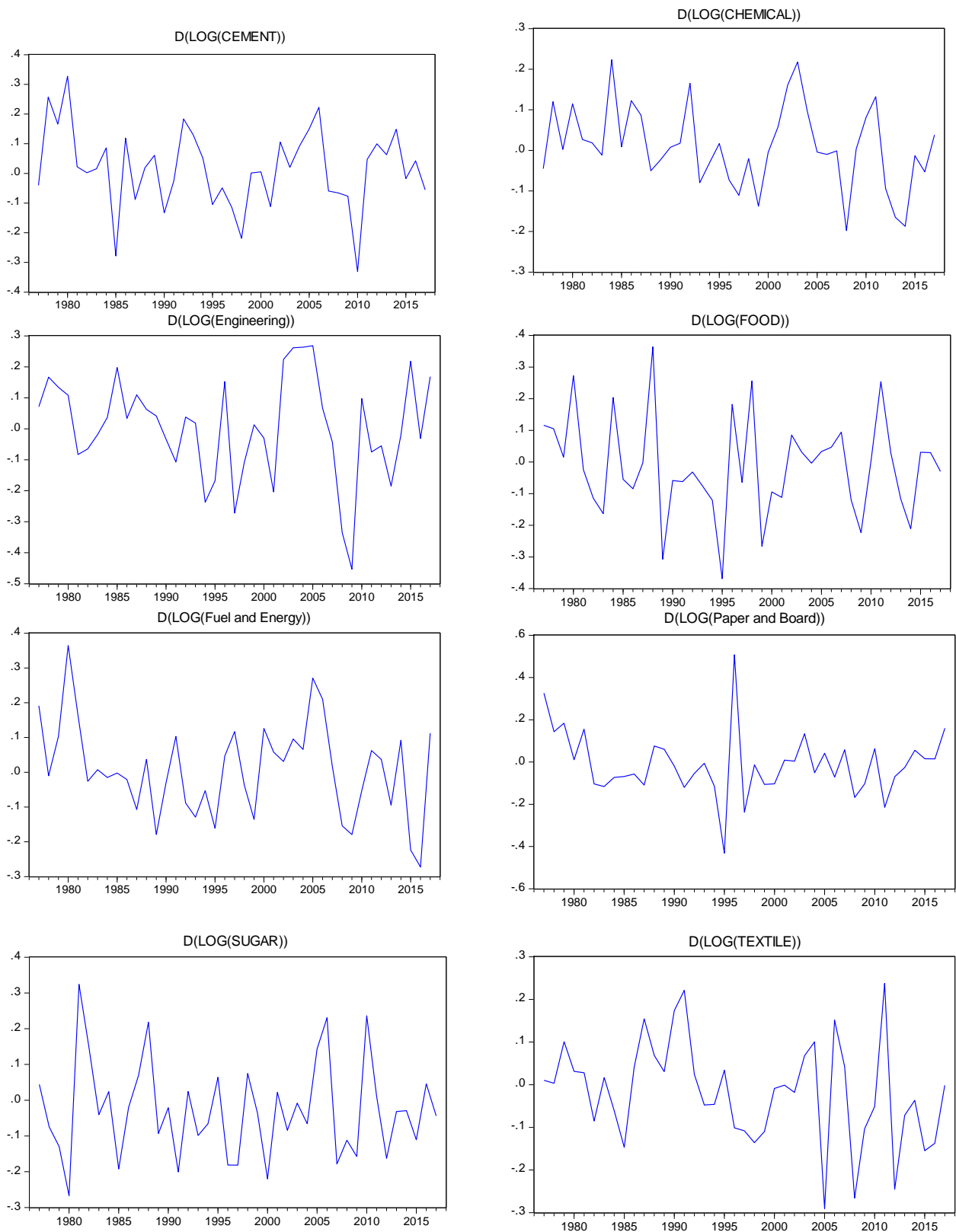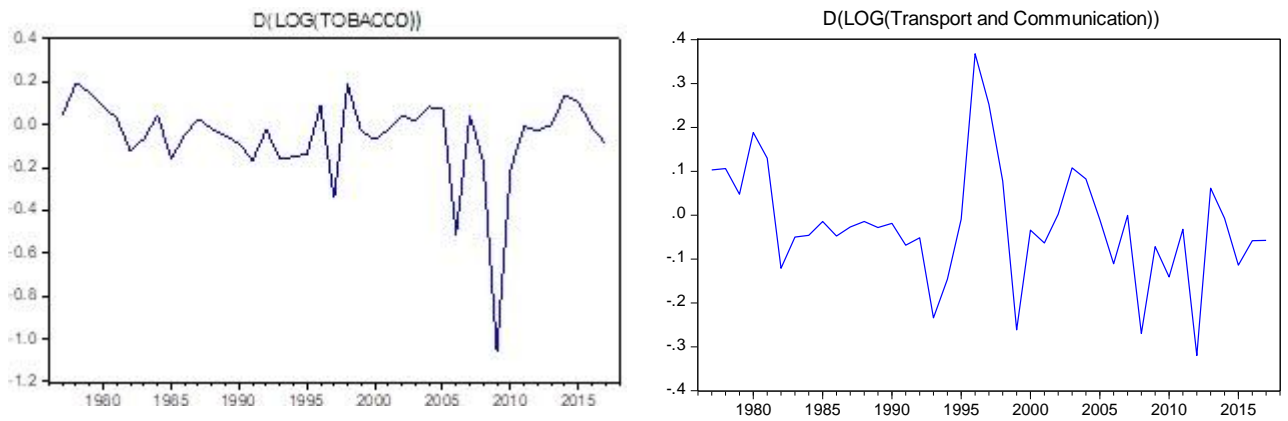
Figure 2. Time series plots of industrial sales growth rates.

Figure 2 presents the time series behavior of the sales growth rates of the industries considered in the analysis. Industrial growth has been quite volatile in Pakistan. Generally, it is observed that the sectors cement, chemicals, engineering, and fuel and energy experienced high sales growth over the President Musharaf period around 2005. The textiles sector is seen to have flourished in the early 1990s while the tobacco and transport and communication sectors attained peak growth in early 1980s.

4. MODEL AND METHODOLOGY

Our model for estimating industry exposure is similar to that used by Peterson & Strongin (1996). However, to the best of our knowledge, our model is the first to posit that industrial output responds to both local and global business cycle fluctuations of industry in a developing country. This paper considers this issue for Pakistan by measuring the sensitivities of its manufacturing and financial industries to local real GDP growth and a measure of world GDP growth, respectively. A developing economy such as Pakistan is a net receiver of global economic shocks, and industrial output must be linked to both local and global business cycles. We therefor specify the following model for estimation of industry exposures:

$$Output_{it} = \beta_0 + \beta_1\, GDPL_t + \beta_2\, GDPW_t + e_{it} \qquad (1)$$

Here $Output_{it}$ is one of two measures of industrial output, i.e., growth rate of both real gross sales and real net

profits (measured in million US dollars (2010)) for Pakistani industry i in year t. $GDPL_t$ and $GDPW_t$ are, respectively, the growth rates of real GDP of Pakistan and the world, expressed in million US dollars (2010). Here

β_1 measures the exposure or sensitivity of an industry output to the local economy and β_2 measures the exposure of a Pakistani industry output to global economic and business conditions. The industries include cement, chemicals and pharmaceuticals, engineering, fuel and energy, paper and board, sugar, textiles, tobacco, transport and communication, and food. The regression in (1) is estimated using annual time series data over the period 1976–2017.

The local and global exposure parameters for each industry can be estimated for each industry separately. This implicitly assumes that industries in Pakistan work independently. However, since many of the factors not considered in modeling industrial output are common to all Pakistani industries, it is intuitive that the error terms of these equations are correlated. This is justified, since all industries are affected by external or internal unexpected shocks to the economy (e.g., changes in tax structure, interest rates, international shocks, and oil price hikes). In

such cases, the optimal estimator is the Generalized Least Square (GLS) estimator based on SUR. The feasible GLS for the system of industry equations is estimated as:

$$\hat{\beta} = [X'(\hat{\Sigma}^{-1} \otimes I_N)X]^{-1}[X'(\hat{\Sigma}^{-1} \otimes I_N)y] \qquad (2)$$

$$Cov(\hat{\beta}) = [X'(\hat{\Sigma}^{-1} \otimes I_N)X]^{-1} \qquad (3)$$

Because the right-hand variables are identical in each industry equation, the equation according to OLS also yields the same estimates. Here N = number of industries, which is 10 in our case. Σ is the contemporaneous residual variance covariance matrix of industry equations and $\otimes$ represents the Kronecker product. In our case, since the regressors (i.e., the growth of real GDP in both Pakistan and the world) are identical in each equation, the equation-by-equation OLS yields the same parameter estimates as the system estimator. However, the efficiency gains in using the SUR are achieved through the residual correlations among equations. Thus, the standard errors of the SUR estimator are expected to be lower than from the OLS.

4.1. Testing the Diagonality of the Residual Covariance Matrix

The seemingly unrelated regressions estimator is effective only if industry equations residuals are correlated. This means that the residuals covariance matrix is nondiagonal. To examine whether or not this is the case, we can use the LR test of the null hypothesis of a diagonal residual covariance matrix. The LR test is given by:

$$LR = T[\sum_{i=1}^{m} \ln S_i^2 - \ln|\Sigma|] \sim \text{Chi Sq} \left(\frac{m(m-1)}{2}\right) \qquad (4)$$

Here S_i^2 are sample variances of each residual of equation i, and Σ is the residual variance covariance equations.

In our case $m = 10$, so the LR test has 45 degrees of freedom.

For the sales growth regression system, the LR test statistic has a computed value of 84.57 with a P-value of 0.00031. For the profit growth case, the LR test has a computed test statistic of 81.12 with a P-value of 0.00077. Thus, in both cases the diagonality of the residual covariance matrix is rejected so the SUR estimator has to be employed.

4.2. Estimation of Sales Growth Model

The results are reported in Table 3.

Table 3. Exposure coefficients of nonfinancial industrial real sales growth to growth of local Pakistani economy and the world economy as estimated by SUR.

Industry	Pak. GDP growth	S.E.	t-ratio	P-value	World GDP growth	S.E.	t-ratio	P-value
Cement	3.054	0.950	3.213	0.001	–0.590	1.563	–0.379	0.704
Chemicals	1.617	0.747	2.163	0.031	0.277	1.230	0.225	0.821
Engineering	3.560	0.966	3.682	0.000	6.389	1.590	4.016	0.000
Food	1.404	1.160	1.210	0.226	3.659	1.908	1.916	0.056
Fuel and energy	2.011	0.979	2.052	0.040	2.338	1.612	1.449	0.147
Paper and board	1.064	1.183	0.899	0.360	2.264	1.946	1.163	0.245
Sugar	0.931	1.049	0.887	0.375	1.303	1.726	0.755	0.450
Textiles	1.046	0.922	1.134	0.257	1.460	1.518	0.962	0.336
Tobacco	2.320	1.414	1.640	0.101	7.871	2.327	3.382	0.000

| Transport and communication | 1.739 | 0.986 | 1.762 | 0.078 | 1.887 | 1.623 | 1.162 | 0.245 |

Average R^2 of system equations = 0.157.

It is observed from Table 3 that the cement, chemicals, and fuel and energy industries are procyclic because their sales growth moves with the local business cycle. However, these industries are noncyclic with respect to the global economy.

The engineering industry appears to be moved by variation in both local and global business cycles. Tobacco and, to a lesser extent, the food industry follow the global business cycle. Sugar, textiles, and transport and communication are noncyclic with respect to both the local and global economy.

4.3. Estimation of Profit Model

Table 4. Exposure coefficients of Pakistani industry real profit growth to that of the local Pakistani economy and the world economy, estimated by SUR.

Industry	Pak. GDP growth	S.E.	t-ratio	P-value	World GDP growth	S.E.	t-ratio	P-value
Cement	9.948	3.961	2.511	0.012	-12.970	6.517	-1.990	0.047
Chemicals	1.287	1.104	1.104	0.270	0.365	1.919	0.190	0.848
Engineering	2.290	1.577	1.453	0.146	5.120	2.596	1.972	0.049
Food	-0.290	1.789	-0.162	0.871	3.406	2.944	1.157	0.248
Fuel and energy	2.098	1.695	1.237	0.216	5.917	2.790	2.120	0.034
Paper and board	0.471	2.146	0.291	0.826	9.610	3.531	2.721	0.006
Sugar	7.701	2.461	3.129	0.001	-6.156	4.049	-1.520	0.129
Textiles	4.233	2.315	1.828	0.068	-1.890	3.809	-0.496	0.619
Tobacco	3.321	1.920	1.729	0.084	-1.190	3.160	-0.378	0.705
Transport and communication	1.490	3.620	0.413	0.679	0.096	5.958	0.016	0.987

Average R^2 of system equations = 0.105.

Looking at the results of the profit model estimated by SUR in Table 4, it is seen that the profitability of the cement industry moves positively with local economic growth but that it is a countercyclic industry with respect to the global economy.

The sugar industry is noted as following the local business cycle. The profitability of the engineering, fuel and energy, and paper and board industries is seen to follow the global business cycle.

4.4. Diagnostic Checks on the Estimated Models

We estimated model (1) by the OLS, assuming that the assumptions of the model are satisfied. The assumption includes no autocorrelation, no heteroskedasticity, parameter stability, and normality of errors. We now test these assumptions.

Table 5 presents different diagnostic tests of the estimated sales growth model. Specifically, we conducted tests of residual serial correlation of orders 1 and 4, of Autoregressive Conditional Hetroscedasticity (ARCH) effects for lag 1 and 4, the Quandt–Andrews parameter stability test and JB normality tests. It appears that, except for tobacco industry regression, parameter instability is not found for any other industry.

Only regressions of the sectors paper and board and transport and communication indicate the ARCH effects. Evidence of serial correlation is found only in the regression residual for transport and communication industry regression. Generally, most of the industrial sales growth equations appear to satisfy the diagnostic tests very well.

Table 5. Diagnostic tests of the sales model (1).

Industry	Serial correlation LM test statistic log1 (*P*-value)	Serial correlation LM test statistic log4 (*P*-value)	ARCH effects Engle's chi-square test log1 (*P*-value)	ARCH effects Engle's chi-square test lag4 (*P*-value)	Parameter stability Quandt–Andrews max. LR break point test (*P*-value)	Normality test JB statistic (*P*-value)
Cement	0.0232 (0.8780)	2.0827 (0.7205)	0.3700 (0.5430)	1.4061 (0.8431)	2.2878 (0.5419)	3.3281 (0.1893)
Chemicals	3.3673 (0.0665)	8.2403 (0.0832)	0.6518 (0.4194)	0.7605 (0.9437)	2.7554 (0.3687)	0.8951 (0.6391)
Engineering	0.4274 (0.5132)	5.7938 (0.2151)	2.4585 (0.1169)	3.4003 (0.4932)	1.6022 (0.8257)	2.3754 (0.3049)
Food	1.6928 (0.1932)	8.8800 (0.0642)	0.4620 (0.4967)	4.1267 (0.3891)	1.5223 (0.8550)	0.4775 (0.7875)
Fuel and energy	1.7741 (0.1829)	6.3176 (0.1766)	0.0934 (0.7598)	2.7550 (0.5996)	1.6699 (0.7996)	0.2537 (0.8808)
Paper and board	2.7223 (0.0996)	3.5545 (0.4696)	8.8611 (0.0029)	13.8595 (0.0078)	2.1452 (0.6010)	18.5316 (0.00009)
Sugar	0.4474 (0.5036)	9.1898 (0.0565)	2.6643 (0.1026)	4.7571 (0.3131)	2.5735 (0.4316)	1.2151 (0.5446)
Textiles	0.0006 (0.9791)	1.0754 (0.8981)	0.3486 (0.5549)	3.9107 (0.4182)	3.2789 (0.2241)	1.1948 (0.5500)
Tobacco	0.5774 (0.4473)	5.4340 (0.2456)	0.1859 (0.6663)	6.8491 (0.1441)	7.6147 (0.0010)	43.1948 (0.00000)
Transport and communication	3.8856 (0.0487)	9.7501 (0.0449)	4.4935 (0.0340)	5.5954 (0.2315)	1.8434 (0.7288)	9.1862 (0.0101)

Table 6. Diagnostic tests of the profit model (1).

Industry	Serial correlation LM test statistic log1 (*P*-value)	Serial correlation LM test statistic log4 (*P*-value)	ARCH effects Engle's chi-square test log1 (*P*-value)	ARCH effects Engle's chi-square test log4 (*P*-value)	Parameter stability Quandt–Andrews max. LR break point test (*P*-value)	Normality test JB statistic (*P*-value)
Cement	0.2776 (0.5983)	6.1922 (0.1852)	0.8761 (0.3493)	10.6977 (0.0302)	2.5950 (0.4239)	2.7484 (0.2530)
Chemicals	1.1960 (0.2741)	4.6643 (0.3235)	1.0552 (0.3043)	2.5616 (0.6336)	3.0909 (0.2699)	1.1400 (0.5653)
Engineering	2.3584 (0.1246)	5.8355 (0.2118)	1.7249 (0.1891)	3.4784 (0.4812)	2.1721 (0.5897)	2.6988 (0.2598)
Food	1.6966 (0.1927)	6.1281 (0.1898)	0.3075 (0.5792)	1.3515 (0.8526)	1.1007 (0.9691)	10.5691 (0.0050)
Fuel and energy	0.5602 (0.4541)	3.1248 (0.5372)	0.3594 (0.5488)	9.1190 (0.0582)	0.6976 (0.9998)	0.6592 (7191)
Paper and board	0.6712 (0.4126)	1.4821 (0.8298)	0.1830 (0.6688)	2.0263 (0.7309)	3.7888 (0.1310)	5.2214 (0.0734)
Sugar	1.8982 (0.1683)	6.6303 (0.1568)	0.0104 (0.9185)	0.5870 (0.9645)	2.5016 (0.4581)	0.1697 (0.9186)
Textiles	2.2931 (0.1299)	5.4560 (0.2436)	0.3635 (0.5465)	1.9114 (0.7520)	1.7030 (0.7864)	0.8310 (0.6599)
Tobacco	1.7560 (0.1851)	4.2508 (0.3731)	4.5808 (0.0323)	5.5392 (0.2363)	2.6281 (0.4121)	1.6355 (0.4414)
Transport and communication	0.3237 (0.5694)	1.2109 (0.8763)	0.6890 (0.4065)	1.1427 (0.8874)	0.7914 (0.9982)	2.9859 (0.2247)

Table 6 presents the results of diagnostic tests of the profit model for each industry. We found no serious violations in any of the model assumptions.

5. ANALYSIS OF THE FINANCIAL SECTOR

Analysis of the nonfinancial and manufacturing sector industries indicates that most industries are either cyclical or noncyclical. Noncyclical industries potentially provide a hedge against business cycle risk. Now we investigate whether the financial sector provides some countercyclical opportunities to create a safe haven against business cycle risk. The financial sector in Pakistan includes commercial banks, development finance institutions, leasing and investment companies, insurance companies, mutual funds, Modarbas, and exchange companies. Unfortunately, data on sales and profitability for the financial sector have only very recently become available in Pakistan. Thus, results for our financial analysis are subject to low precision due to sample size issues. Nevertheless, for the sake of completeness we also perform analysis of the financial sector in order to investigate whether the results for that sector are different from those of the real sector. We perform the analysis only for profitability, since for many financial sector industries sales revenue is not a meaningful measure of performance. For banks and development finance institutions (DFIs) (note: house finance companies are merged with DFIs) and investment banks, the main sources of revenue are interest received from loans and interest income in short-term securities. Another important revenue source is noninterest-based transactions (e.g., fees for their various services). For leasing companies, the revenue comes from financing and operating lease and income on their investments. Net profit is realized after subtracting administrative expenses and taxes, which is used as the output variable in our analysis. For mutual funds, the revenue source is markup and interest income, income from dividends, and future transactions and capital gain realized when assets increase in value. Expenses include remuneration to managers and trustees, brokerage fees, and other general and administrative expenses. Net income is used as the output variable. For Modaraba companies, which are a type of partnership company where one party provides financing and the other provides management efforts and skills, revenue is obtained from undergoing various commercial activities (e.g., financing, trading, manufacturing, equipment rental services, property development, portfolio management, and many others). After subtracting operating expenses, management fees, and taxes, net profit is realized and is used as our output variable. Exchange companies generate revenue as a margin from buying a foreign currency at a given rate and selling at a higher rate. After subtracting administrative expenses and taxes, net profit is realized and is used as output variable. For the insurance sector, the main source of revenue is the premium charged for the policies they sell. In addition, they invest in a variety of venues (e.g., property, government securities, shares of corporate firms). After subtracting claims, administrative expenses, and tax expenses, net profit is calculated and is used as the output variable. Unfortunately, for the financial sector the sample size is small due to unavailability of data. Because the State Bank of Pakistan (SBP) have started reporting financial data for industry only since 2006, the results of analysis for the financial sector involve only a short sample (2006–2017) and may not be as precise as for the nonfinancial sector.

5.1. Descriptive Statistics for Financial Industries' Profit Growth Rates

Table 7 presents descriptive statistics of the profit growth for each of the financial industries considered in the analysis. The results show that the profit growth rates of Pakistani financial industries underwent much higher fluctuations than the real sector, as evident by their very higher standard deviations. Except for exchange companies, all financial industries have suffered losses on average over the period under study. The normality of profit growth distribution is not rejected, except for the insurance companies, as evident from results of the Jarque–Bera test.

5.2. Regression Results and Discussion of Financial Industries' Real Profit Model

Table 8 presents the exposure coefficients of Pakistani financial industries' real profit growth to that of the local Pakistani economy and the world economy. Here we describe the results for each industry. The results indicate that the financial sector in Pakistan is noncyclic with respect to local business cycle fluctuations, because none of the coefficients is significantly positive. However, the profitability of exchange companies and investment banks is countercyclic with respect to the global business cycle (at the 5% significance level), as indicated by their negatively significant exposures. Weaker evidence of the countercyclic nature of mutual funds is also seen.

Table 7. Descriptive statistics of financial industries' profit growth rates.

Industry	Mean	Median	Max.	Min.	St. dev.	Skewness	Kurtosis	JB	P-value
Commercial Banks	-7.769	-8.322	35.357	-94.259	36.065	-1.075	4.126	2.701	0.259
DFIs	-5.290	-3.948	159.203	-98.321	73.877	0.823	3.319	1.289	0.525
Exchange Companies	12.074	13.307	107.340	-61.593	55.259	0.307	2.031	0.603	0.740
Insurance Companies	-13.161	2.620	92.252	-279.008	94.969	-2.111	6.948	15.312	0.000
Investment Banks	-23.408	-27.184	122.046	-141.491	93.065	0.295	1.783	0.839	0.658
Leasing Companies	-13.273	3.023	163.812	-236.080	98.702	-0.631	4.105	1.289	0.525
Modaraba Companies	-4.072	-5.132	40.763	-70.058	32.945	-0.521	2.452	0.634	0.728
Mutual Funds	-24.387	12.679	480.650	-560.474	252.460	-0.187	4.051	0.570	0.752

Table 8. Exposure coefficients of financial industries' real profit growth in the local Pakistani economy and the world economy.

Industry	Pak. GDP growth	S.E.	t-ratio	P-value	World GDP growth	S.E.	t-ratio	P-value
Commercial banks	2.780	8.894	0.312	0.7626	5.925	7.94	0.745	0.477
DFIs	18.689	17.249	1.083	0.3102	-15.332	15.407	-0.995	0.348
Exchange companies	-2.303	10.259	-0.224	0.8280	-24.052**	9.16	-2.624	0.030
Insurance companies	32.528	21.591	1.506	0.1703	-1.165	19.285	-0.060	0.953
Investment banks	11.496	18.492	0.621	0.5514	-38.766**	16.517	-2.347	0.046
Leasing companies	26.003	21.496	1.209	0.2609	-29.9602	19.200	-1.560	0.157
Modaraba companies	8.003	7.772	1.029	0.3330	-6.443	6.94	-0.928	0.380
Mutual funds	79.364	50.340	1.576	0.1536	-90.106***	44.964	-2.003	0.080

Note: *estimates obtained by the OLS. Average R^2 = 0.280., **= significant at 5%,   ***=Significant at 10%

This analysis shows that investors should diversify their investment by allocating funds in both the real and financial sectors, especially in exchange companies, investment banks, and mutual funds, since a portfolio consisting of real sector industries will hedge against global recession risk. We observed this diversification in investments, especially in large family business agglomerations in Pakistan that have diversified their business over a varied level of industries including both real and financial sector industries. For example, one of the most powerful family business groups in Pakistan, the Habib Group of Companies, has diversified their business by investing in

commercial banks (e.g., Bank Al-Habib Ltd.), sugar mills (e.g., Habib Sugar Mills), asset management companies (e.g., Al Habib Asset Management), etc. This diversification provides them the opportunity to manage and reduce the risk of both global recession and local business cycles. Similarly, Nishat Mills Ltd. is another very successful business agglomeration that has diversified their business over insurance companies (e.g., Adamjee Insurance Ltd.), the cement sector (e.g., D.G. Khan Cement Company), banks (e.g., MCB Bank), power companies (e.g., Nishat Power), and the textiles sector (e.g., Nishat Chunian Ltd.).

6. CONCLUSION

In this paper we have investigated the level of exposure of Pakistan's major real sector and financial industries to local or global business cycle variation. In the case of nonfinancial industries, we measured exposures using two variables separately (i.e., the growth of real gross sales and real growth of net profit in each industry). With real gross sales growth as the dependent variable, we found that cement, chemicals, fuel and energy, and transport and communication industries real sales growth are procyclic with respect to local GDP growth, and noncyclic with respect to global GDP growth. Also, the sugar, textiles, and paper and board industries were found to be noncyclic with respect to variation in both local and global business cycles due to the nature of their inelastic demand. Food and tobacco industry sales growth was found to be noncyclic with respect to local GDP, and procyclic with respect to global GDP. Only the engineering industry was found to be procyclic with respect to both local and global business cycles. When real net profit growth was employed as the nonfinancial dependent variable, we found that the sugar, textiles, and tobacco industries are procyclic with respect to local business cycles and noncyclic with respect to the global business cycle. The engineering, fuel and energy, and paper and board industries were found to be noncyclic with respect to local business cycles and procyclic with respect to global GDP growth. The chemicals, food, and transport and communication industries were found to be noncyclic with respect to both local and global business cycles. Only the cement industry was found to be procyclic with respect to local business cycles and countercyclic with respect to the global business cycle. It was observed that among the real sector none of the industries is countercyclic with respect to local business cycles, and only the cement industry was found to be countercyclic with respect to the global business cycles. In order to investigate whether the financial sector in Pakistan can be considered a reliable hedge against the risk of local and global recession, we next investigated exposures for financial industries. Using real net profit growth as the dependent variable, we found that the real net profit growth of commercial banks, development finance institutions, insurance companies, leasing companies, and Modaraba companies is noncyclic with respect to both local and global GDP, while that of exchange companies, investment banks, and mutual funds is noncyclic with respect to local GDP and countercyclic with respect to global GDP. Thus, investing in these financial industries not only safeguards business during local recession risk but is also a safe haven against the risk of global recession. Thus, it can be concluded that some nonfinancial industries in Pakistan are vulnerable to the risk of both local and global recession. These observations have obviously very useful implications for business owners, investors, and policymakers. For example, the government can support these industries by providing concessional tax treatment. Portfolio investors can construct better and diversified investment portfolios and businesses groups can consider a diversified investment agglomeration. The empirical findings of this paper can be a valuable source of further research in this area, for example by considering firm-level exposure.

REFERENCES

Andrea, B., Galeotti, M., & Manera, M. (2017). Oil supply shocks and economic growth in the Mediterranean. *Energy Policy, 110*, 167-175.Available at: https://doi.org/10.1016/j.enpol.2017.08.004.

Berman, J., & Pfleeger, J. (1997). Which industries are sensitive to business cycle? *Monthly Labor Review, 19*(2), 19-25.

Braun, M., & Larrain, B. (2005). Finance and the business cycle: International, inter-industry evidence. *The Journal of Finance, 60*(3), 1097-1128.

Cecchetti, S. G., & Kashyap, A. K. (1996). International Cycles. *European Economic Review, 40*(2), 331-360.

Chand, S., & Sen, K. (1998). Competitive pressures from trade exposure: Evidence from Indian manufacturing. *Indian Economic Review, 34*(2), 113-126.

CIA World Fact Book. (2017). Retrieved from: https://www.cia.gov/library/publications/download/download-2017/index.html. [Accessed July 18, 2018].

Esposito, L., & Esposito, F. F. (1971). Foreign competition and domestic industry profitability. *The Review of Economics and Statistics, 53*(1), 343-353.

Hall, R. E. (1988). The relation between price and marginal cost in US industry. *Journal of Political Economy, 96*(5), 921-947.Available at: https://doi.org/10.1086/261570.

Hornstein, A. (2000). The business cycle and industry co-movement. *Federal Reserve Bank of Richmond Economics Quarterly, 86*(1), 24-48.

Iqbal, J., & Baig, M. A. (2017). Exploring channels of economic linkages of Pakistan's economy to the globe. *Pakistan Development Review, 56*(4), 219-235.

Kalman, R. E. (1960). A new approach to linear filtering and prediction problems. *Journal of Basic Engineering, 82*(1), 35-45.Available at: https://doi.org/10.1115/1.3662552.

Knudsen, E. S. (2019). Bad weather ahead: Pre-recession characteristics and the severity of recession impact. *Journal of Business Research, 104*(2019), 118-130.

Konovalova, M. S., & Maksimov, A. G. (2017). On sensitivity of industries and companies to the state of economy. *Cogent Economics and Finance, 5*(1), 1299074.

Lee, D. (2019). Transmission of domestic and external shocks through input-output network: Evidence from Korean industries. IMF Working Paper Series, WP/19/117, (May 2019).

Lien, L. B. (2010). Recessions across industries: A survey. *The Quarterly Journal of Economics, 111*(3), 805-833.

Machin, S., & Reenen, J. V. (1993). Profit-margins and the business-cycle: Evidence from UK manufacturing firms. *The Journal of Industrial Economics, 41*(1), 29-50.

Marchetti, D. J. (1999). Markup and the business cycle: evidence from italian manufacturing branches. *Open Economic Review, 13*(1), 87-103.

Noh, S., & Baek, I. (2020). Real business cycles in emerging countries: The role of nonlinearity. Available at SSRN: https://ssrn.com/abstract=3624597 or http://dx.doi.org/10.2139/ssrn.3624597. [Accessed June 15, 2020].

Peterson, B., & Strongin, S. (1996). Why are some industries more cyclical than others? *Journal of Business and Economics Statistics, 14*(2), 189-198.

Roura, & Abarca. (2001). Business cycle and service industries: General trends and the Spanish case. *Service Industries Journal, 21*(1), 103-122.

Shea, J. S. (2002). Complementarities and Co-movement. *Journal of Money Credit and Banking, 34*(2), 412-433.

Stockman, A. C. (1988). Sectoral and national aggregate disturbances to industrial output in seven European countries. *Journal of Monetary Economics, 21*(2-3), 387-409.

Wang, P. (2010). An examination of business cycle features in UK sectoral output. *Applied Economics, 42*(25), 3241-3252.

Wong, K. K. F. (1997). The relevance of business cycles in forecasting international tourist arrivals. *Tourism Management, 19*(8), 581-586.