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# Researches



Azam Ahmad Abbasi
Dr. Attaullah Shah

# مستقبل الاسهم الاجنبيه علاقة التاخير والتقدم مع مؤشر اسعار البورصة امثلة من سوق كراتشي للأسهم

# Foreign Stock Futures Indices Lead-Lag Relation With Stock Spot Index: Evidence From Karachi Stock Exchange

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## الملخص

يتناول البحث علاقة الارتباط والتقدم بين مؤشرات اسعار الاسهم الاجنبية ومؤشر اسعار بورصة كراتشي المسمى مؤشر كي اس اي 100. المؤشرات الاجنبية المستخدمة في البحث هي مؤشرات هانغ سنغ 40 (الصين) ومؤشر اس اند بي 500 (الولايات المتحدة الاميركية) ومؤشر اسعار اكستيرا داكس (المانيا) ومؤشر اسعار هانغ سينغ للمؤسسات الصينية (الصين) ومؤشر اس اند بي/ اي اس اكس200 (استراليا 200) فوتسي/جي اس اي مؤشر اهم 40 مؤشر افريقي ومؤشر اسعار اي بي سي(المكسيك) ومؤشر اس جي اكس سي ان اكس (الهند 50). تستخدم الدراسة النموذج الموجه الارتدادي للتحليل حيث تظهر النتائج وجود علاقة تأخيروتقدم

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بين مؤشر اسعار الاسهم الاجنبية ومؤشر كي اس اي 100 وبالتحديد تظهر النتائج ان مؤشر اسعار الاسهم الاجنبية يقود مؤشر البورصة في الباكستان. ان هذه النتائج لها دلالات مهمة لمستثمري التجزئة ومديري محافظ الاستثمار بضمنهم الصناديق المشتركة وصناديق التقاعد الذين يستطيعون ادارة المحافظ بالاستفادة من تحركات مؤشرات اسعار الاسهم الاجنبية.

# مستقبل الاسهم الاجنبيه علاقة التاخير والتقدم مع مؤشر اسعار البورصة امثلة من سوق كراتشي للأسهم

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# Foreign Stock Futures Indices Lead-Lag Relation With Stock Spot Index: Evidence From Karachi Stock Exchange

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## Abstract

The study investigatesthe lead-lag relationship between foreign stock futures indices and Karachi Stock Exchange's Stock spot index i.e. KSE-100 Index. The foregin indices used in this study areHang Seng 40 Index Futures (China), S&P500 Index Futures (U.S.A), Xetra DAX Index Futures (Germany), Hang Seng China Enterprises Index Futures (China), S&P/ASX200 Index Futures (Australia 200), FTSE/JSE Africa Top 40 Index Futures, IPC Index Futures (Mexico), and SGX CNX Nifty Index Futures (India 50). Using Vector autoregressive model for analysis, the result indicated that there is a lead-lag relationship between foreign stock futures indices and the KSE-100 Index. More specifically, the evidence suggests that foreign stock futures indices lead the stock index in Pakistan. These reults have important implications for retail investors and portfolio managers including mutual funds and pension fund managers who can actively manage their portfolios by taking lead from movements in foreign futures indices.

# 1. Introduction

The financial world has been renovated ever since globalization directed the world into new horizons. With the advancement in the technology, the removal of regulatory barriers in international trade and financial liberalization, it is time for new market practices and new structures. This means that the world is on a march towards a financially integrated global world.

In the last twenty years, global integration is the most noticeableattribute of financial markets. In these global integrated markets, policy makers and investors take advantage of the increasing efficiency aspects of market interaction(Hasan, Saleem, & Abdullah, 2008). In order to avoid the side effects of globalization, a proper and efficient monitoring and controlling system in these markets is required. Academicians are taking keen interest in exploring the link and connection in the international markets due to the reason of increased interdependence of businesses and markets.

Intgegration of financial markets is extensively dicussed in the financial literature. Increased global wealth, globalization of economic activities and reduced information cost are to be considered in newly emerging markets. Several factors that contribute to how financial markets interact are innovations in technology used in communications, settlement and trading systems, innovative financial products and cross border movement of funds(Hasan, Saleem, & Abdullah, 2008). Globalizationplays a vital role in increasingthe interest of academicians to study relationship between different financial markets.

Studies have shown thatthe Karachi Stock Exchange is integrated with foreign indices(Lamba, 2005)(Hasan, Saleem, & Abdullah, 2008)(Subhani, Hasan, & Mehar, 2011).Since stock futures are derivaties based on underlying spot stocks and studies have shown that there exist a lead-lag relation between these markets (Nieto, Fernandez, & Munoz, 1998)(Antoniou & Holmes, 1995). These lead-lag relationship between stock futures and spot stocks can be a cross-border phenomena, i.e. stock futures of one country effecting spot stocks of another or vice versa. This study is intended to comprehend the lead-lag relationship betweenthe stock futures indices throughout the world and KSE-100, spot index of the Karachi Stock Exchange and. These include stock futures indices of the US, Hong Kong, China, Germany, South Africa, Australia, Mexico and India. If there exist lead-lag relationship between KSE-100 Index and these stock futures indices then investors can benefit from this relationship, use the information from stock futures indices, and forecast the movement in the KSE-100 Index of KSE.

The objective of this study is to find out how foreign stock futures are related to Karachi Stock Exchange's Stock spot index of KSE-100 by examininglead-lag relationship between foreign stock futures indices and KSE-100 index.

This research will provide investors with the technical aspect of the market and a predictive tool for investing and divesting for the investors. This will help the investors to determine the timing of their investments in KSE-100 Index.

This research is organized into five sections. Section1 introduces the paper, while section 2 presents a brief summary of the literature to elaborate how spot stock indices and future stock indices are related. Section 3 consists of the methodology and the data used in the research. The empirical findings are discussed in Section 4 and section 5 concludes the research.

## 2.Literature Review

Researchers started their work on finding the relationship between spot stock market and future market after the crash of 1987. There are numerous researches which emphasize on finding out the relationship between spot stock market and stock future market by focusing onprice,price return, inter-market price volatility,return volatility, and if there are any connections between the volatilities of the two markets. It should be noted that these studieshave been conducted in different geographical locations and in markets having different characteristics, with different data used and different methodologies employed.

There exists a little agreement among researchers regarding future contracts' effect on their underlying stock spot markets. While there is a general perception that due to the introduction of futures, the volatility in the prices of underlying spot markets has increased, or future leads the spot, this infersthat there exist aassociationamong futuresof stock market and its underlying spot stock market. Still there is a lack of empirical data, which will bring the researchers to a common point. (Khan, Winter 2006)

While on the other hand, the observable results seem to be mixed but majority of analysts, researchers and practitioners suggest that spot stock markets are being led by futures markets (Athanasios, 2010).

Researchers have developed three schools of thought concerninglead-lag relation between stock futuresand stock spot market. (Khan, Winter 2006)

The first school of thought is that**,** the future stock market leads the spot/cash stock market, or Stock index Futures trading has caused volatility in the underline spot market.

The proponents of the second school of thought believe that it is not the future market that causes volatility but spot market causes the volatility in the future market. According to this school of thought, spot stock markets lead the futures market. This school of thought is in direct contrast with the first school of thought.

The third school of thought contradicts both the first school of thought and the second school of thought. It states that there is no lead-lag relation between stock futures and its underlying stock spot market and there is no substantial in fluence of index futures trading on the volatility in spot stock market.

## 2.1 First school of thought – Futures lead the spot

The first school of thought believes that due to large, excessive irrational and speculative activities, future trading has caused volatility in the stock spot market. Due to low transaction cost in the stock futures markets, uninformed speculation has increased (Sharon Brown-hruska, 1995). The volatility in the stock spot market will increase if the investors or traders in stock futures markets are less informed as compared to the stock spot market's investors or traders (Figlewski, 1981). Empirical studies have tried to prove that stock futures trading has triggeredprice volatility in the underlying spot market. Studies reveal that with the introduction of index futures the volatility of spot market rose as a result (Edwin D. Maberly, 1989). Antonios Antoniou and Phil Holmes are of the same opinion (Antoniou & Holmes, 1995). Harris concluded that futures trading have caused a significant increase in volatility of spot markets (Harris, 1986). There was a significant increase in the volatility of stock indices in Hong Kong, U.K., Japan, Australia and U.S. after the introduction of index futures in the market (Sang Bin Lee, 1992).

Some of the studies supports the first school of thought are stated here.

Zeckhauser and Niederhoffer (1983) did one of the first researches on finding out the relationship between spot stock market and futures market and came up with the conclusion that future prices have the capability of predicting price movements in spot stock market.

Since the market activity in the futures market is different on expiration days from the days prior to expiration, because of this, Kawaller and his fellow researchers (1987) examined the relation of stock spot prices andstock futures prices on days prior of expiration and expiration dayof futures. They used minute-to-minute data of S&P 500 index future and S&P 500 stock index and run times-series regression analysis in order to find lead and lag relationship. The results show that S&P 500 index future is led by S&P 500 spot stock index by 20 to 45 minutes, while spot index's movement affects movement of futures within a minute. Lead from future index to spot stock index was almost of the same period.

In the same year, a study was done by Herbst and McCormack (1987), in order to find the hypnotized lead and lag relationship between spot and future market indices. They took 144 observations employing daily data from 24 February 1982 to 18 September 1982. The variables were Value Line futures index and Value Line stock. The researchers also took data of S&P 500 stock index and the S&P 500 futures index, 2200 observations per day and each observation is 10 seconds apart. The results derived from both of the data were of the same kind; in both cases, futures lead the spot by 16 minutes and 8 minutes respectively.

In 1990, Stoll and Whaley (1990) did an important research on finding out the lead and lag relationship between future market and the spot market by employing intraday five-minute returns data for the period of five years and using ARMA to find out the results. The outcomes were the same like previous study; future leaded the spot by 5 minutes on average and rarely 10 minutes.

In 1992, Chan (1992) did a research on finding out the lead and lag relationship between Major Market Index (MMI) and returns of the MMI futures and the S&P 500futures index over two different time periods of August 1984 to June 1985 and January to September 1987. Results suggested that asymmetric lead and lag relationship exist between the future market index and spot market index, and futures market strongly leads spot market when there is market wide information and the reason for that is that futures market process information quicker than the spot market.

In 1995 a research was done by Abhyankar (1995), in order to find the relationship between FTSE-100 index of the spot market, the FTSE- 100 index future and the period that was used to collect the hourly data was from 1986 till 1990.Abhyankar employed E-GARCH to find the relationship. The result suggested that there does exist a relationship between the spot market index and future market index and that future market index leads spot market index, especially in the case of market wide information.

During 1996, bi-variate EGARCH was applied on daily closing prices (2770 observations) of S&P 500futures index and the S&P 500 index ranging from 1984 to 1993 by Kutmos and Trucker (1996). The result of this research suggested that in the short run, there was no relationship between spot and futures markets, but only in case of innovations, deriving from futures market will result in increased volatility in the underlying spot market.

Cheung and Fung (1997) came up with a research in which they employed Ganger causality tests, co-integration analysis and AR-GARCH model on daily data of the Eurodollar futures rate and three-month Eurodollar stock rate from 1983 to 1997. Their results were that bidirectional feedback causality exists between future and spot markets, according to them future prices, effect spot markets prices and spot effect future markets, but the impact of future is bigger.

In 1997, De Jong and Nijman (1997) did a research on finding out lead lag relationship between S&P500 index and S&P500 future index by using high frequency data (one-minute observations) from the period of last quarter of 1993. The results indicate the bi-directional relationship exist, future lead spot by ten minutes and spot lead future by two minutes.

Furthermore, Nieto and other researchers (1998) was interested in finding a lead and lag relationship between Spanish futures index (Ibex 35) and the underlying spot market by using Johansen co-integration method in order to test Granger causality test for the period of March, 1994 – September, 1996. The results of the research indicated that there is no lead and lag relationship between the Ibex 35 and underlying spot market in the long run but future index lead the spot market index in the short run.

Antoniou and other researchers (2003) took a step away from the traditional researches on finding out the lead and lag relationship between spot and future market and introduced a new perspective to the research area, they examined the diffusion of volatility caused by futures market across international markets. According to them, there exist interdependent relationships among countries' markets. They used multivariate VAR-EGARCH analysis on DAX-100, CAC-40 and FTSE-100's daily closing prices. Their results confirmed that future market leads stock market and not only in the same country but internationally in the examined countries. Their conclusions were that the relation of future and spot market is influenced by foreign markets as well and an investor must consider this.

Additionally, researchers in 2004 found out that future stock market leads the spot stock market to a greater degree by using daily closing data of FTSE/ASE-20 and its future indices by employing GARCH and Granger causality tests. (Katrakilidis, Athianos, & Lake, 2004)

It was again empirically proved that future to lead the spot stock market by researchers, they employed Bivariate GARCH model on spot and futures of FTSE/ASE- Mid 40 and FTSE /ASE-20 due to the factor that the future markets are more information efficient and more liquid than the spot market. (Floros & Vougas, 2007)

Based on the studies conducted on the lead - lag relationship between stock futures indices and stock spot indices, the researcher had provided a hypothesis, which is that future indices lead the spot indices in capital markets. The results of the research will be significant even if the results do not agree with the hypotheses of the researcher.

$H_1$ = Foreign stock future indices lead KSE-100 index.

## 2.2 Second school of thought – Spot lead the futures

Researchers supporting the second school of thought believe that the introduction of futures or activities in the futures market does not cause or predict any volatility in the spot market, instead activity in the spot market lead the futures market.its has been empirically proved by some studies that stock futures indices are led by stock spot indices and the reason was the complexicity of the futures market compared to spot market, due to this complexicity investors trade in spot market. This reason also increase information flow in the spot market.

Some of the researches that support second school of thought are stated below.

Chan and other researchers used a non-linear multivariate regression model in order to find the lead and lag relationship of future and spot markets.Chan and others confirmed that spot leads future by employing all the data containing all trades and bid-ask quotations from the New York stock exchange. This lead was about 15 minutes and was stated that it was because how spot and futures are traded. (Chan, Chungand, & Johnson, 1993)

Shakeel Moonis came up with a conclusion that spot led the future by employing co-integration, error correctional model and Granger causality test on daily closing prices of nifty spot and future index from June 2000 - December 2007. (Moonis, 2009)

Pradhan and Bhat concluded that due to the reason that derivative markets are in the immature stage, the primary market for the price discovery is considered spot market, hence the spot market will be leading the future market. (Pradhan & Bhat, 2009)

Kapil Chuodhary and Sushil Bajaj investigated that which market between future and spot assimilate information and discover price efficiently compared to the other and then affect the other. They employed Johansen's co-intergegration and Engle, Granger's residual based approach and Granger causality test on 31 individual securities from April 2010 to March 2011. Their results stated that out of 31 securities, 19 securities were led by the spot market and 12 out of 31 were led by future hence concluding that spot lead the future (Choudhary & Bajaj, 2012).

## 2.3 Third School of Thought – No lead-lag relation between future &spot

The third school of thought is also supported by several studies based on finding the lead-lag relationship between the spot market and futures trading but found no such relation between stock futures indices and the underlyingstock spot market.

Studies that support this school of thought are stated below.

Nieto and other researchers were interested in finding a lead and lag relationship between Spanish futures index (Ibex 35) and the underlying spot market by using Johansen co-integration method in order to test Granger causality test for the period of March 1994 – September 1996. The results of the research indicated that there is no lead-lag relation between the Ibex 35 futures and its underlying spot market in the long run, but the future index led the spot market index in the short run. (Nieto, Fernandez, & Munoz, 1998)

Abhyankar, while continuing his research on the topic in 1998, to explain the lead-lag relation among FTSE-500 findex and FTSE-500 stock futures index and using Granger causality tests both linear and non-linear on high frequency data. Non-linear Granger causality tests showed no lead or lag relationship between the stated indices. (Abhyankar, 1998)

In 1999, using a method of cross-correlations and cross-bicorrelations in order to find out the lead lag relationship between S&P500 and FTSE100 and their respective futures contracts, the researchers concluded no such lead and lag relation between the spot and respective futures. (Brooks, Garrett, & Hinich, 1999)

### 2.4 Karachi Stock Exchange relation with foreign indices

Due to the globalization effect, every economy in the world is now affected either directly or indirectly by all the other economies. Capital markets have been affected directly due to the increased information flow and low cost of transmitting information between economies. These are the few factors causing integration in the markets among many other factors. In case of the Karachi Stock Exchange, many studies support that The Karachi Stock Exchange is integrated with other foreign stock exchanges. It was found that in the long run there exists a Granger cause in stock prices of the KSE due to the stock prices in Sri Lanka, India and Bangladesh, while in the short run, KSE Granger-cause in stock prices of Bombay stock exchange and Colombo stock exchange. (Narayan, Smyth, & Nandha, 2004). Lamba (2005) found out that The Karachi Stock Exchange is not related to the capital markets of UK, US and Japan. Supporting the previous research, The Karachi Stock Exchange was found not to be integrated by Arshad Hasan and all (2008) with the stock exchanges of UK, Canada, US, Australia, Italy and Germany; however, it was found to be integrated with stock exchange of France and Japan.

Summarizing the results of the studies and articles mentioned above, we can conclude that empirical data identify the relationship between the stock futures index and its underlying stock spot market up to some extent, but still there is a need to investigate the relationship between the stock spot market and foreign futures trading in an emerging capital market of Pakistan. There is not any work done on foreign futures and their lead-lag relationship with KSE and this gap will be fulfilled by the results of this research.

## 3.Methodology

As already discussed in the literature, different researchers have used different methodologies and data in order to investigate the lead and lag relationship between future and spot indices. These researchers have collected data with time interval ranging from one minute to a week. Both closing prices and returns of the indices have been taken in different researches mentioned in literature.

Different econometric models have been used by researchers such as ARMA, GARCH, E-GARCH, AR-GARCH, Johansen co-integration, Error correctional, Engle, Granger causality test, VAR, and VAR-EGARCH, in order to find out the lead-lag relation among stock futures indices and stock spot indices.

## 3.1 Sample and data collection

This research is based on daily closing prices of Karachi Stock Exchange's 100 Index and 8 other future stock indices throughout the world.This includes Standard and Poor's 500 future index from US, South Africa's FTSEJSE Africa Top 40 Index,Hong Kong's Hang Seng 40 Index Futures,Mexico's IPC Index Futures, Germany's Xetra DAX Index Futures, China's Hang Seng China Enterprises Index Futures, Australia's S&PASX200 Index Futures, India's SGX CNX Nifty Index Futures. These daily closing data is ranging from 19/Nov/2009 till3/Dec/2012. This data is collected from Bloomberg professional software.

## 3.2 Data Description

There are nine variables used in this research, all of them indices of different stock exchanges. One of them is an index of spot while others eight are stock futures indices.

### *3.2.1 KSE-100 Index*

KSE-100 is the index of The Karachi Stock Exchange for the 100 largest companies selected from different sectors. Companies are picked based on higher market capitalization.

### *3.2.2 S&P 500 Futures*

S&P 500 Futures index is based on an underlying spot index Standard & Poor's 500. S&P 500 is a stock market index of 500 top publiccompanies of US as determine by S&P.

### *3.2.3 Xetra DAX Index Futures*

The Xetra DAX Futures index is based on DAX - Deutscher Aktien IndeX, as its underlying spot index of Frankfurt stock exchange. DAX is an index determining the performance of thirty blue chip German companies.

### *3.2.4 FTSE/JSE Africa Top 40 Index futures*

FTSE/JSE Africa Top 40 Futures are a derivative based on stock spot index of FTSE/JSE Africa Top 40 Index; this represents the performance of 40 blue chip companies of South Africa belonging to FTSE/JSE All Shares index.

### *3.2.5 IPC Index Futures*

IPC index futures are a derivative of the Mexico stock exchange's broadest indicator of the performance, which is IPC. IPC represents all the shares that are traded on the Mexico stock exchange.

### *3.2.6 Hang Seng China Enterprises Index Futures*

HSCE index futures are based on the underlying index on Hang Seng China Enterprises index, which is an index of the Hong Kong stock exchange. It represents top 40 companies of the main land China.

### *3.2.7 Hang Seng 40 Index Futures*

Hang Seng 40 index futures are a derivative of Hang Seng Index (HSI), which is the benchmark of the Hong Kong stock exchange. The Hang Seng Index is one of the best Asian Stock index, known and used throughout Asia by fund managers for performance benchmarking.

### *3.2.8 S&PASX200 Index Futures*

The underlying index of S&PASX200 Index Futures is Australia stock exchange's stock spot index known as S&P/ASX 200. This index determines the performance of top 200 companies listed on the Australia stock exchange. S&P/ASX 200 was launched in April of year 2000 and is known as Australia's preeminent benchmark index.

### *3.2.9 SGX CNX Nifty Index Futures*

The S&P CNX Nifty index futures are a derivative of S&P CNX Nifty index. These indices are of National stock exchange of India.S&P CNX Nifty is the index for 50blue chip companies,from twenty-four different sectors, trading on the National Stock Exchange of India.

## 3.3 Standardization

The time series variables that are used in this research are from different markets throughout the world with different base years and base year's points, which makes these variables quite differently. In order to bring standardization in these variables first differences in natural logarithms will be taken of all the variables according to the following expression

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

$P_t$ is the price of index at given time "$t$"

$P_{t-1}$ is the price of index at "$t$-1"

### 3.4 Stationarity

Employing time series analysis such as ARMA, GARCH, E-GARCH, VAR, and VAR-EGARCH, etc. requires all the data to be of the same order. Unit root tests are used to determine the stationarity of the data. In this research, Augmented Dickey-Fuller Test will be used to check the stationarity in the data with the following expression;

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta 2 \Delta Y_{t-1} + e_t$$

$Yt$ is the variable of interest

$\beta$ is is a coefficient

$e_t$ is the disturbance term

### 3.5 Econometric Model

In 1980s, a new framework of macro econometric was introduced by Christopher Sims (1980) by the name of vector auto regressions. Vector auto regression that is used in this research is a multi-equation; it is a linear model for n-variable and n-equation. In which every variable is elucidated by its own lagged values as well as past and current values of other remaining variables at n-1. This model provides a very systematic approach to apprehend valuable dynamics in multiple time series. VAR is quite useful because it provides an accurate and coherent way of describing data, structural inference, and forecasting. Co movements that are not detectable in bivariate or univariate models, but it can be captured in VAR model due to the reason that VAR includes current and lagged values of multiple time series. The vector auto regression's expression that is used in this research is stated below.

$$KSE100_t = \alpha + \beta_1 KSE100_{t-1} + \beta_2 KSE100_{t-2} + \beta 3 S\&P_{t-1} + \beta_4 DAX_{t-1}$$
$$+ \beta 5 FTSEJSE_{t-1} + \beta_6 IPC_{t-1} + \beta 7 China\ H\ Shares_{t-1} + \beta 8 Hang\ Seng\ 40_{t-1}$$
$$+ \beta 9 S\&PASX200_{t-1} + \beta 10 SGX\ CNX\ Nifty_{\ t-1} + e_t^y$$

*$KSE100_t$ is the value of KSE100 at time "t\"*

*$KSE100_{t-1}$ is the value of KSE100 at time "t-1"*

*$S\&P_{t-1}$ is the value of S&P 500 futures at time "t-1"*

*$DAX_{t-1}$ is the value of Xetra DAX Index Futures at time "t-1"*

*$FTSEJSE_{t-1}$ is the value of FTSE/JSE Africa Top 40 Index futures at time "t-1"*

*$IPC_{t-1}$ is the value of IPC Index Futures at time "t-1"*

*$China\ H\ Shares_{t-1}$ is the Hang Seng China Enterprises Index Futures at time "t-1"*

*$Hang\ Seng\ 40_{t-1}$ is the value of Hang Seng 40 Index Futures at time "t-1"*

*$S\&PASX200_{t-1}$ is the value of S&PASX200 Index Futures at time "t-1"*

*$SGX\ CNX\ Nifty_{t-1}$ is the value of SGX CNX Nifty Index Futures at time "t-1"*

## 4.Analysis and Discussion

In this section, analysis of the data with the tools described in the methodology section of the research is stated.

### 4.1 Descriptive statistics

Descriptive statistics of all the indices are given in the Table 1. The descriptive analysis includes mean, standard error, standard deviation, sample variance, kurtosis and skewness. Carefully examining the Table 1, it is found that KSE-100 Index provides investors with the largest return with minimum risk, which is determined by standard deviation. S&P 500 futures, FTSE/JSE Africa Top 40 futures, IPC futures (Mexico), SGX CNX Nifty futures (India 50) show positive returns at almost same risk level. S&P/ASX200 futures (Australia 200), Hang Seng China enterprises futures, Hang Seng 40 futures, these indices are having negative returns at the nearly same level of risk. Hang Seng China Enterprises futures are showing the worst performance with highest negative returns with higher risk compared to other Indices.

## Table 1: Descriptive Statistics

| | KSE-100 | S&P 500 futures | FTSE/JSE Africa Top 40 futures | IPC futures (Mexico) | SGX CNX Nifty futures (India 50) | S&P/ASX200 futures (Australia 200) | Hang Seng China Enterprises futures | Hang Seng 40 futures | Xetra DAX |
|---|---|---|---|---|---|---|---|---|---|
| Mean | 0.00084 | 0.00034 | 0.00046 | 0.00045 | 0.00022 | -0.00007 | -0.00038 | -0.00007 | 0.00035 |
| Standard Deviation | 0.00955 | 0.01250 | 0.01197 | 0.01097 | 0.01244 | 0.01153 | 0.01702 | 0.01358 | 0.01620 |
| Sample Variance | 0.00009 | 0.00016 | 0.00014 | 0.00012 | 0.00015 | 0.00013 | 0.00029 | 0.00018 | 0.00026 |
| Kurtosis | 2.28432 | 4.26939 | 0.97462 | 3.51261 | 0.49077 | 4.06501 | 1.02681 | 1.13477 | 5.43445 |
| Skewness | -0.447 | -0.610 | -0.087 | -0.42622 | -0.01085 | -0.12339 | 0.05461 | -0.05932 | -0.604 |

## 4.2 Stationarity

The vector autoregression model requires time series data to be in the same order so in this section of the research, time series data has been tested for stationarity. According to the methodology, Augmented Dickey-Fuller Test is employed. Table 2 reveals that the data is stationary and it can be used for VAR.

**Table 2: Unit root test - ADF**

| | Test Statistics | P-value |
|---|---|---|
| KSE-100 | -17.0961 | 0.0000 |
| S&P 500 futures | -27.7783 | 0.0000 |
| FTSE/JSE Africa Top 40 futures | -13.1711 | 0.0000 |
| IPC futures (Mexico) | -27.459 | 0.0000 |
| SGX CNX Nifty futures (India 50) | -27.3253 | 0.0000 |
| S&P/ASX200 futures (Australia 200) | -26.6551 | 0.0000 |
| Hang Seng China Enterprises futures | -26.0765 | 0.0000 |
| Hang Seng 40 futures | -26.4651 | 0.0000 |
| Xetra DAX | -26.405 | 0.0000 |

Table 2 provides the results for the time series, since the p-value of all the time series are less than 0.05, this meanes that all the time series are stationary and the researcher can proceed with vector autoregression.

## 4.3 Vector autoregression lag selection

Table 3 shows the results of the VAR large selection. As shown by theAkaike criterion, the bestlag is found to be 2. It will be used for vector autoregression because it is having the lowest Akaike criterion compared to other lags.

**Table 3: VAR lag selection**

| lags | Loglik | p(LR) | AIC |
|---|---|---|---|
| 1 | 2265.19362 | | -6.527333 |
| **2** | 2266.95612 | 0.06045 | **-6.52954*** |
| 3 | 2266.98278 | 0.81739 | -6.526723 |
| 4 | 2267.0088 | 0.81953 | -6.523904 |
| 5 | 2267.01621 | 0.90315 | -6.521031 |

## 4.5 Vector autoregression results

According to the methodology, we employed VAR with two lag on the data of the indices. KSE-100 Index is an endogenous variable in this research while others are exogenous. The result of this model suggest that the changes in the KSE-100 Index follow changes in the foregin market futures indices.

The results of the VAR model are shown in the given Table 4. The significance of the lead-lag relationship is measured by looking at the p-values of the variables, if p-value is less than 5% than the relationship between the variables is significant.

Looking at the results of the study it can be seen that KSE-100 Index is not significantlyledby its own single lag rather it is significantly led by its second lag at 10% significance. S&P 500 futures significantly lead KSE-100 Index at 1% significance. Hang Seng 40 index futures also lead KSE-100 Index at a significance level of 10%. Germany's Xetra DAX index futures, does not show any significant lead-lag with the KSE-100 Index of the Karachi stock exchange. China's Hang Seng China Enterprises shows a significant leading of KSE-100 at 10% significance level. S&P ASX200, which is Australia's future index, does not hold significant lead relation with KSE-100 index. Africa's FTSE/JSE Africa Top 40 index futures, also does not show any significant lead-lag relationship with the KSE-100 index. IPC index futures, does not confirm any significant lead-lag relationship with KSE-100 index. India's SGX CNX Nifty Index Futures proved to have a significant lead-lag relation with KSE-100 at a significance level of 5%.

An increase of 1 point in the $KSE_{t-2}$ will cause an increase of 0.06 points in the $KSE_{t}$. S&P 500 futures will cause an increase of 0.2 points if increased by 1 point. Hang Seng 40 Index futures are having a positive impact on KSE-100 in a way that if it is increased by 1 point then KSE-100 index's returns will move upward by 0.16 points. Mexico's IPC Index Futures if increased by 1 point then KSE-100 Index will decrease by 0.025 points, which is insignificant increase. Increase in the Hang Seng China Enterprises Index Futures by 1 point will decrease the returns of KSE-100 Index by 0.128 points. Australia's S&PASX200 Index Futures will cause an insignificant decrease of 0.0305 points in the returns of KSE-100, if it is increased by 1 point. Africa's FTSE/JSE Africa Top 40 Index futures and Germany's Xetra DAX Index Futures if increased by 1 point will insignificantly increase the returns of KSE-100 Index by 0.022 and 0.005 points respectively. SGX CNX Nifty Index Futures of India if increased by 1 point will cause a positive change in the returns of KSE-100 Index by the significant amount of 0.074 points.

The fitness of the model is explained by $R^2$ of the model. According to the result provided in the table 4, the value of $R^2$ is equal to **0.0956**, and p-value off-statistic, which is **0.00**, it means that around 10% of the changes in the KSE-100 Index of spot stock market are explained by this VAR model and the model is highly significant. It can be also be said as, that 10% of the movements in the returns of KSE-100 Index are due to the changes in the foreign future stock indices. Autocorrelation is found out by using the Durbin-Watson's value; if this value is around two then the data is not auto-correlated. The value of Durbin-Watson, which is equal to **2.019**, shows that there is no autocorrelation in the given data.

According to the results of VAR model, Alternative hypothesis, which is "foreign futures stock indices lead KSE-100 index", is accepted for Hang Seng 40 Index Futures,S&P 500 futures,SGX CNX Nifty Index Futures, and Hang Seng China Enterprises Index Futures. While Alternative hypothesis is, rejected and null hypothesis is accepted in case of IPC Index Futures, S&PASX200 Index Futures, Xetra DAX Index Futures,and FTSE/JSE Africa Top 40 Index futures.

## Table 4: Vector Autoregressive Model

| | Coefficient | Std. Error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 0.000645647 | 0.000352064 | 1.8339 | 0.06711 | * |
| KSE-100 (one-lag) | 0.0168798 | 0.0368873 | 0.4576 | 0.64738 | |
| KSE-100 (two lag) | 0.0687499 | 0.0365937 | 1.8787 | 0.06071 | * |
| S&P 500 futures | 0.211453 | 0.0771825 | 2.7396 | 0.00631 | *** |
| Hang Seng 40 Index Futures | 0.162869 | 0.0876667 | 1.8578 | 0.06362 | * |
| Xetra DAX Index Futures | 0.00510371 | 0.0499226 | 0.1022 | 0.9186 | |
| Hang Seng China Enterprises Index Futures | -0.128243 | 0.070833 | -1.8105 | 0.07066 | * |
| S&PASX200 Index Futures | -0.0305754 | 0.0603872 | -0.5063 | 0.61279 | |
| FTSE/JSE Africa Top 40 Index futures | 0.0220171 | 0.0392934 | 0.5603 | 0.57544 | |
| IPC Index Futures | -0.0246147 | 0.0494096 | -0.4982 | 0.61852 | |
| SGX CNX Nifty Index Futures | 0.0743565 | 0.0353227 | 2.1051 | 0.03565 | ** |
| | | | | | |
| Mean dependent var | 0.000851 | | S.D. dependent var | 0.00956 | |
| Sum squared resid | 0.057224 | | S.E. of regression | 0.00915 | |
| **R-squared** | **0.0956** | | Adjusted R-squared | 0.08236 | |
| F(10, 683) | 7.219704 | | **P-value(F)** | **0.0000** | |
| rho | -0.010105 | | **Durbin-Watson** | **2.01918** | |

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## 5. Conclusion

The objective of this study is to find wether any lead-lag relation exists between KSE-100 Index and several global futures indices.This analysis is important for knowing cross-border ability of stock futures indices to predict movements of spot stock index and for international diversifications of portolios. For this purpose, data of nine indices were collected for the period of around three years starting from 18-11-2009 and ending on 03-12-2012. Econometric model of Vector autoregression (VAR) was used for this purpose. The result of VAR shows that four out of eight future indices significantly lead the spot index of KSE-100 Index. There exists an evidence that foreign stock futures indices lead the stock spot index of KSE-100 Index. Stock futures indices of the US, China, Hong Kong and India significantly lead the stock spot index of KSE-100 Index. Germany, Africa, Australia and Mexico's futures indices show insignificant lead-lag relationship with KSE.

There can be several reasons for this behavior of these indices. Factors like geographical location of the markets, trading between countries, foreign direct investments, political affiliation, investors' awareness and other factors can directly/indirectly effect behavior of these foreign indices.

The inflow of foreign direct investment from the US to Pakistan is higher compared to other countries. The US is also a major trading partner of Pakistan. Investors have more access to news and information regarding US market. US government officials also play a vital role in economic policy making of Pakistan. These can be fewer reasons for S&P 500 futures to lead KSE-100 Index.

India's SGX CNX Nifty Index Futures and China's Hang Seng China Enterprises Index Futures both lead the KSE-100 Index and that can be partially due to the factor that these countries are direct neighbors of Pakistan. China's is also having a huge chunk of foreign direct investment in Pakistan during the period of study, relations between Pakistan and India are getting stable by the day compared to a few years back. Import and export between Pakistan and China may also contribute to the phenomena. People migrated from India to Pakistan are mostly settled in Karachi, which is Pakistan's industrial hub, due to their sentiments with the India may also have some impact on the capital market of Pakistan.

Hang Seng 40 Index Futures of Hong Kong are also significantly leading Karachi stock exchange's KSE-100 Index and the reasons that might contribute to this relationship can be the position of Hong Kong as a financial hub of Asia and Asia's trade route with the world.

Germany's Xetra DAX Index Futures, Australia's S&PASX200 Index Futures, South Africa's FTSE/JSE Africa Top 40 Index futures, and Mexico's IPC Index Futures have shown no significant lead-lag relationship with Karachi stock exchange's KSE-100 index. There must be many factors affecting this relationship of these futures and spot. Even though Germany have invested comparatively large amount in Pakistan still there is not any lead-lag relation between KSE-100 Index and Xtra DAX index futures. These foreign futures indices with no significant lead-lag relationship with KSE-100 Index could be due to several other reasons such as low awareness of investors regarding capital markets of these countries, no geographical locational advantage of these counties, low trade with these countries, and no direct intervention in the policy making of Pakistan.

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# نظرة على العلاقة بين التحضر والنمو الاقتصادي في الصين: نموذج تحليل زمني (1961-2011)

# An Insight into the Relationship between Urbanization and Economic Growth in China: An Intertemporal Analysis (1961-2011)

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## الملخص

تهدف الدراسة الى البحث في العلاقة بين التحضر والنمو الاقتصادي في سياق تحليل زمني للاقتصاد الصيني. المعلومات الثانوية حول التحضر والتطور الاقتصادي في الصين مأخوذةمن دبليو دس اي 2011-. تنقسم طريقة الدراسة الى قسمين. الاولى وصف تحليلي عام للتحضر والنمو الاقتصادي وذلك لاستيعاب العلاقة المتبادلة بين المتغيرات في سياق تاريخي. والثاني تم تطبيق سلسلة من اختبارات السلسلة الزمانية لتقديم نظرة حول العلاقة بين التحضر والنمو الاقتصادي في سياق ديناميكي زمني. وتظهر الدراسة ان سببيةغرانجر ذات اتجاه واحد يسير من التحضر الى النمو الاقتصادي. وتظهر الدراسة ان التحضر في

الصين في ارتفاع مستمر منذ 1974، وقد سبب زيادة ملحوظة في النمو الاقتصادي بمعدل ٪4 لكل وحدة تحضر. هناك علاقة قائمة بين التحضر والنمو الاقتصادي وإذا ظهرت اي صدمة لتغيير هذه العلاقة فان الاقتصاد قادر على تصحيح نفسه بمعدل ٪18 كل عام.

واخيرا تظهر الدراسة ان معدل التحضر والنمو الاقتصادي في الصين اعلى منه عن اميركا. لقد حصل التطور الاقتصادي في اميركا في عام 1940 عندما اقتربت نسبة التحضر من ٪60 بينما يحصل نفس التطور في نسبة الفرد من الناتج الاجمالي الصيني بمعدل اقل من ٪20 من التحضر. وبعد المواصفات المتعددة تقترح الدراسة ان التحضر في الصين يمكن التنبؤ به باستخدام المعادلة متعددة الحدود. وبنفس الطريقة فان الدراسة تقترح بان البيان الارتدادي 1 للتحضر هو الشكل الدالي الصحيح للاقتصاد الصيني للتمثيل الديناميكي للعلاقة بين التحضر والنمو الاقتصادي مع ابقاء تأثيرات العوامل الاخرى ثابتة. وتحذر الدراسة القائمين على التحضر في الصين بان الزيادة المطردة للتحضر سوف تزيد الضغوط على الموارد المدنية في المستقبل.

# نظرة على العلاقة بين التحضر والنمو الاقتصادي في الصين: نموذج تحليل زمني (1961-2011 )

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## Abstract

**This study aims to provide an insight into the relationship between urbanization and economic growth in intertemporalcontext for Chinese economy.Secondary time series data regarding the urbanization and economic growth have been takenfrom WDI-2011. The methodologyof the study is twofold; first, a descriptive generalized analysisof urbanization and economic growth has been carried out to comprehend the mutual relationship between the variables in a historical context. Second, a set of time series tests have been appliedto provide an insight into the relationship between urbanization and economic growth in dynamic and intertemporalcontext. The study reveals that Granger causality is uni-directional and from urbanization to economic growth. The study further reveals that urbanization is consistently increasing in China since 1974 causes a significantincrease in economic growth by 4 percent per unit of urbanization. There is a long run relationship between urbanization and economic growth and if any shock occurs to disturb this relationship the economy has the potential to restore itself at the rate of 18percentage point per annum. Finally, the study reveals that urbanization and economic growth rate in China is faster than the US. The economic expansion in US occurred in 1940 when the urbanization rate approached to 60% while the same expansion in Chines GDP per Capita is experienced at the rate of less 20% of urbanization. After multiple specifications the study suggests that urbanization in China can appropriately**

**be predicated by using the suggested polynomial equation. Similarly, the study suggests that AR-1 with urbanization is the appropriate functional form for the Chinese economy to dynamically model the relationship between urbanization and economic growth, keeping the effect of all other factors constant. The study alerts the urban administrations of china that persistent rise in urbanization will increase the pressure on urban resources in future.**

**Keywords:** Urbanization, Economic growth, intertemporal analysis

**JEL codes:**O180, O400, C52

# 1. Introduction

Urbanization and economic growth have long been regarded as a mutually interrelated process. Economic progress is often proxy by the degree of urbanization and number of large cities (Lo, 2010). In fact, the development history of many present-day developed nations has clearly demonstrated a dramatic rise in urbanization as their economies grew (Hughes and Cain, 2003). Numerous Studies across the world have revealed that there is a strong significant relationship between the percentage of urban residents in a county and GDP per capita(Henderson, 2003).

It has been widely recognized by economists that urban places exist largely because of some sort of agglomeration economies in production that is not present in rural environments. Thus, apart from firm-level internal scale economies, firms could also benefit from increasing returns to scale arising from larger urban concentrations. Hochman (1996) argued that firms could benefit economically by spatially concentrated in a smaller area. They could reduce search costs and information costs for labor, suppliers and potential customers. Knowledge about productions, sales strategies, marketing etc. could be shared extensively among the producers. Viewing the society as a whole, by crowding population into large urban areas, urbanization can enhance efficiencies in terms of provision of infrastructures, law enforcement, social goods and services. (Abdel-Rahman et al., 2006; David Segal, 1976) statistically found that cities with populationsgreaterthan 2 million are on average 8% more productive than cities less than 2 million.

Recently, studies tended to lay heavy emphasis on econometrically testing the impact of urbanization on economic growth using more advanced mathematical techniques. Moomaw and Shatter (1993) related growth and different measures of urbanization using regression techniques and concluded that urban concentrations might stimulate economic growth. In their subsequent study (Moomaw and Shatter 1996), they revealed that urbanization not only increases with per capita GDP but also with industry share of GDP. Similar empirical evidences can be found in Abdel-Rahman et al. (2006), which showed, in a cross sectional analysis, a statistically significant positive relationship between level of urbanity and standard of living, measured by real per capita GDP. Henderson (2003) contributed by specifying a non-monotonous effect of urban dominanceongrowth, indicating a spectrum of values of optimal dominance level, below which urban concentration promotes productivity. He further suggested that the optimal degree of urban concentration varies with the level of development and country size. During his cross-country productivity studies, he pointed out that urbanization per se does not drive the growth, rather it is the urban concentration (or the degree to which urban resources are concentrated in one or two large cities) that is more relevant.

Determining the long run effects based on simple cross section techniques may produce biased and inconsistent results. Studying the relationships in the framework of time series may greatly facilitate our understanding of the interrelation of urbanization and growth, truly capturing the dynamic and temporal nature of the question. The present study will follow this approach and put the problem in the context of temporal analysis.

This general objective of the study is to investigate the relationship between urbanization and economic growth forthe Republic of China. This study focuses on three important objectives; Firstly, to provide an insight tothe relationship between urbanization and economic growth in a more comprehensive way. Secondly, to investigate the causal relationship between urbanization and economic growth. Thirdly, to dynamically specify the relationship between urbanization and economic growth for the Chinese economy.

# 2. Material and Methods

## 2.1 The data

The selected period of study is 1961-2011. The data about the selected variables; urbanization (Urban population) and economic growth (real GDP per capita) have been taken from World Development Indicators (WDI-2011). Apart from data availability, the reason we focus on such a relative long-term relationship is that it will mainly reflect the structural differences, rather than simply temporary convergences and divergences of the two processes influenced by other exogenous factors.

## 2.2 Methodology

The methodology of the study is twofold; First portion consists of a descriptive analysis to provide an insight of the relationship between urbanization and GDP per capita inChina since1961-2011. While the second part comprises dynamic temporal analysis to provide an insight to determine the relationship between urbanization and economic growth.

### 2.2.1 Descriptive Analysis

This portion consists of four parts which provide an insight to determine the relationship between urbanization and economic growth (GDP per capita) for the Republic of China.

1. Urbanization trend in China since1961-2011.
2. Urbanization and GDP per capita in China from1961-2011.
3. The relationship between urbanization and GDP per capita (in terms of simple index) in China from 1961-2011.
4. Correlation between urbanization and GDP per capita 1961-2011.

## 2.3 Econometric Modeling

Time series data require the assumption of stationarityof the given time series to produce consistent and unbiased results. In order to check the stationarityof the given data we first employ Augmented Dickey-Fuller (ADF) test including trend and drift by empirical specification.

### 2.3.1 Augmented Dickey-Fuller (ADF) Test

Next we check the stationarityof time series by using Augmented Dickey-Fuller test (ADF)

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t, \quad (1)$$

Where $\alpha$ is a constant, $\beta$ the coefficient on a time trend and $p$ the lag order of the autoregressive process and Ytis the variable of interest for checking stationarity. Optimal lags have been selected on the basis of Schwarz's information Criterion (SIC) and Akaike's Information Criterion (AIC).

If both variables of interest integrated of the same order like one (I(1)) or (I (2)) then next it is then checked for co-integration. In this case the variables of interest are urbanization (Urban population) and economic growth (real GDP per capita).

## 2.3 Co-integration Test

### 2.3.1 Engle-Granger Co-integration test

If two or more time series are individually integrated but some liner combination of them has a lower order of co-integration than the series are said to be Co-integrated series. Engle and Granger (1987) two step methodology was adopted for this paper.

### 2.3.2 Error Correction Model (ECM)

When variables of interest are co-integrated then the relationship between the two variables can be expressed as an error correction model (ECM), in which the error term from the OLS regression, lagged once, acts as the error correction term. In this case the co-integration provides evidence of a long-run relationship between the variables, whilst the ECM provides evidence of the short-run relationship. A basic error correction model would appear as follows:

$$\Delta y_t = \chi_0 + \chi_1 \Delta x_t - \tau(u_{t-1}) + \varepsilon_t \qquad (2)$$

Where τ is the error correction term coefficient, which theory suggests should be negative and whose value measures the speed of adjustment back to equilibrium following an exogenous shock. The error correction term $u_{t-1}$, which can be written as: $(y_{t-1} - x_{t-1})$, is the residual from the co-integrating relationship.Ytrepresents the natural logof real GDP per capita while $X_t$ representsthe naturallogof urbanization (Urban population), where the Δ represents the first difference.

### 2.4 Granger causality test

Co-integration is a necessary but not sufficient condition for causality. In this study, we applied Granger's causality test (1969, 1988) to examine the causal linkage between the two series. Theoretically, a time series $X_t$Granger-causes another time series $Y_t$if the addition of past values of $X_t$contributes significantly to the explanation of variations in $Y_t$,other things being constant (Pindyck and Rubinfeld, 1998).

### 2.5 Dynamic specifications of urbanization and economic growth for the Chines economy

Autoregressive model of order one (AR-1) along with urbanization variable is the best model to capture the changes in real GDP per capita for Chineseeconomy.This specification has been employed by using certain econometric tests (normality of residuals, pure and conditional hetroskedasticity,dynamic misspecification, RESET test etc.). The model has been specified as:

$$Ln(GDP\ per\ capita) = \alpha + \beta\ ln(urban\ popn) + \pi\ ln(GDP\ per\ capita\ (-1) \quad (3)$$

Lag lent in AR-1 along with urbanization variable has been specified by using a joint restriction Wald test.

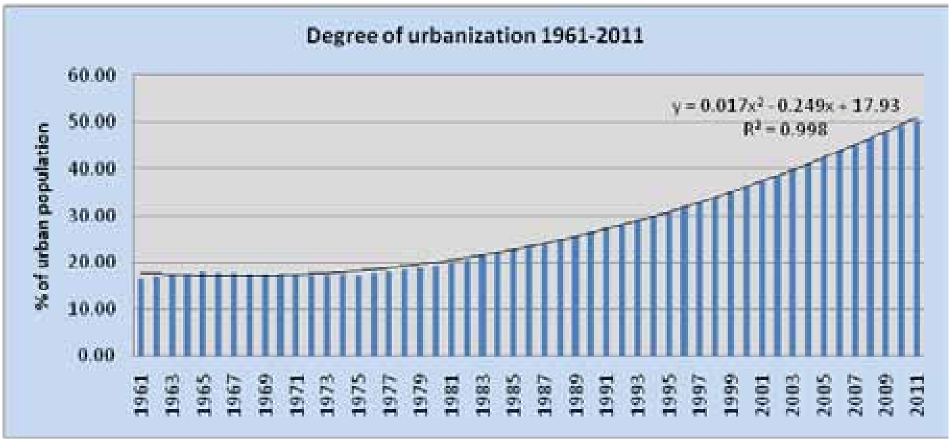
## 3. Results and Discussion

This study provides an insight to understand the relationship between urbanization and economic growth in diverse contexts. The study uses various techniques to comprehend the relationship between the variables of interest (urbanization and economic growth) to approach an appropriate functional form of urbanization and economic growth for the Chinese economy.

### 3.1 Urbanization in China: A time series perspective

Like the rest of the countries of the world, urbanization in China is also a recent phenomenon. Until 1978 urbanization rate was slow and volatile in china. Afterward, a consistent increase in urbanization occurred. In order to capture this behavior of data, after multiple specifications finally, polynomial equation has been specified because this functional form has the ability to effectively capture the underlying pattern of change of the urbanization process in China. We can predict that what will be the percentage of urban population forany given future year. The following figure shows the historical evidence about the degree of urbanization in China.

**Figure-1: Degree of Urbanization in China (1961-2011)**



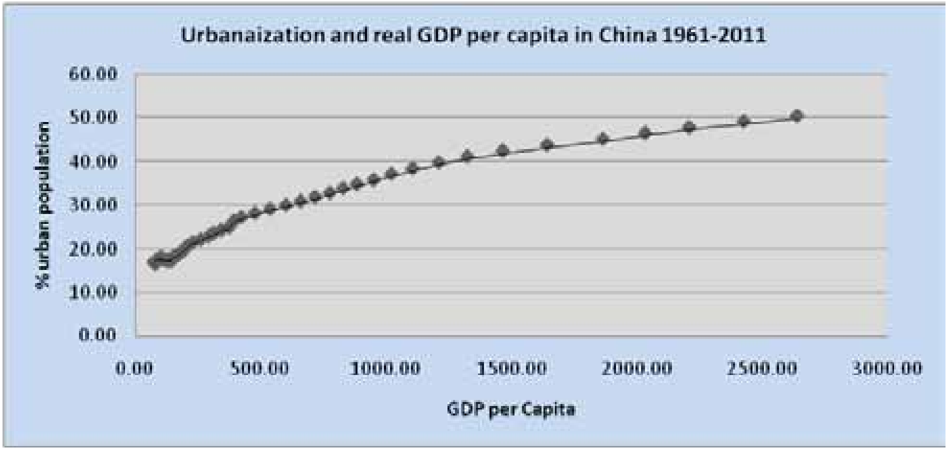

(Source: constructed from the WDI 2011 data set for China)

## 3.2 Urbanization and Economic growth in China

The historical and empirical relationship between urbanization and economic growth is important to understand the current scenario and estimate future trends. These calculations are also important to compare and contrast Chinese economy with the developed economies of the world to investigate how far behind or ahead the economic progress of China is. The following figure shows the relationship between urbanization and economic growth. After multiple specifications, it has been concluded that two year moving average is the best method to capture the given data pattern and make predictions[1].

(1) For detail of specification of relationship between GDP per capita and urbanization please see appendix-1

**Figure-2: Urbanization and Economic growth (1961-2011)**

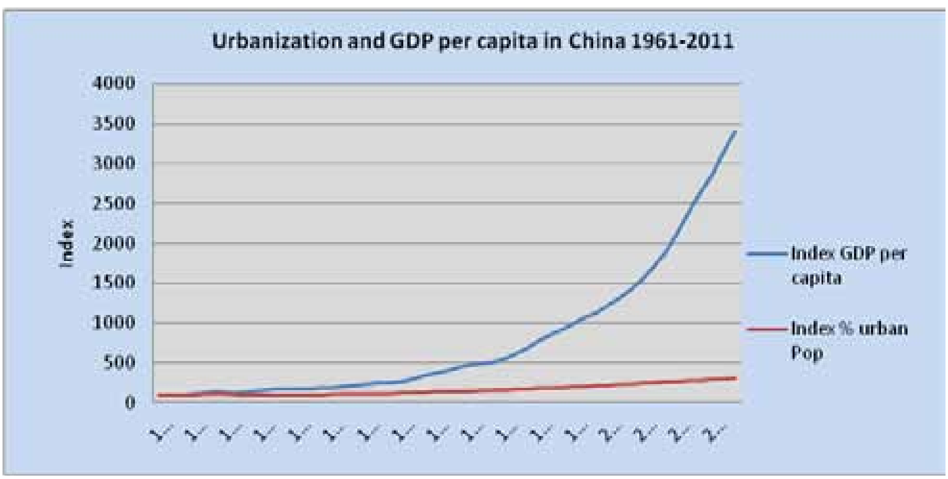



(Source: constructed from the WDI 2011 data set for China)

### 3.3 Urbanization and Economic growth in terms of indices

The relation between urbanization and GDP per capita is striking. Historical data provide some insights into the evolution of urbanization and per capita income over time. In the United States, urbanization rates and per capita income moved together until about 1940, when urbanization reached close to 60 percent; thereafter per capita income expanded much more rapidly. Presumably, in the initial phases, when urbanization rates and per capita income increase at roughly thesamerates, productivity increases reflectshifting resources from lowerproductivity rural activities. In later phases rapid productivity gains reflectmainlyimprovements within industries and services (Romer 1986).

**Figure-3: Urbanization and GDP per capita (1960-2011)**



The values of urbanization and real GDP per capita have been indexed at the beginning year (1961). The figure depicts that the economic growth (GDP per capita) and urbanization was approximately the same until 1973 for China. Afterwards, the GDP per capita expanded by exponential way leaving the urbanization rate far behind. Unlike America, the expansion in real GDP per capita forChina has been recorded at less than 20% of urbanization. This phenomenon reflects that China is going on a faster track than America to achieve the economic development goals.

## 3.4 Correlation between urbanization and economic growth

The following table reports the result of the correlation relationship between urbanization and real GDP per capita (real GDP per capita has been used as a proxy of economic growth throughout this paper).

**Table-1: Correlation between urbanization and economic growth (1960-2011)**

| | | Urbanization | GDP_PC |
|---|---|---|---|
| Urbanization | Pearson Correlation | 1 | 0.958** |
| | Sig. (2-tailed) | | 0.000 |
| | N | 51 | 51 |
| GDP_PC | Pearson Correlation | 0.958** | 1 |
| | Sig. (2-tailed) | 0.000 | |
| | N | 51 | 51 |

There is a very strong and statistically significant relationship between urbanization and economic growth in Chinese economy however, this does not show whether urbanization significantly influences the economic growth or it is the other way around? In order to resolve this problem we move for advance time series analysis.

## 3.5 Time series analysis of urbanization and economic growth (1961-2011)

As discussed earlier that modeling time series data require the stationarityof the given time series to produce consistent and unbiased results. In order to check the stationarity of the given data set we first employ Augmented Dickey-Fuller test (ADF) including trend and drift by empirical specification. The following table reports the stationarity result of the data with level and first difference. The result depicts that both variables are integrated of order one (I(1)). Finally, the data has been checked for co-integration by using Engle-Granger Co-integration test (1987). The linear combination of natural log of urbanization and natural log of economic growth (residual) is integrated of order 0 (I(0)) which represents that both variables are co-integrated and have a stable long run relationship.

**Table-2: ADF result for urbanization and economic growth at level and 1st difference**

| Variables | ADF level result | ADF 1st difference result |
|---|---|---|
| LnUrban | 0.146 | -3.58<br>0.048* (Probability) |
| LnGDP_PC | -1.625<br>0.7686 (Probability) | -5.57<br>0.002** (Probability) |
| Residual | -6.985<br>-0.000** (Probability) | N/A |

*,** represents significance at 5 and 1% respectively

The following table reports the result of ECM representing the short term relationship between degree of urbanization and GDP per capita and speed of adjustment of the model.

$$\Delta y_t = \chi_0 + \chi_1 \Delta x_t - \tau(u_{t-1}) + \varepsilon_t \quad \rightarrow \text{Error Correction Model (ECM)}$$

Where τ is the error correction term coefficient, which theory suggests should be negative and whose value measures the speed of adjustment back to equilibrium following an exogenous shock. The error correction term $u_{t-1}$, which can be written as: $(y_{t-1} - x_{t-1})$,is the residual from the co-integrating relationship. $y_t$ represents the natural log of real GDP per capita while $x_t$ represents the natural log of urbanization (Urban population), where the Δ represents the first difference.

**Table-3: Error Correction Model (ECM) result**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| ΔLNURBAN_POP | 1.16 | 0.86 | 1.35 | 0.18 |
| LAG(Residual) | -0.18 | 0.08 | -2.25 | 0.05 |
| C | 0.02 | 0.03 | 0.85 | 0.39 |

The speed of adjust of equilibrium is -0.18. This represents that if a temporary disequilibrium occurs between economic growth and urbanization then the convergence rate of equilibrium will be -0.18.

Finally, we check Granger causality and then specify a dynamic function form of urbanization and economic growth for China. The following table reports Granger causality result.

**Table-4: Granger causality result**

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| LNGDP_PC does not Granger Cause LNURBAN_POP | 49 | 1.87 | 0.16 |
| LNURBAN_POP does not Granger Cause LNGDP_PC | 49 | 5.69 | 0.006 |

The granger causality result shows that there is a uni-directional relationship from urbanization to economic growth for Chinese economy based on the data set (1961-2011). This result is consistent with (Lo, 2010; Henderson, 2003). Finally, an appropriate dynamic specification has been approached after many specification tests. These specification testsare namely; normality of residuals, pure and conditional hetroskedasticity, dynamic misspecification, RESET test etc.

**Table-5: Result of dynamic specification model: GDP per capita and urbanization**

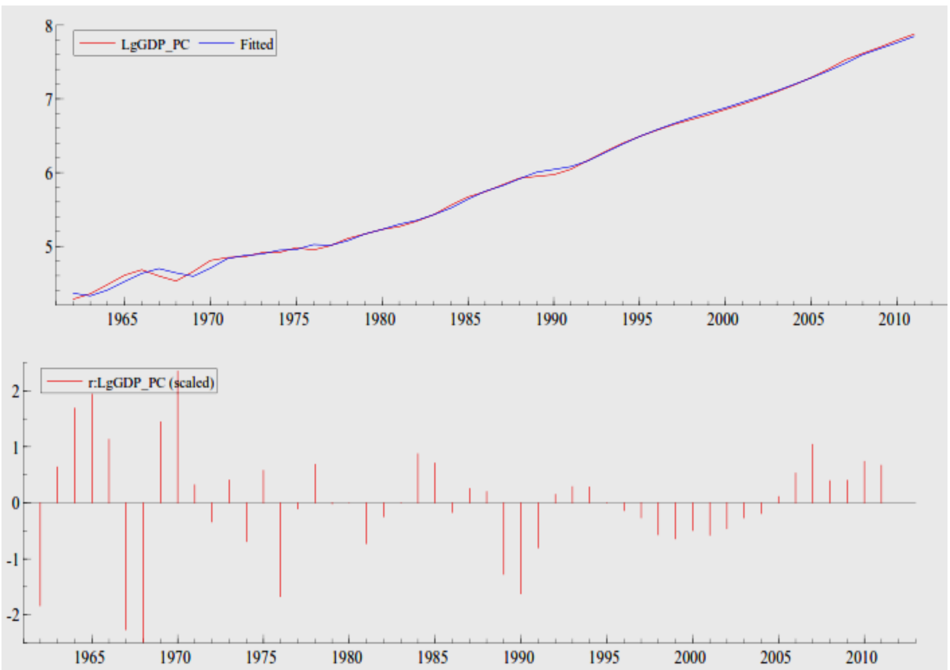
| | Coefficient | Std.Error | t-value | t-prob | Part.R^2 |
|---|---|---|---|---|---|
| LnGDPPC(-1) | 0.78 | 0.069 | 11.3 | 0.0000 | 0.7305 |
| Constant | -7.13 | 2.140 | -3.33 | 0.0017 | 0.1913 |
| Ln(urban popn) | 0.43 | 0.131 | 3.32 | 0.0017 | 0.1903 |
| sigma | 0.04 | RSS 0.091 | | | |
| R^2 0.998 | | F(2,47) = 1.443 [0.000]** | | | |
| log-likelihood 86.72 | | DW 1.89 | | | |
| No. of obsr. 50 | | no. of parameters 3 | | | |

$$Ln(GDP\ per\ capita) = -7135 + 0.044\ ln(urban\ popn) + 0.786\ ln(GDP\ per\ capita\ (-1) \tag{4}$$

The model reveals that if urbanization expands by 1 percentage point (means if the urban population increase by 1 percent) then the GDP per capita in China will increase by 4.4 percent keeping all the other factors constant. Similarly, current GDP per capita is also determined by the lag GDP per capita. Current expansion in GDP per capita cannot be modelwithtaking its lag values.

Keeping into consideration all these specification test results, it is concluded that the Autoregressive model of order one (AR-1) along with urbanization variable is the best model to capture the changes in GDP per capita for Chinese economy due to expansion of urbanization process. The following figure shows the actual values of real GDP per capita and dynamically estimated trend line. This trend line has been estimated with the help of equation number 4. The estimated line approximately coincides with the actual line which confirm the authentication of the specification of the model.

**Figure-4: Actual "real GDP per capita" and dynamically estimated trend line**




# 4. Conclusion and Policy Implications

## 4.1 Conclusion

This study aims to provide an insight into the relationship between urbanization and economic growth in empirical, intertemporalcontext for the Chinese economy. For this purpose, secondary time series data regarding the mentioned variables have been taken from WDI-2011. The methodology of the study is twofold; firstly, a descriptive generalized analysis of urbanization and economic growth has been carried out to comprehend the mutual relationship between urbanization and economic growth in a historical context. Secondly, a set of time series tests has been applied to provide an insight into the relationship between urbanization and economic growth in dynamic and intertemporalcontext. These tests are namely; co-integration test, Granger causality test, Error Correction Model (ECM) and dynamic specification model test of urbanization and economic growth. Finding of the study suggests that urbanization is consistently increasing in China since 1974 causes a significant increase in economic growth by 4 % per unit of urbanization. The study further reveals that Granger causality is uni-directional and from urbanization to economic growth. There is a long run relationship between urbanization and economic growth and if any shock occurs to disturb this relationship the economy will restore itself at the rate -0.18. Finally, the study reveals that urbanization and economic growth rate in China is faster than the US, because the economic expansion in US occurred in 1940 when the urbanization rate approached to 60% while the same expansion in Chinese GDP per Capita is experienced at the rate of less 20% of urbanization. After multiple specifications the study suggests that Urbanization in China can appropriately be predicated by using the suggested polynomial equation. Similarly the study suggests that AR-1 along with urbanization is the best specification for China to model the relationship between economic growth and urbanization keeping the effect of all other factors constant.

## 4.2 Policy Implications

Keeping findings of the study into consideration the following policy measures are suggested;

1. As there is a strong and significant correlation (95%) between economic growth and urbanization and Granger causation from urbanization to economic growth therefore this phenomenon is a strength as well as a challenge for the Chinese economythat how to enhance urbanization and urban concentration while targeting the optimal economic growth?
2. A continuous increasing tendency in the process of urbanization has been observed since 1970 with an estimated polynomial rate (Urbanization = 0.0176X2 -0.249X + 17.93). This situation suggests a future increasing pressure on urban resources and urban management institutions.
3. A rapid expansion in economic growth of China has experienced at a rate of less 20 percent of urbanization (while the US had experienced this expansion with 60% urbanization) suggesting that a big developing economy like China may have its own development track. This difference is either due to difference in human capital or urban concentration. (This issue can be resolved by future research).

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**Appendix-1: Various forms of specification of urbanization and economic growth**

Figure-1: Exponential trend

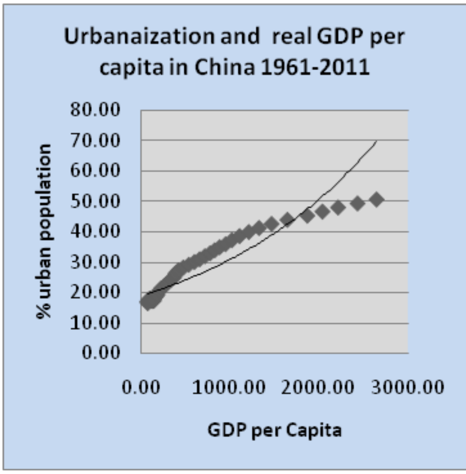



Figure-2: Linear trend

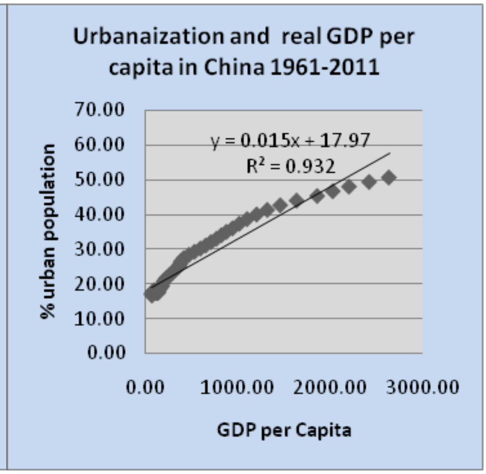



Figure-3 Logarithmictrend

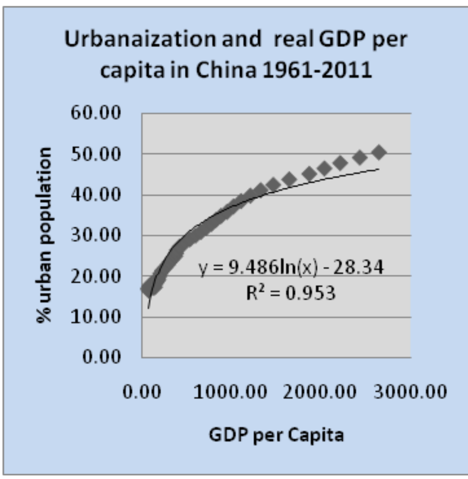
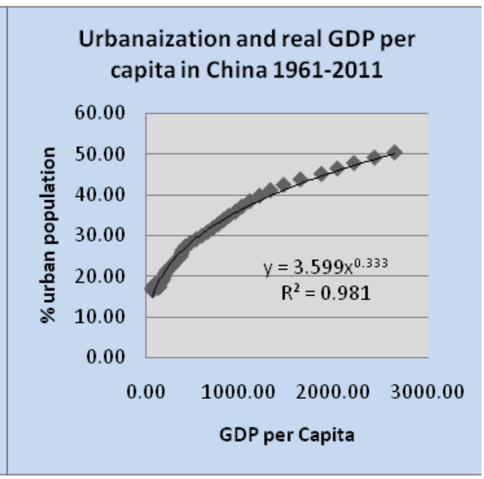



Figure-4: Power trend



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# Researches