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Role of Construction Sector in Economic Growth: Empirical Evidence from Pakistan Economy.

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Abstract

Construction sector and construction activities are considered to be one of the major sources of economic growth, development and economic activities. Construction and engineering services industry play an important role in the economic uplift and development of the country. It can be regarded as a mechanism of generating the employment and offering job opportunities to millions of unskilled, semi-skilled and skilled work force. It also plays key role in generating income in both formal and informal sector. It supplements the foreign exchange earnings derived from trade in construction material and engineering services.

Unfortunately construction sector is one of the most neglected sectors in Pakistan. Although the construction sector has only a 2.3 percent share in GDP, its share of the employed labor force was disproportionately large at 6.1 percent in FY07.

The construction sector is estimated to have grown by 17.2 percent in 2006-07 as against 5.7 percent of last year. The higher demand for construction workers is also reflected in a continued double-digit rise in their wages since FY05. Their wages increased by 11.1 percent in FY07.

The purpose of this study is:

- To examine the contribution of construction sector in Pakistan economy.
- To identify the relationship between construction sector and economic growth in the case of Pakistan and
- To identify whether there is a unidirectional or bidirectional causal relationship.

Keywords:
Construction Sector, GDP, Causal Relationship, Co-integration.

1. Introduction

The construction industry plays an essential role in the socio economic development of a country. The activities of the industry have great significance to the achievement of national socio-economic development goals of providing infrastructure, sanctuary and employment. It includes hospitals, schools, townships, offices, houses and other buildings; urban infrastructure (including water supply, sewerage, drainage); highways, roads, ports, railways, airports; power systems; irrigation and agriculture systems; telecommunications etc. It deals with all economic activities directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature. Besides, the construction industry generates substantial employment and provides a growth impetus to other sectors through backward and forward linkages. It is, essential therefore, that, this vital activity is nurtured for the healthy growth of the economy. The main purpose of this study is to see whether growth in construction industry actually caused the economic increase or, alternatively, did economic expansion strongly contribute to construction growth instead?

1.1 Global Distribution of Construction Output and Employment:

Globally, construction industry is regarded as one of the largest fragmented industry. An estimate of annual global construction output is probably closer to U.S $ 4.5 trillion in 2004[1]. The construction industry is also a prime source of employment generation offering job opportunities to millions of unskilled, semi-skilled and skilled work force. Global picture of construction output and employment in developing and developed countries can be seen in table -1 below.

It can be seen from the table-1 that total construction output worldwide was estimated at just over $3,000 billion in 1998. Output is heavily concentrated (77 per cent) in the high income countries (Western Europe, North America, Japan and Australasia). The contribution of low and middle income countries was only 23 % of total world construction output (ILO Geneva2001).

Table 1 Global contribution of construction output 1998

Number of Countries	Region	Output $ in Million		
		High Income Countries	Low income countries	Total
9	Africa	-	20 962	
23	America	723 569	243 247	
22	Asia	666 556	387831	
02	Oceania	46 433	-	
34	Europe	876 546	123 345	
90	Total	2312 104	701 755	3013 859
% of Total		77	23	

Sources: International Labor Office Geneva Report 2001

The data in employment situation table 2 tells a rather different story so far as employment is concerned. It can be seen that there was an excess of 111 million construction workers worldwide in 1998 and most of them were in the low- and middle-income countries.

The distribution of construction employment is, in fact, almost the exact reverse of the distribution of output. The high-income countries produce 77 per cent of global construction output with 26 per cent of total employment. The rest of the world (comprising low- and middle-income countries) produces only 23 per cent of output but has 74 per cent of employment (ILO Geneva2001).

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[1] Source: Engineering News Record, USA

Table 2 Global employment situation in construction sector 1998

Number of countries	Region	Employment (000s)		
		High Income Countries	Low Income Countries	Total
9	Africa	-	1867	
23	Amrica	9275	10917	
22	Asia	7258	60727	
02	Oceania	685	-	
34	Europe	11820	8978	
90	Total	29038	82439	111527
% of Total		26	74	

Sources:International Labor Office Geneva Report 2001

1.2 Construction Industry in Pakistan:

The housing and construction sector in Pakistan plays an important role in developing aggregate economy and reducing unemployment. It provides substantial employment opportunities as it contributes through a higher multiplier effect with a host of beneficial forward and backward linkage in the economy. The sector through linkages affects about 40 building material industries, support investment and growth climate and helps reduce poverty by generating income opportunities for poor household. It provides jobs to about 5.5 per cent of the total employed labor force or to 2.43 million persons, (2.41 million male and 0.2 million female) during 2003- 04
(Economic Survey 2004-05)

Unfortunately the construction sector is one of the most neglected sectors in Pakistan. It is at low ebb, which can be judged from the fact that per capita consumption of cement in Pakistan is one of the lowest among the developing countries i.e. 72 kgs. (Hassan, 2002).

2. Literature Review:

Construction in any country is a complex sector of the economy, which involves a broad range of stakeholders and has wide ranging linkages with other areas of activity such as manufacturing and the use of materials, energy, finance, labor and equipment (Hillebrandt, 1985).

The contribution of construction industry in the aggregate economy of a country has been addressed by a number of researchers and valuable literature available on the linkage between construction sector and other sectors of the economy. Several researchers conclude that the construction sector has strong linkages with other sectors of the national economy.

Hirschman (1958) first defined the concept of 'linkage' in his work *The Strategy of Economic Development*. He emphasized the significance of 'unbalanced' growth among supporting sectors of the economy as opposed to a balanced development of all interrelated economic activities (Lean, 2001). Park (1989) has confirmed that the construction industry generates one of the highest multiplier effects through its extensive backward and forward linkages with other sectors of the economy. It is stated that the importance of the construction industry stems from its strong linkages with other sectors of the economy (World Bank, 1984). However, interdependence between the construction sector and other economic sectors is not static (Bon, 1988; Bon, 1992). Strout (1958) provided a comparative inter-sectoral analysis of employment effects with an emphasis on the construction. Ball (1965) and Ball (1981) addressed the employment effects of the construction sector as a whole.

Many studies (Fox, 1976; Bon and Pietroforte, 1993; Pietroforte and Bon, 1995) use the strong direct and total linkage indicator to explain the leading role of the construction sector in the national economy.

2.1 Construction Industry and National Economy:

Construction activities and its output is an integral part of a country's national economy and industrial development. The construction industry is often seen as a driver of economic growth especially in developing countries. The industry can mobilize and effectively utilize local human and material resources in the development and maintenance of housing and infrastructure to promote local employment and improve economic efficiency (Anaman and Amponsah, 2007).

Field and Ofori (1988) stated that the construction makes a noticeable contribution to the economic output of a country; it generates employment and incomes for the people and therefore the effects of changes in the construction industry on the economy occur at all levels and in virtually all aspects of life (Chen, 1998; Rameezdeen, 2007). This implies that construction has a strong linkage with many economic activities (Bon, 1988; Bon and Pietroforte, 1990; Bon et al., 1999; Lean, 2001; Rameezdeen, 2007), and whatever happens to the industry will directly and indirectly influence other industries and ultimately, the wealth of a country. Hence, the construction industry is regarded as an essential and highly visible contributor to the process of growth (Field and Ofori, 1988).

The significant role of the construction industry in the national economy has been highlighted by Turin (1969). On the basis of cross section of data from a large number of countries at various levels of development, Turin (1969) argued that there is a positive relationship between construction output and economic growth. Furthermore, as economies grow construction output grows at a faster rate, assuming a higher proportion of GDP. (Turin, 1969, Hua, 1995, Wells,1986). In a recent article Drewer (1997) returns to the 'construction and development' debate. Using data for 1990 similar to that assembled by Turin for 1970, he shows that global construction output has become increasingly concentrated in the developed market economies. He goes on to argue that this new evidence does not support Turin's propositions (Drewer, 1997, Wells, 1986).

The issue of concern here is whether the construction sector and the aggregate economy are fragmented or mutually dependent, and whether construction activity contributes to economic growth and /or vice versa.

Studies have shown that the interdependence between the construction sector and other economic sectors is not static but changes as the nation's economy grows and develops (Bon, 1988, 1992).

2.2 Tools for Measuring Strength of Linkage:

Two analytical tools, which most widely used for measuring the strength of the linkage, sector vise economic performance and production interdependence and to analyze economic relationships, are:
(i) Leontief's (1936) Input–output analysis and
(ii) The new econometric methodology developed by Engle and Granger

Bon (1988) is one of the few researchers who applied the concept of Leontief input-output matrix to the construction industry. He considered the input–output technique to be ideal, for it provides a framework with which to study both direct and indirect resource utilization in the construction sector and industrial interdependence. He also found that the input–output tool can be used for studies of the construction sector in three broad aspects: employment creation potential, role in the economy, and identification of major suppliers to the construction industry (Lean, 2001). Rameezdeen et al, (2006), also used input-output table to analyze the significance of construction in a developing economy and its relationships with other sectors of the national economy.

With the popularity of the new econometric methodology presented by Engle and Granger, many modeling studies related to economic and financial issues have applied this new technique to analyze economic relationships.

Green (1997) applied the Granger causality test to determine the relationship between GDP and residential and non-residential investment, using quarterly national income and gross domestic product data for the period 1959–1992. His results showed that residential investment causes, but is not caused by GDP, while non-residential investment does not cause, but is caused by GDP. He concluded that housing leads and other types of investment lag the business cycle (Lean, 2001). Tse and Ganesan (1997) is also used the same econometric technique (Granger causality test) to determine the causal relationship between construction flows and GDP using quarterly Hong Kong data from 1983 to 1989. They found that the GDP leads the construction flow and not vice versa.

2.3 Research Objective:

The objective of the present paper is to examine the specific lead lag relationships between construction flow and gross domestic product (GDP). For obtaining this goal we will use annual data for construction sector and economic GDP of Pakistan from 1950 to 2005.

Granger causality methodology is commonly applied to investigations on the relationships among money supply, stock prices and inflation, but very few researchers tested the linkages between the construction sector and the aggregate economy using this method.
Here we will use the same approach to identify whether there is a unidirectional or bidirectional causal relation between construction sector and economic growth in the case of Pakistan.

In addition, we will use unit root tests to examine the stationarity of both series (construction sector and GDP) and co integration test will use to find out the existence of long run relationship between these variables. It is a powerful concept, because it allows us to describe the existence of an equilibrium or stationary relationship among two or more time series, each of which is individually non- stationary.

3. Methodology:

A simple statistical and econometric analysis will be used to know the general properties of data and to see the relationship among variables of interest like construction sector (LCNS) and aggregate economy of Pakistan (LGDP).

This study uses time series annual data (1950 to 2005) to demonstrate the causal relationship between construction sector and GDP in Pakistan. A time series is a sequence of values or readings ordered by a time parameter, such as hourly and yearly readings.

When time series data is used for analysis in econometrics, several statistical techniques and steps must be undertaken. First of all unit root test has been applied to each series individually in order to provide information about the data being stationary. Non-stationary data contains unit roots. The existences of unit roots make hypothesis test results unreliable. If the data are non-stationary, then frequently stationarity can be achieved by first differencing (Granger and Newbold, 1986) that is, obtaining the differences between the current value and that of the previous period. Once stationarity is determined, structural modeling of the variables or testing for causality can take place. The causality test aims to verify whether historical variations of the construction data follow or precede the GDP. To test for the existence of unit roots and to determine the degree of differences in order to obtain the stationary series of LGDP and LCNS, Augmented Dickey- Fuller Test (ADF) has been applied.

If the time series data of each variable is found to be non-stationary at level, then there may exists a long run relationship between these variables, LGDP and LCNS. Johansen's (1988) co-integration test has been used in order to know the existence of long run relationship between these variables.

A series is said to be integrated if it accumulates some past effects, such a series is non-stationary because its future path depends upon all such past influences, and is not tied to some mean to which it must eventually return. To transform a co-integrated series to achieve stationarity, we must differentiate it at least once. The number of times the data have to be differenced to become stationary is the order of integration. If a series is differenced *d* times to become stationary, it is said to be integrated of order *I*(*d*).However, a linear combination of series may have a lower order of integration than any one of them has individually. In this case, the variables are said to be co-integrated.

The following section presents the results of the simple descriptive statistical analysis and then unit root analysis to study the stationarity of GDP and construction flow. Accordingly, we employ Granger causality methodology to investigate the lead lag relationships between the construction flow and the GDP.

3.1 Data and Descriptive Statistical Analysis:

The annual data for the period 1950 to 2005 is being used for empirical analysis. Construction industry flows (LCNS) and Gross Domestic Product (LGDP) data in local currency is employed to analyze the dynamic relationship between GDP and construction sector. All the variables are expressed in natural logarithms so that they may be considered elasticity of the relevant variables. We examine the contemporaneous correlation and check for the evidence of Granger causality between these two variables. Table-3 presents summery statistic of the data and table- 4 tell us that there is a strong correlation between construction sector and GDP of Pakistan during 1950 to 2005. Annual observations of GDP and construction sector are taken from Handbook of Statistics of Pakistan Economy, 2005 and various issues of Economic Survey of Pakistan.

Table 3 Descriptive statistics

	LCNS	LGDP
Mean	8.605299	11.98993
Median	8.996238	11.90110
Maximum	11.87699	15.62865
Minimum	4.976734	9.126524
Std. Dev.	2.184803	2.082374
Skewness	-0.140903	0.195506
Kurtosis	1.651252	1.664931
Jarque-Bera	4.429918	4.515697
Probability	0.109158	0.104575
Observations	56	56

Table 4 Correlation Matrix

LCNS	1	0.988453435142
LGDP	0.988453435142	1

3.2 Unit Root Test:

Granger causality tests require the use of stationary time-series data (Granger and Newbold, 1974; Ong, 1994; Huang, 1995). Under current practice the unit root test is conducted to check the stationarity of data series. This step is very important because if non-stationary variables are not identified and used in the model, it will lead to a problem of spurious regression (Granger and Newbold, 1974), whereby the results suggest that there are statistically significant relationships between the variables in the regression model when in fact all that is evidence of contemporaneous correlation rather than meaningful causal relations (Granger and Newbold, 1974; Harris, 1995).

The unit root test is also known as augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1981), typically based on the following mathematical formulation.

$$\Delta Y_t = \alpha_0 + \alpha_1 T + \alpha_2 Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-i} + \mu_t \qquad \textbf{(1)}$$

Where $\Delta Y_t = Y_t - Y_1, \alpha_0$ is a drift term and *T* is the time trend with the null hypothesis, $H_0 : \alpha_2 = 0$ and its alternative hypothesis $H_1 : \alpha_2 \neq 0$, *n* is the number of lags necessary to obtain white noise and μ_t is the error term. The simpler Dickey Fuller (DF) test removes the summation term. However, the implied *t* statistic is not the Student *t* distribution, but instead is generated from Monte Carlo simulations (Engle and Granger, 1987, 1991). Note that failing to reject H_0 implies the time series is non-stationary.

3.3 Results of Unit Root Test:

Unit-root test are classified into series with and without unit roots, according to their null hypothesis, in order to conclude whether each variable is stationary. The test results are based upon estimating the following equations:

$$\Delta LGDP_t = \alpha_0 - \alpha_1 T + \alpha_2 LGDP_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta LGDP_{t-i} + \mu_{t1} \qquad \textbf{(2)}$$

$$\Delta LCNS_t = \beta_0 - \beta_1 T + \beta_2 LCNS_{t-1} + \sum_{i=1}^{n} \delta_i \Delta LCNS_{t-i} + \mu_{t2} \qquad \textbf{(3)}$$

Table: 5 Unit Root Test

Series	DF test at level		ADF test in first difference				PP test in first difference			
	No trend	With trend	No trend	Lag order	With trend	Lag order	No trend	Lag order	With trend	Lag order
LCNS	-0.85	-1.58	-4.71***	1	-4.64***	1	-6.81***	1	-6.83***	1
LGDP	2.22	-3.32*	-4.64***	1	-5.31***	1	-6.51***	1	-7.17***	1

*Note: *, ** and *** denote the rejection of unit root at 10 %, 5% and 1% significance level, respectively

Table: 6 Mackinnon critical values for rejection of hypothesis of a unit root

Critical values	DF test at level		ADF test in first difference		PP test in first difference	
	No trend	With trend	No trend	With trend	No trend	With trend
1%	-3.55	-4.13	-3.56	-4.14	-3.55	-4.13
5%	-2.91	-3.49	-2.92	-3.50	-2.92	-3.49
10%	-2.59	-3.17	-2.60	-3.18	-2.60	-3.18

Source: Mackinnon (1991)

The results of the unit root tests using the augmented Dickey Fuller (ADF), Dickey Fuller (DF) and Phillips Perron (PP) methods are summarized in Table 5. The null hypothesis of a unit root is performed at the usual 1%, 5% and 10% significance levels, and the critical values for the tests are presented in Table- 4.

Table-5 reports the DF and ADF test statistics on the natural logarithm of the LCNS and LGDP in regression (2) and (3).The results from the DF tests indicate that the two data series (LCNS and LGDP) are not stationary in their level form, since the null hypothesis of unit root with and without time trend cannot be rejected at all conventional levels of significance except LGDP series with time trend at 10% significance level.
The ADF (with one lag) test statistics reject the hypothesis of a unit root at all conventional levels of significance, suggesting that both series (LCNS and LGDP) appear to be first difference stationary (i.e. I(1)).

Results from the PP tests strongly support the conclusion that each of the series is stationary after first differencing at the 1% significance level. This means that only differenced data should be used in the model. Since both test variables are integrated of the same order I(1), it is possible to apply co integration tests to determine whether there exists a stable long run relationship between the construction sector (LCNS) and economic growth (LGDP) in Pakistan.

3.4 Granger Causality Test Result:

The traditional practice in testing the direction of causation between two variables has been to use the standard Granger framework. The basic concept of the Granger causality tests is that future values cannot predict past or present values. If past values of construction sector do contribute significantly to the explanation of GDP, then construction sector is said to Granger-cause GDP. This means that construction sector is Granger-causing GDP when past values of construction sector have predictive power of the current value of GDP even if the past values of GDP are taken into consideration. Conversely, if GDP is Granger-causing construction sector, it would be expected that GDP change would take place before a change in construction sector.

The Granger causality test is used in the present study, fitted with annual data from 1950 to 2005 to test whether construction sector stimulates aggregate economy or aggregate economy leads the construction activity, or if there exist feedback effects between construction sector and the aggregate economy, The Granger causality test consists of estimating the following equations:

$$LGDP_t = \beta_0 + \sum_{t=1}^{n} \beta_{1i} LGDP_{t-i} + \sum_{t=1}^{n} \beta_{2i} LCNS_{t-i} + U_t \qquad \textbf{(4)}$$

$$LCNS_t = \alpha_o + \sum_{t=1}^{n} \alpha_{1i} LCNS_{t-i} + \sum_{t=1}^{n} \alpha_{2i} LGDP_{t-i} + V_t \qquad \textbf{(5)}$$

Where U_t and V_t are uncorrelated and white noise error term series. Causality may be determined by estimating equation 1 and 2 and testing the null hypothesis that $\sum_{t=1}^{n} \beta_{2i} = 0$ and $\sum_{t=1}^{n} \alpha_{2i} = 0$ against the alternative hypothesis that $\sum_{t=1}^{n} \beta_{2i} \neq 0$ and $\sum_{t=1}^{n} \alpha_{2i} \neq 0$ for equation (4) or equation (5) respectively.

If the coefficients of β_{2i} are statistically significant, but α_{2i} are not statistically significant, then LGDP is said to have been caused by LCNS (uni-directional). The reverse causality holds if coefficients of α_{2i} are statistically significant while β_{2i} are not. But if both α_{2i} and β_{2i} are statistically significant, then causality runs both ways (Bi-directional).

The result of causality from construction sector (LCNS) to gross domestic product (LGDP) and from LGDP to construction sector (LCNS) in Pakistan is shown in table-7 below. It shows that construction activities cause GDP. This means that there is strong causality between construction industry and LGDP, which is true for lag order one in case of Pakistan. Construction sector leads economic GDP by one year in Pakistan. This causal linkage can be interpreted as the forward linkage of the construction sector with aggregate economy.

On the other hand From the *F* statistics, we are unable to reject the null hypothesis; LGDP does not Granger Cause LCNS. Our sample is statistically rejected that the causal affect running from economic GDP to the construction sector in first-differences of the data. GDP does not cause construction sector means that in case of Pakistan economic growth in GDP does not affect greatly the construction industry.

Table: 7 Granger causality between construction sector and GDP of Pakistan.

Null Hypothesis	Lag order	F-Statistics	Probability
LGDP does not Granger Cause LCNS	1	0.04	0.83
LCNS does not Granger Cause LGDP	1	5.60	0.02

* Note that * and ** indicates significant at the 5% and 1% significance level respectively. The null hypothesis of no causality is rejected if the *F* statistics exceed the critical values 4.10 and 2.8 at 1% and 5% significance levels respectively.

Granger causality indicates that there is uni-directional relationship between construction industry and aggregate economy of Pakistan.

3.5 Co-integration Test:

The stationary linear combination is called the co-integrating equation and may be interpreted as a long-run equilibrium relationship between variables.

Several co-integration techniques are available for the time series analysis. These tests include the Stock & Watson (1988) procedure, the Engle Granger (1987) test and Johansen's (1988) Co-integration test. Their common objective is to determine the most stationary linear combination of the time series variables under consideration. Consequently, Johansen's (1988) co-integration technique has been employed for the investigation of stable long run relationships between construction receipts and gross domestic product. The following equations were estimated with VAR lag 1 and assume that the series does not contain deterministic linear trends but the co-integrating relation only includes a constant. The results are summarized bellow in table- 8 & 9.

Johansen's Co-integration Test (consider a VAR of order p)

$$Y_t = \alpha_1 Y_{t-1} + ... + \alpha_p Y_{t-p} + \beta X_t + \varepsilon_t \qquad \textbf{(6)}$$

Where Y_t is a K-vector of non-stationary I(1) variables, X_t is a d-vector of deterministic variables, and ε_t is a vector of innovations.

Table: 8 Johansen's Co-integration Test

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.364682	**24.90475**	**15.41**	**20.04**	**None ****
0.007541	**0.408754**	**3.76**	**6.65**	**At most 1**

* (**) denotes rejection of the hypothesis at 5% (1%) significance level

The LR test rejects the hypothesis of no co-integration. The value of likelihood ratios indicates one co-integrating equation at 5% significance level. The normalized co-integrating relation assuming one co-integrating relation r = 1 is shown in table # 9 below.

Table: 9 Normalized Co-integrating Relation

LCNS	LGDP	C
1.000000	-0.870818	2.898633
	((0.06501)	(0.61388)
Log likelihood	111.5535	

The estimated co-integrating equation is: LCNS – 0.8708LGDP + 2.8986

4 Conclusions:

This paper carried out empirical tests on the Granger causality as well as regression analysis of the relationship between the construction sector and the real growth rate of *GDP* in Pakistan from 1950 to 2005. The aim of this study is to examine the causal relationship between construction sector activities and economic expansion (GDP) of Pakistan.

Using the concepts and methods of the co-integration and Granger causality test, this study explored the short term dynamic relations as well as long-run equilibrium conditions. Similar to the results by Tse and Ganesan's (1997) using the data for Hong Kong, a co-integration between construction flow and economic growth exist in Pakistan.

The results showed that there is strong causal relationship between the aggregate economy and the construction sector of Pakistan. The construction flow precedes GDP whereas GDP does not precede construction flow. There is a uni-directional causal relationship between the two variables real growth rate of GDP and construction flows. It established the causal linkage from the construction sector to the aggregate economy of Pakistan. Aggregate economy of Pakistan is greatly influenced by the construction industry.

Considering the significance of the construction sector, it is necessary to identify the major issues affecting the efficiency of the sector and take corrective action for increase in economic growth and development of Pakistan.

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