# ECONOMETRICS TOOLS FOR SOCIAL SCIENCE RESEARCH

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#### ABSTRACT

Econometrics as a separate discipline has proved itself as a dominant method for its applicability in the researches of social science mainly. It has been evident of providing accurate and efficient results for the researchers. Econometrics literally means economic measurement. It generally takes the help of mathematics and statistics to prove the economic theories and support the economic model to answer the questions of the researchers. The study undertaken by the researcher studies about the sectoral impact of FDI using the econometric tools like Vector Auto Regression and Granger Causality Test. The econometric techniques are usually used for the quantification of the economic relationships.

#### **KEYWORDS:** *Econometrics, Applicability, Statistics, Economic Model.*

#### INTRODUCTION

Literal interpretation of the word econometrics means "economic measurement or the measurement in economic terms". Econometrics is the quantitative application of statistical and mathematical models using data to develop theories or test existing hypotheses in economics and to forecast future trends from historical data. [1]

According to Arthur S. Goldberger, "Econometrics may be defined as the social science in which the tools of economic theory, mathematics and statistical inference are applied to the analysis of economic phenomena". "Econometrics is concerned with the systematic study of economic phenomena using observed data" (Aris Spanos). From the above definitions it is observed that, It is the branch of economics which is concerned with the use of mathematical and statistical methods in describing, analysing, estimating and forecasting economic relationships. It is an amalgam of economic theory, mathematical economics, economic statistics and mathematical statistics. [2]

Econometrics was pioneered by Lawrence Klein, Ragnar Frisch and Simon Kuznets (Nobel Prize winners in Economics, 1971). Now, it is a regularly used phenomenon among academics as well as researchers. It analyzes data using statistical models to test or develop economic theories. An example of the application of econometrics is to study the income effect using observed data. The researcher may hypothesize that as a person increases his income, his spending will also increase. If the data shows that an association is present, a regression analysis can be conducted

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to understand the magnitude or strength of the relationship between income and consumption and whether or not statistically significant. [3]

It helps in the measurement of the mostly experienced things in the world: rents, prices, wages, interest rates, gross domestic product, inflation, changes in the economy etc.

Three are two kinds of econometrics: Applied Econometrics

Theoretical Econometrics

Applied econometrics is used to study some special fields of economics and business; production function, investment function, portfolio theory etc. and developing predictive models of how something will respond to specific changes in something else. [4]

Theoretical econometrics uses statistical methods such as regression analysis, probability to model how well economic models work or don't work.

It is an understanding of relations of economic data by using statistical model referencing and getting an observation or pattern from the collected data for developing the approximate future trend. It is simply economics with the additive of mathematics and statistics which helps in forecasting and estimation by applying statistical methods. The common methods are: [5]



- 1- Multiple Linear Regression
- 2- Estimate Theory
- 3- Linear Programming
- 4- Frequency Distribution
- 5- Probability Distribution
- 6- Correlation and Regression
- 7- Time- Series Analysis
- 8- Simulation Equation

A research work was conducted using the econometrics techniques for studying the impact of foreign direct investment on the sectoral development of the Indian economy in the postliberalisation era. The main objectives of the study were: **[6]** 

- To make comparative analysis of the FDI inflows to the key sectors of the Indian economy. To also study the patterns and trends of FDI inflows.( Data from 1990-91 to 2013-14)
- To study the impact of FDI inflows in each sector by considering some important economic variables like trade balance, GDP, growth rate in real GDP, employment etc.

This exploratory study will be empirical in make use of secondary data are to be collected from the research journals, periodicals, government publications, different websites etc. like

Publications of Ministry of Industry and Commerce, Reserve Bank of India, World Bank, IMF, UNCTAD etc. Apart from the use of descriptive statistical measures, some econometrics tools have been used for analysis and interpretation of the data. [7]

1. Test of Seasonality of all the variables

Analysis of any time series data for forecasting involves the identification of patterns that exists in the data like trend, seasonality, cyclicality and random variability. Seasonality is defined as the pattern of changes or randomness of change within a year.

Example- Knowledge of seasonality of sales or price data may be critical to management decisions concerning production planning, inventory levels, sales promotion etc. it is necessary to be able to predict variations in time series that are attributable to seasonality and act accordingly.

The main use of seasonality adjusted time series are for short-term forecasting and policy analysis. By seasonality, we generally mean periodic fluctuations or variations in the data. For example- the retail sale of air conditioners tend to peak for the summer season and then decline after that season. So the time series will show an increasing sale from March to June and declining sales afterwards. If seasonality is found in the data then, it must be removed by using some seasonal dummy variables. **[8]** 

In our study, no seasonality is found except in the agricultural sector.

2. Unit Root Test

For any econometric study, the first step is to check the stationarity of the variables (stationarity means the mean and variance of the time series do not vary systematically over time). A unit root is a stochastic (random) trend in a time series. Sometimes also called as "a random walk with drift". If a time series has a unit root, it shows a systematic pattern that is unpredictable. The reason behind its name is because of the mathematics behind the process. At a basic level, a process can be written as a series of monomials (expressions with a single term); each monomial corresponds to a root. If one of these roots is equal to 1, then that's a unit root. In a time series, the existence of unit roots can cause serious issues for the analysis: **[9]** 

Spurious Regressions: we can get high r- squared values even if the data is not correlated.

Errant Behaviour: due to assumptions for analysis not being valid.

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Unit root tests are tests for stationarity in a time series. A time series has stationarity if a shift in time doesn't cause a change in the shape of the distribution. Unit roots are the cause for non-stationarity of the time series data. This test is assumed to have low statistical power. **[10]** 

Where t is the time or trend variable, in each case the hypotheses are:

- → Null Hypothesis:H<sub>0</sub>: 6=0(i.e. there is a unit root or the time series is nonstationary or it has stochastic trend)
- $\rightarrow$  Alternative Hypothesis: H<sub>1</sub>: 6<0 ( i.e. the time series is stationary, possibly a deterministic trend)

The unit root test is used for individual variables of time series data with the purpose of ensuring the variables are integrated. This study uses the Augmented Dickey Fuller (ADF) test for unit roots. This ADF test includes the extra lagged terms of the dependent variables in order to eliminate autocorrelation. In this study, all series have unit root except log of FDI (LFDI) that means except LFDI all series are non- stationary. As it is not possible to check the long run relationship between the variables. So, the short run dynamic relationship of the three variables (GDP, FDI, and TRADE BALANCE) is studied. **[11]** 

3. Vector Auto Regression (VAR)

This forecasting algorithm that can be used when two or more time series influence each other i.e. the relationship between the time series involved is bi-directional. Each variable is modelled as a linear combination of past values of itself and the past values of the variable in the system. It was developed by C.A. Sims. According to Sims, if there is true simultaneity among a set of variables, they should all be treated on equal parameters; there should not be any prior distinction between endogenous and exogenous variables. It is the reason that led Sims developed his VAR model. [Exogenous variable is one whose value is determined outside the model and is imposed on the model. Endogenous variable is determined by the model.] **[12]** 

Calculate the value of variables Y<sub>1</sub>, Y<sub>2</sub>, time-t

To calculate  $Y_{1(t)}$ , VAR will use the past values of both  $Y_1$  and also  $Y_2$  and to compute  $Y_{2(t)}$ , the past values of  $Y_1$  and  $Y_2$  are used.

$$Y_{1,t} = \alpha_1 + \beta_{11,1} Y_{1,t-1} + \beta_{12,1} Y_{2,t-1} + \varepsilon_{1,t}$$

 $Y_{2,t} = \alpha_2 + \beta_{21,1} Y_{1,t-1} + \beta_{22,1} Y_{2,t-1} + \varepsilon_{2,t}$ 

Where, Y {1, t-1} and Y {2, t-1} are the first lag of time series  $Y_1$  and  $Y_2$  respectively. The above equation is referred as VAR (1) model, because each equation is of order 1, that is it contains up to one lag of each of the predictors ( $Y_1$  and  $Y_2$ ).

In our study, Vector Auto Regression is used to investigate the dynamics of the relationship between FDI and other variables like GDP, Trade balance, income etc. Results suggested that there is bi-directional causality between Trade Balance and GDP in the service sector.

4. Pair-wise Granger Causality Test

Because Vector Auto Regression models describe the joint generation process of a number of variables, they can be used for investigating relations between the variables. A specific type of relation was pointed out by Granger (1969) and is known as Granger- causality. Granger called a

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variable  $Y_{2t}$  causal for a variable  $Y_{1t}$  if the information in past and present values of  $Y_{2t}$  is helpful for improving the forecasts of  $Y_{1t}$ . This tests the null hypothesis that the coefficients of the past values in the regression equation are zero. The past values of time series (X) do not cause the other series(Y). So, if the p-value obtained from the test is lesser than the significance level of 0.05 then, you can safely reject the null hypothesis. We can test the relationship between variables without model building.

Example- p-value at 0.0003(represents p-value of Grangers Causality Test) which is less than the significance level of 0.005. So, null hypothesis is rejected. The results show that there exists a uni-directional causal relationship between GDP in agriculture and FDI in India. GDP in agriculture has a short run dynamic relation with FDI inflow in India. **[13]** 

It is of vital importance to the firm that forecasts of sales, prices or any other variable of interest to be as accurate as possible. Economic time series commonly contain a seasonal element affected by annual patterns of different variables. Many important policy decisions of the management depend largely on the forecasting which ultimately depends on the available data and its analysis. Although statistical tests determine the correctness of the data collected and its results, the econometrics tools and techniques should be used to prove the authenticity and pattern of data and its effect and relationship with other variables.

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