# Project-Oriented Dissertation

## On

## "THE INDIAN SHADOW ECONOMY: SHRINKING OR EXPANDING?"

Submitted To:

**Central University of Jharkhand, Ranchi**

**In Partial Fulfillment Of The**

**Requirement**

**Of**

**BACHELOR OF ARTS IN ECONOMICS**

Under Guidance Of:

**AISHWARYA DHAWAN**
**(Assistant Professor)**

Submitted By:

**JAISHREE JOSHITA**



**Centre for Education**

**Central University of Jharkhand,**

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(CUJ/I/2015/BABED/05)



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# DECLARATION

I, **Jaishree Joshita**, a student of four years integrated B.A.B.Ed. course, certify that the work entitled **"The Indian Shadow Economy: Shrinking or Expanding?"** is a record of original work done by me in partial fulfillment of the requirement for the award of the Degree of **"Bachelor of Arts"** in **"Economics"** under the supervision of **Assistant Professor Aishwarya Dhawan** at **Centre For Education, Central University of Jharkhand, Ranchi.**

I declare that I have faithfully acknowledged, given due credit to and referred to the research workers whenever their work have been cited in the text and in the body of dissertation. I further certify that I have not wilfully lifted up some other's work, para, text, etc. or available at websites & included them in this project-oriented dissertation and cited as my own work. Moreover, this work has not been submitted to any other university or institute for the award of any respective degree or diploma.

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**Central University of Jharkhand**

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# <u>Certificate from the Supervisor</u>

The project oriented dissertation titled **"The Indian Shadow Economy: Shrinking or Expanding?"** submitted by **Jaishree Joshita**, Centre For Education, Central University of Jharkhand, Ranchi, as a part of the Bachelor's Program, is an original piece of work has been carried out under my supervision for the partial fulfillment of the requirements of the Degree of **"Bachelor of Arts"** in **"Economics"**.

**Aishwarya Dhawan**

**Assistant Professor, Center for Education**

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# <u>Certificate from the Head of the Centre</u>

This is to certify that the contents of the project-oriented dissertation titled "**The Indian Shadow Economy: Shrinking or Expanding?**" by **Jaishree Joshita**, submitted to Centre for Education, Central University of Jharkhand for the award of the degree of **"Bachelor of Arts"** in **"Economics"** is an original research work carried out by her under the supervision of Assistant Professor Aishwarya Dhawan. This report has not been submitted either fully or partly to any other university or institute for the award of any degree or diploma.

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# <u>**Certificate of Approval**</u>

This is to certify that the project-oriented dissertation titled **"The Indian Shadow Economy: Shrinking or Expanding?"** submitted to the Centre for Education, Central University of Jharkhand in partial fulfillment for the degree of **"Bachelor of Arts"** in **"Economics"** is a work carried out by **Jaishree Joshita** under the guidance of Assistant Professor Aishwarya Dhawan.

All help received have been duly acknowledged. No part of this project-oriented dissertation have been submitted anywhere.

**External Examiner(s)**

# Abstract

*Indian Economy can be considered as a giant Elephant which moves at slow place, this way of allegory is given to countries to understand the pace of their economic growth, likewise for Australia, it is stated as Kangaroo, New Zealand as Kiwi, Russia as Bear, US as Eagle, etc. Indian Economy is an amalgamated phenomenon of Formal Economy and Shadow Economy. Formal Economy refers to those economic activities which are accountable and transparent in the eyes of government. Whereas on the other hand, there is shadow economy, which refers to those economic activities that are not accounted for because there are no physical measure to do that. Shadow Economy differs from the formal economy in terms of technology, economies of scale, use of labor intensive processes, absence of well-maintained accounts and not regulated by the government under any statue.*

*The Importance of Indian Shadow Economy is not less than the Formal Economy but it is often neglected in studies. A large part of total economy is contributed by shadow economy i.e. it accounts for more than 50 percent of national output and more than 90 percent of the workforce. Thus, it is imperative to study shadow economy to analyze the Indian economy and make better policies for further rejuvenate the development path of the country. Although, Shadow Economy is not officially regulated yet it is affected by new economic policies, economic changes and technological advancements in terms of its size and characteristics. This work is an attempt to analyze the change in size (in terms of percentage contribution to total GDP) of shadow economy over the time period 1991 to 2016 using Electricity Consumption Method. Along with this, the effect of recent economic changes i.e. Demonetization, Goods & Services Tax and Online Economy is also examined.*

**Keywords:** *Shadow Economy, Formal Economy, Economic Reforms, Electricity Consumption Method, Total GDP*

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Jaishree Joshita

# Contents

# List of Figures

# List of Tables

# Chapter 1
# Introduction

❖ General Introduction

❖ Genesis of Shadow Economy

❖ Definition of Shadow Economy

❖ Typologies of Shadow Economy

❖ Characteristics of Shadow Economy

❖ Shadow Economy in Indian Scenario

❖ Approaches to Measure Shadow Economy

*"The inconsistency between the predictions of conventional microeconomic theories and the 'facts' of economic life have led to a re-examination of both the theories and facts"*

- Edgar L. Feige

*"To paraphrase Granovetter (1985, p. 334), small may not be beautiful, but it is certainly bountiful, and the combined activities of small and unregulated operations now appear to be of more than marginal significance"*

- Portes & Sassen-Knob (1987)

*"Selling oranges in a grocery store is a formal economic activity. Selling them on highway exit ramp in Los Angeles County to passing motorists is an informal activity.*

*Likewise, producing T-shirts in a factory where labor and health standards are not enforce is an informal economic activity"*

- Marcelli, Pastor, & Joassart (1999)

*"Let's face it, the informal economy exists because it is financially advantageous - at least in the short run - for both the employer and the employee. The demand side wants a job done at a discount; the supply side wants the cash."*

- Milwaukee Journal Sentinel (2001)

*"There are probably few people who do not, at some level, have mixed feelings about informal economic"*

- Harding and Jenkins

# 1. Introduction

In order to make robust economic policies and to predict the future economic scenario of a country, one cannot neglect the study of Shadow Economy along with the Formal Economy. The Shadow Economy plays a vital role in economic development and growth of all the countries. Particularly, it contributes half of the economy of developing nations such as, India. It is a source of employment to more than 90 percent of the workforce in India which reduces the problem of unemployment substantially. Therefore, it's potential for growth and contribution for sustaining livelihoods has confirmed it's legitimacy as a viable sector of the economy. The term "Shadow" itself suggests that this economy is not regulated by the government in any form. The size, income, and labor force of shadow economy is obscure to the government that is why it is difficult to study. Agriculture, Construction, and Household Enterprises are the key sectors that contain a large part of the shadow economy along with some small enterprises, i.e., vegetable vendors, brokers, agents, foot-path traders, etc. The existence of shadow economy has also some negative contribution to the economy such as, tax evasion, negligence of labor rights, harmful working conditions, and corruption etc. which result in tax revenue loss and ineffective public policies.

In spite of hidden nature of shadow economy, it is affected by the economic policies, economic reforms and changes introduced by the government that has affected its size over the years. There are two factors to represent the size of the shadow economy - total labor force and percentage contribution to the total GDP. Between these, the later one is more powerful to study the overall economic nature of a nation. It is very difficult to measure the size of the shadow economy however some tools are available that can give estimate of the size. One of the tool is Electricity Consumption Method that assumes electricity consumption as a proxy for total economy and estimate the growth of the shadow economy in real time. The same method is used in current study along with a brief discussion on the effect of recent economic

changes and reforms, i.e., Demonetization, Goods and Services Tax, and Online Economy[1] on shadow economy.

## 1.1 Genesis of Shadow Economy

The term "Shadow Economy" is first coined by Frek, Weck & Pommerehne in 1982. It has also been used in different forms by different scholars for example "Irregular Economy" by Ferman & Ferman, "Underground Economy" by Simon & White, "Black Economy" by Dilnot & Morris etc. Although different terms are used to describe the shadow economy but all of them essentially represent the economy that is not organized but part of the total economy of a nation.

The International Labor Organization (ILO) use the term "Informal Sector"[2] for the Shadow Economy and the concept of "Informal Sector" was first coined in an ILO study of labor markets in Ghana in 1973. Thereafter, it was used to study the economy of many African and other developing countries where it come into widespread use as a means of describing a dualistic economic structure found in these countries. The economy of these countries involves both the mainstream formal economy and an unofficial economy which are useful for delivering various economic and social benefits.

## 1.2 Definition of Shadow Economy

The definition of Shadow Economy has many variations according to the context in which it is being used. Internationally accepted definition is given by ILO apart from this, Shadow Economy is defined at a nation level[3] based on the economy of the nation. Studying the definition is essential for this study in both contexts. The definition of Shadow Economy by

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[1] Online Economy is economic activities which include interaction with the service providers through internet for example, online shopping, online taxi booking, etc.
[2] It was first applied by Keith Hart in 1972.
[3] It is defined by an economic institute of a particular country, for example, NSSO in India.

ILO referred as the ILO concept of Informal Sector given in 1993, which is defined as -

*"Informal Sector is a group of production units which form part of the household sector as unincorporated enterprises owned by households."*

Within the group of household enterprises, the informal sector consists of -

(i) <u>Informal own account enterprises</u> - These enterprises are owned and operated by own account workers[4]. However, they can have contributing family members or paid employees but for occasional basis. Now, it depends on the nation that these enterprises will come under Informal Sector or not. In India, such enterprises come under Shadow Economy.

(ii) <u>Enterprises of informal employers</u> - These enterprises employ one or more employees on a continuous basis. Now, it depends on national institutions that they consider them in Informal Economy. It is decided on the basis of two criterions - Number of employees are sufficient or not to be considered as a formal sector enterprise and the employees are registered or not.

The definition given by International Labor Organization is very broad and general as it only mentions the enterprises which are run by households are categorized in Informal Sector. This definition does not entails the type of activity in which these enterprises are involved. It also does not categorize in terms of kind of workplaces where these activities are carried out, the extent of capital assets used, the duration of operations of these enterprises and whether it is the owner's primary or secondary activity. Sometimes, it is also possible that a person is involved in both the formal and informal activities so it is difficult to categorize that household into formal or informal sector. However, some of the activities which are undertaken to produce goods or services mainly for own consumption by household are excluded from the informal sector. Thus, a family of farmer completely dependent on themselves will not be considered in Informal Sector. It can be said that the definition given by ILO is market-oriented. It only

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[4] Account Worker is a worker who is self-employed independently or who has no employees.

includes the enterprises where the production of services or goods is undertaken by households to earn some money even if the money earned is very less.

The definition of Shadow Economy in the Indian context is not much different than described by International Labor Organization (ILO). In India, The Indian National Account Statistics (NAS) describes it as Unorganized Segment of the Economy and it is defined as following -

*"All Operating Units whose activities are not regulated under any Statutory Act or Legal Provision and/or those which do not maintain any regular accounts"*

The main criterion for classify an economy activity as unorganized is the non-maintenance of regular accounts. One example of an unorganized enterprise is Fruit-Sellers as they do not maintain their regular account of revenue, income etc. thus it is not accessible to officials to count in economy. In contrast to the unorganized segment of economy, the organized segment in NAS includes all major mining enterprises, Manufacturing Enterprises registered under the Factory Act, 1948, and private and public organizations engaged in Non-Manufacturing activities and the statistics of their activities are accessible. The major component of the unorganized segment is household own enterprises, for example, A small tea shop will be considered in unorganized segment of the economy. In addition to the above described definition of unorganized sector, it also includes -

(i) Own account production of goods;

(ii) Imputed services of owner occupied dwellings;

(iii) Services of domestic servants consumed by the households that consume them;

(iv) Enterprises which do not provide regular accounts to the statistical services; and

(v) Private non-profit institutions serving households.

In addition to these regular unorganized activities, there are others which do not cause direct income generation to the individual involved but provide full life time security for example, a person working in a shop and getting food, shelter, etc. but no income. There are many other variants of Shadow Economy that are difficult to define and categories.

## 1.3 Typologies of Shadow Economy

The definition of Shadow Economy as described in last section, does not give insight about the activities which can be classified in Shadow Economy. It only presents a general picture of Shadow Economy. The aim of this section is to categorize various form of activities and work that can be put under Shadow Economy. It gives a better understanding of Shadow Economy activities. The typologies of Shadow Economy[5] is following -

(i) <u>Labor Market based Categorization</u>: Labor Market Approach is one of the best approach to classify the shadow economy in the form of labor involved in its activities. The Dual Labor Market Theory (Doeringer & Piore, 1971; Saint-Paul, 1997) is used for this classification. It divides the labor market into four categories: Primary, Secondary, Informal and Illegal. Each category is described in the table below -

**Table 1.1: Informal Sector Categorization (Sector Based)**

| Category | Characteristics |
|---|---|
| Primary Sector | - Regular & Wage Jobs that are regulated and taxed<br>- Security in Jobs<br>- Example: White-Collar Jobs, Industrial jobs, Govt. Jobs |
| Secondary Sector | - Lower wage and less regulated Jobs<br>- less Security than private Jobs<br>- Example: Pink-Collar Jobs, Blue-Collar Jobs |
| Informal Sector | - Personal small business with cash-only and unregulated<br>- Off the books employees (Family Members also)<br>- Example: Small Grocery Shop, Food Vendor, Tea Seller |
| Illegal Sector | - Criminal Activities |

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[5] Losby, J. L., Else J. F., Kingslow, M. E. (2002). Informal Economy Literature Review, ISED Consulting & Research.

This typology assumes that informal sector composed of people who are unable to access primary and secondary sector work but there are many people involved in both of Primary and Informal Sector to generate additional income or sometimes earn main income through Informal Sector. This typology fails to classify such labor.

(ii) <u>Work based categorization</u>: Informal work or the work considered in Shadow Economy can be of different structures and forms. This is another form of typology which presents categories of Informal Work based on the context of the work. This typology essentially categorize the work done by a person individually or as an employee into formal and informal work. The categorization in this typology is given below in table -

**Table 1.2(A): Informal Sector Categorization (Work Based)**

|  | Primary Work for Company | Extra Work for Current Employer |
|---|---|---|
| **Person Works for Someone Else** | - Works off-the-books<br>- Works under-the-table<br>- Paid in cash and not taxed<br><br>Ex. Workers in household small businesses | - Work extra hours on weekends or evenings (Paid in cash and not taxed)<br><br>Ex. Freelancer Work |

**Table 1.2(B): Informal Sector Categorization (Work Based)**

|  | Person operates own small business | Person does sporadic jobs |
|---|---|---|
| **Person Self-Employed** | - Business is primary income<br>- Invest income in business<br>- On Going and Regular<br>- Cash only exchanges<br>Ex. Household own small businesses | - Seasonal Work<br><br>- Not classified as "small - business"<br>Ex. Small work like garland making and sell in society |

*Source: Adapted from work done by the International Labour Organization, 2002: 12-13*

## 1.4 Characteristics of Shadow Economy

Shadow Economy does not have a precise definition even for a country specific. It takes many structure and forms that can't be listed down so it is necessary to study the characteristics of

the activities involved in Shadow Economy. Characterization of Shadow Economy can be done on various aspects but currently only four aspects are considered -

(i) <u>Legal vs. Illegal</u>: The activities under Shadow Economy can be classified as legal or illegal. The legality of an activity is decided by the legality of goods or services produced in that activity or/and the manner in which goods or services produced or exchanged. For example, Groceries, Food, Clothing, Household Services and Childcare Services are legal commodities but can be originate from both legal and illegal manner. An Ice-cream vendor in street has perfectly legal good but if he is not showing his income to tax authorities, than his production of Ice-cream is considered to be illegal. On the other side, if a person is selling Marijuana than his product is illegal so that activity is also considered as illegal. Also, on the other side of such scenario of Marijuana, if a legal tender is given to pharma-company by the government to grow it for its own business then it comes into legal consideration. If a grocery shopkeeper is selling legally and paying taxes on his income and venture than it is a completely legal activity.

(ii) <u>Cash is the most common medium of exchange</u>: Enterprises involved in Shadow Economy involved in activities which are not reported, so cash is the most convenient medium for transaction as other medium such as, credit cards, debit cards, cheques, etc. reveal the transaction to the bank or any other institution. Having large Cash Economy in a country shows the existence of Shadow Economy.

There are some transaction in Shadow Economy that do not involve any monetary value. They are based on service exchange, for example, a barber offer his service to a milkman and get milk in return. These type of transactions are also not recorded.

(iii) <u>Unreported Income or Wages</u>: The main characteristics of Shadow Economy is its concealing nature. As mentioned earlier that the transaction involved in Shadow Economy is not officially recorded so that makes it easier to hide the income or wages of the employees.

The wages are also given in cash so there is no reporting of that transaction. Not only small enterprises, even big industries employ labor in this form. This also make tax evasion easier.

(iv) <u>Conditions of Labor</u>: Although Shadow Economy provides employment to large number of workforce but the type of work is not officially reported. Apart from this, employers may not comply with labor laws so workers may be employed in hazardous work conditions or paid lower wages than minimum wage set by labor department. The employment in Shadow Economy is considered inferior to the formal sector employment because of lower wages, no social and health security and dangerous work conditions.

## 1.5 Shadow Economy in Indian Scenario

Shadow Economy in India is referred as "Unorganized Sector" and it contributes more than half of total economy of India. According to National Sample Survey (NSS, 1999-2000) about 370 million workers constituting 92% of total workforce in the country employed in unorganized sector. A large part of the unorganized sector consist of agriculture and occupations related to it such as, fishery, forestry, etc. Apart from agriculture, construction and mining are also two major areas of unorganized sector employment. Thus, unorganized sector in India provides employment to a large part of workforce which ensures that it contributes a large amount in Net Domestic Product[6] of the country. The contribution of unorganized sector to NDP is 56.7% in 2002-03. Sector wise distribution is given in following table -

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[6] The Net Domestic Product (NDP) equals the Gross Domestic Product (GDP) minus depreciation on a country's capital goods

**Table 1.3: Unorganized Sector Contribution in total NDP (2002-03)**

| Industry | Organized Sector (% of NDP) | Unorganized Sector (% of NDP) | Total |
|---|---|---|---|
| Agriculture, Forestry, Fishery | 4.1 | 95.9 | 100.0 |
| Mining, Manufacturing and Construction | 60.5 | 39.5 | 100.0 |
| Services | 53.1 | 46.9 | 100.0 |
| **Total** | 43.3 | 56.7 | 100.0 |

*Source: NSSO, India*

It is clear from the table that the large share of NDP is through unorganized sectors. The contribution of unorganized sector to the Indian Economy has both positive and negative aspects. On the positive side, it provides employment to a large number of workforce so a major source of income generation and poverty alleviation. Giving employment to large population of India in organized sector is next to impossible so unorganized sector proved to be helpful here and makes positive contribution to the economy. Although, on the negative side, unorganized sector has no reported transactions and income so there is huge loss in revenue to the government, hence loss of funds to improve infrastructure and for public goods and services. One of the reason for joining unorganized sector is given as people don't want to pay taxes on their income. Additionally, this sector is inferior for labor in terms of lower wages, no security and hazardous work conditions. It also becomes difficult for the government to make effective policies because of large hidden economy. This is the reason that the developed nation has very small unorganized sector in comparison to developing nation. Clearly, the disadvantages of unorganized sector outweighs the advantages.

## 1.6 Approaches to Measure Shadow Economy

Determination of the exact size of the shadow economy is next to impossible because of the very definition of it that it exists under the cover of economic front thus no reliable data is available. However, estimation of the size can be made and it can give the approximate

measurement of shadow economy which is certainly helpful in making the right policies for a nation whether it is developed or developing. India is a developing country and its economy is quite complex compare to other developing countries. Apart from this, there is a lack of technology for example, electricity, communication, etc. in large part of shadow economy. These may be the reasons that large amount of literature is not available about estimating the size of shadow economy for India. To keep this in mind, a small effort is made in the current study to estimate the size of shadow economy in India using the available methods in literature.

There are three categories of methods for estimation of the size of shadow economy - Direct Methods, Indirect Methods and Model Approach. These methods differs in approach or parameters used for estimating the size of the shadow economy that is why they can give different results both qualitatively and quantitatively for the same country. However, different methods can be used for different countries based on their development scenario, economic conditions and technological advancements so it is imperative to find suitable method for the country which is under study to get the approximately good results. Each method has its own advantages and disadvantages based on the context in which it is applied.

## 1.6.1 Direct Methods

These methods are based on micro-analysis approach that includes the collection of primary data in the form of surveys, questionnaires and polling etc. and analyze the data to get the estimation of the size of the shadow economy. These methods have some advantages that a complete ground level picture of shadow economy can be captured through these methods and more exhaustive collection of data can be made through these methods as wide spectrum of data can be collected. For example, a simple survey of households can be give the data about the Income level in shadow economy, labor force participation and type of occupation, etc.

However, these methods also suffer from some limitations such as these methods are very time consuming and tedious so it is not practical to use these methods for a large country

like India. They are feasible to study shadow economy for a Metro City like Delhi, Mumbai or Kolkata, etc. not for a country whole. Apart from this, a static one time analysis can be done using these methods for every time performing such study is not possible so dynamic analysis for range of years as done in this study is not suitable for these methods.

The present study is primarily focused on performing macro level analysis of shadow economy and estimation of shadow economy over a large period of time (1991-2016) so clearly, these methods are not suitable.

## 1.6.2 Indirect Methods

These methods are based on macro-analysis approach to estimate the size of shadow economy. These methods use available data for the analysis and using various parameters estimate the size of the shadow economy judiciously even though the direct data about the shadow economy is not available. The methods are less time consuming and dynamic analysis can be performed over the years to analyze the size of the shadow economy. One of the limitation of these methods are that they cannot give the exact picture of the shadow economy so many factors can be neglected while using these methods.

Based on the parameters taken for analysis, various methods can be derived for estimation of the size of the shadow economy in this category. Here, only five important methods are presented and suitable method is chosen for this study. Each method in this category uses a fundamental idea that one of the factor can give the estimation of total economy and other factor can give the estimation of formal economy so the difference between these two gives the estimation of the size of the shadow economy -

$$Shadow\ Economy = Total\ Economy - Formal\ Economy \qquad [1.1]$$

Choosing a particular method for a country depends on the economic scenario of that particular country and availability of data on that parameter used.

### 1.6.2.1 Electricity Consumption Method

This method is one of the robust method and extensively used method for estimating the size of the shadow economy. The parameter for predicting the size of the total economy is electricity consumption and the parameter for predicting the size of official/formal economy is Gross Domestic Product (GDP). Electricity Consumption is considered to be the single best proxy for overall economic activity. The growth rate of Electricity Consumption shows the growth rate of overall economic activity and the growth rate of GDP shows the growth rate of official / formal economy in a nation. The difference between these two can gives the approximate growth rate of Shadow Economy. In Empirical form -

$$Growth\ in\ Shadow\ Economy$$
$$= Growth\ in\ Electricity\ Consumption - Growth\ in\ official\ GDP$$

[1.2]

This method is developed by Kaufmann and Kaliberda [14] to examined the size of Shadow Economy in FSU (Former Soviet Union) and CEE (Central and Eastern Europe) which consist of both the developed and less developed countries. It is one of the easiest method in estimating the Shadow Economy that does not incorporate any other factor that can affect the Electricity Consumption such as Prices of Electricity, Technological advancement and shifting to other electricity resources etc. In the method later developed by Eilat and Zinnes incorporate all these effect using Regression. However, in the current study, simple approach by Kaufmann and Kaliberda is being used.

### 1.6.2.2 Labor Force based Method

This method takes the advantage of the link between formal and informal sector to indirectly estimate the size of the shadow economy in the form of labor force working in shadow economy. The difference between the official labor force and real labor force gives the labor force participating in the shadow economy. This method does not include any other factor to estimate the size apart from labor force so estimation may have a little error however this is

one of the powerful method and used extensively. This method also has some limitations, for example, a worker can involve both in formal and informal sector so this factor will not be captured in this method.

### 1.6.2.3 National Income versus Expenditure Method

This method uses the hypothesis that the difference between overall national income and national expenditure is caused by presence of shadow economy only. In other words, if there is no shadow economy then, national income will be equal to national expenditure. Thus, the relative comparison between the data of national income and national expenditure gives the estimation of the size of the shadow economy indirectly. National Income data captures the formal economy and complete expenditure of the nation shows the total economy of a nation so the difference between these gives the size of the shadow economy.

This method also suffers from some limitation such as, concrete data for national expenditure is not easily available especially for developing nation like India. Apart from this, a person can have both official and shadow income but the expenditure will be constant so this factor also not captured. In the current study, this method is not used because of unreliability of data on expenditure.

### 1.6.2.4 The Currency Demand Approach

This approach is based on the idea that Shadow Economy is mostly run by cash transaction so increased demand of cash in economy can be correlated by the size of the shadow economy in a country. One of the reason for engaging in the shadow economy activities is tax evasion so tax rate in an economy is also effect the size of the shadow economy. Larger tax rate motivates people to engage in shadow economy rather than in formal economy where tax evasion is not possible. The result of this is to use cash for transaction so that benefit from the avoidance of tax payments can be achieved.

This method is generally used for developed economy like United State of America where the large economy is covered under the tax corpus so a good estimate can be made about the growth of shadow economy. In the case of India, this method will not be feasible as miniscule part of the economy pay taxes[7]. Considering this factor, this approach is not used in this study.

### 1.6.2.5 The Transaction Approach

This approach is also based on the fundamental idea of estimating the shadow economy where the indicator for formal/official economy is Gross National Product (GNP) and the indicator for total economy is the total amount of price transactions. The difference between these two indicators represent the size of the shadow economy. This approach is developed by Edge Feige and is based on Fischer's quantitative theory of Money. If there is no shadow economy in a country than these two will be equal. In mathematical form -

$$M * V = P * T \qquad [1.3]$$

Official Economy = Total Economy

where: $M$ = Quantity of Money, $V$ = Velocity of Money Circulation

$M * V$ = Official Gross National Product (GNP)

$P$ = Level of prices, $T$ = Volume of Transactions

If product of prices and volume of transactions exceeds the value of GNP then it shows the existence of shadow economy. In this method, the data for GNP is readily available but it is difficult to obtain the data for the amount of transactions especially for the developing country like India. This approach is feasible for developed countries where the data for the transaction is available so this method is not used in this study.

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[7] It is around one percent of 1.23 billion population of India in the year 2013

### 1.6.3 Model Approach

This approach is based on detection of the main causes of the Shadow / Informal Economy to determine the size of it. In this approach, a latent variable is estimated which is Shadow Economy in this case by combining Multiple Indicators with Multiple Causes (MIMIC) so this is also known as MIMIC approach. This method is developed by Frey and Weck-Hannemann who considered Shadow Economy as a latent variable. This method requires the use of advanced statistics and econometrics so it is not explored in current study.

Each Method mentioned above is suitable for a specific country based on the characteristics of its economy, availability of data and technological advancements. In this section each method is summarized and the scope of using each method in the context of India is explored. Based on this study, Electricity Consumption Method is found suitable for this study.

# Chapter 2
# Literature Review

❖ Literature Review

❖ Statement of the Problem

# 2. Literature Review

The importance of studying the shadow economy cannot be more emphasized. However, there is a scarcity of concrete literature because of unregulated and hidden nature of shadow economy. The available literature is mostly focused on labor force of shadow economy and their work conditions. It should be noted that the "Shadow Economy" is described as "Informal Economy", "Unorganized Sector" and "Hidden Economy" in many literatures.

- **Kaufmann, D., & Kaliberda, A. (1996). Integrating the Unofficial Economy into the dynamics of post-socialist Economies: A Framework of Analysis and Evidence. Policy Research Working Paper of World Bank, 1691** applied simpler form of electricity consumption method on post - socialist economies and estimate the growth of the shadow economy. The macroeconomic approach presents good results for these economies and helpful in integrating the shadow economy into an analysis of shadow economy. The study suggests that integrating the unofficial economy into the analysis of whole economy sheds a different light on interpretation of national income, of sectoral trends (such as trade, services and exports) and of labor markets and household patterns, often leading to different interpretation. The framework to measuring shadow economy presented has implications for measurement, forecasting and policymaking.

- **Missiou, O., & Psychoyios, D. Estimating the size of Shadow Economy with Electricity Consumption Method** shows that along with the positive effects of the shadow economy, there are some negative impact that hinder the economic growth of a country such as distortion of macroeconomic policies, tax revenue losses and lower quality of public goods and services. Thus, it is important to know the size of the shadow economy so that the

amount of negative impact can be estimated. The study uses Electricity Consumption Method to estimate the size of the shadow economy of Eastern European countries because this method cannot be unreliable. The method is applied for both the developed and less developed countries and the robustness of the method was tested on various parameters. The method successfully captured the impact of economic events such as, economic slowdown in 2008 so this is one of the most reliable method for estimating the size of the shadow economy.

- **Sakthivel, S., Joddar, P. (2006). Unorganized Sector Workforce in India - Trends, Pattern and Social Security Coverage** focuses on the labor force pattern and social security coverage of unorganized sector in India. The study found that nearly 92 percent of the workforce belong to unorganized sector and agriculture completely falls into it. In the non-agricultural sectors, the share of informal sector gradually decreases with income ladder. The study clearly points out that the social security schemes, for example, provident funds are concentrated only at miniscule organized sector while unorganized sector has abysmal conditions of social security coverage.

- **Satpathy, A. (2004). Size, Composition and Characteristics of Informal Sector in India** provides estimate of employment in the informal sector and size of the sector as a whole. The study also gives a clear picture of who constitutes as informal worker and their characteristics. The work found that the size of the informal employment is 370 million workers that is nearly 93 percent of total workforce. About 83 percent of the non-agricultural workforce were in informal employment and was estimated at 133 million workers. Out of these, 27 percent is women and 55 percent live in urban areas. This was estimated using Residual Method. The contribution of the informal sector to the national income is 60 percent.

The study also explored worker's conditions in informal sector which is characterized by lack of regular stable contracts, lack of designated place of work and lower income compared to formal sector. The study suggests that the most disturbing characteristics of the workforce structure in India is the link between gender, informality and poverty. The share of women in informal workforce was found to be greater than the share of women in total workforce.

- **George, J. (2014). Informal Sector in India: A Review. Munich Personal** studied the positive side of the shadow economy in the context of India. By providing employment to a large number of workforce, informal sector reduces distress by strengthening rural and backward areas. The study also suggested that the informal sector is largely illustrated as a manifestation of a distressed phenomenon especially in urban segment and in the rural area, agricultural distress gives way to the development to informal sector.

- **Siggel, E. (2010). The Indian informal sector: The impact of globalization and reform** studied the impact of globalization and reforms on Indian informal sector. The study suggests that the informal sector plays an important role as a buffer against economic shocks. When the inefficient and over-employed Indian economy was liberalized, a massive drop in the formal sector took place and it could have led to the problem of unemployment and extreme poverty. Several industries in the formal sector succeeded in substantially reducing their cost, thereby increasing the international competitiveness and that was possible only through cutting in workforce and increasing efficiency. In this situation, the Indian informal sector worked as employer for the jobless formal worker and the economy was not affected drastically through this economic reforms.

- **Swaminathan, M. (1999). Understanding the Informal Sector: A Survey. World Institute of Development Economic Research** shows that the formal and informal sector are related to each other. A precise boundary is difficult to draw between the two. The two

sectors may be distinct but not isolated. For example, many formal enterprises contract their work to informal sector enterprises so the policy makers must look at the implication on both sectors while making policies for any one sector. The study also throws light on the difference in characteristics of informal economy in developing and developed nations. In developing nations, informal sector is mass employer with the workers having low skills, low productivity and low income. While in developed nations, the informal economy exists in small amount and it is considered as hindrance to the development and growth so the policies are made to remove informal economy.

- **Schneider, F. (2012). The Shadow Economy and work in the shadow: What do we (don't) know?** studied the shadow economy of highly developed OECD[8], developing and transition countries using the MIMIC[9] approach. The data is also analysed on illicit work force in the rural and non-rural sector. The MIMIC approach reports strong effect of tax morale, but underline the higher importance of tax policies and state regulations to increase the shadow economy. The study points out that an individual looks for ways to improve their economic situation and thus, contribute productively to aggregate income of a country whether he is employed in formal or informal sector.

  Finally, the author answers the questions that what do we know about the shadow economy is we have some knowledge about the size and development of the shadow economy and its labour force but what do we don't know are exact motives, why people work in shadow economy and what is their relations and feelings if a government undertakes reforms in order to bring them back into formal economy.

- **Pratap, Sangeeta & Quintin, Erwan (2006). The informal sector in developing countries: output, assets and employment** researched on the nature, determinants and

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[8] OECD - Organization for Economic Co-operation and Development is an intergovernmental economic organization with 35 member countries. (India is not a member of this organization)
[9] MIMIC - Multiple Indicators Multiple Causes Approach to measure the shadow economy

consequences of informal activities in developing nations. The study found out that the importance of informal activities is highly correlated with a nation's level of economic development and the quality of its institutions. Furthermore, the informal sector is based on small-scale, unskilled-labour intensive and self-financed activities. Finally, the study suggests that modelling informal activities should not only be an academic question but it should be used to alleviate poverty in developing nations.

- **Chaudhuri, K., Schneider, F., Chattopadhyay, S. (2006). The size and development of the Shadow Economy: An Empirical Investigation from states of India. Journal of Development Economies** investigated the size of the hidden economy in Indian states over the period 1974/75 to 1995/96. The study showed that after liberalization of the Indian economy in 1991/92, the growth in the size of the shadow economy has decreased on an average. The growth in the size of the hidden economy is approximately 4% less in scheduled election years than in all other years. The work also demonstrated that the growth is lower in those states where the coalition government is in power.

- **Kalyani, M. (2016). Indian Informal Sector: an Analysis. International Journal of Managerial Studies and Research (IJMSR)** suggests some ways to increase the productivity of informal sector enterprises. It shows that the converting informal sector into formal sector by introducing strict policies and stringent tax regulations will not solve the problem. These type of policies may drive them out of business, leading to poverty and destitution of informal sector employees and entrepreneurs. The need is the supply of educated entrepreneurs that can run efficient and productive businesses with the informal sector. Increased efficiency will lead to increased GDP of the country, thus lead to the growth of the nation.

- **Feige, E. L. (1979). How big is the Irregular Economy. The Challenge** studied the negative effect of not considering the informal economy in policymaking. Neglecting the

informal economy gives false data on the total economic scenario of a country so the constituted policies will not be implemented effectively. The study found three major factors on which it can affect the policies - First, if the irregular economy is growing faster than the official economy and the real resources are being shifted from the latter to the former - then clearly the official statistics on income will grossly understate the true growth of total economy. Second, official unemployment statistics will certainly overestimate the true situation since informal employment is not captured in official data. Third, the official inflation statistics are themselves likely to be substantial overestimates.

- **Surowiecki, J. (2013). The Underground Recovery. The New Yorker** reviewed the work done by Feige about the American Informal Sector. The study found that shadow economy caused two trillion dollars tax revenue loss to the government on the income made by shadow economy workers. This income could have been used in reducing the revenue deficit. The size of the shadow economy shows that the overall economy is probably doing better than the data reported by the government. Thus, the size of shadow economy should be included while presenting the total economic picture of a country.

  *"Economies work best when people have some sense, however abstract, they are all tied together"* *- James Suroweiecki*

- **Harriss, J. C. (1990). Linkages between the formal and the informal sectors in developing countries: A review of literature. Working Paper of World Employment Programme** explored the market conditions of informal sector and how are the formal and informal sectors related to each other. The study found that the informal producers operate under conditions of intense competition, either because they operate in consumer markets where the purchasing power is very restricted and which are subjected to seasonal and other fluctuations and/or because of the severity of the competition amongst themselves,

sometimes when they confront an Oligopsony[10] of medium and large sized firms. The intense competition amongst Informal Sector producers is related to the exclusion of labour from Formal Sector wage employment.

- **Kundu, A. & Sharma, A. N. (2001). Informal Sector in India: Perspectives and Policies** deals comprehensively with the realities of informal sector labour market in India and the issues relating to the informal sector. The study found that informal sector is rapidly growing even in the wake of liberalization, privatization and globalization. The formal sector is also shifting some part of production to the informal sector thus helping in informalization of employment relations.

- **Kulshreshtha, A. C. (2011). Measuring the Unorganized Sector in India** examines the problems of measuring the unorganized sector and explains the approach taken by Indian Central Statistical Office (ICSO). The size of the informal sector is examined in terms of employment it generates and its contribution to value added. The study also reviewed the definitions provided by ILO and ICSO about the unorganized sector. It was found that share of unorganized sector in total NDP (Net Domestic Product) is decreasing from the year 1999 to 2006. The study hypothesized that the decline in the share of unorganized segment in the NDP is attributed to reduction in demand for the goods and services produced by the informal sector.

- **Gutmann, P. M. (1977). The Subterranean Economy. Financial Analysis Journal** studied Currency Demand Approach to estimate the size of the shadow economy. They referred shadow economy as "Subterranean Economy". The study found out that the currency in circulation has been growing more rapidly than deposits. This shows that the subterranean economy is growing since currency is the only form of cash suitable for transaction that is unreported and untaxed. The disparity between cash circulation and

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[10] Oligopsony - A state of market in which only a small number of buyers exist for a product

deposits shows the growth of the shadow economy. The study predicts that shadow economy generated an illegal GNP (Gross National Product) of 176 billion dollars. The author suggests that the reasons behind increase in shadow economy are rising tax rates and the ever increasing burden of government regulations.

- **Hussmanns, R. (2004). Measuring the Informal Economy - From employment in the informal sector to informal employment** describes the direct method (based on surveys) to develop the statistics on the informal economy because it helps to improve labour statistics and national accounts. It also enhances the visibility of many workers in the informal economy and of their economic contribution. The study explains the international statistical definitions of employment in the informal sector and of informal employment, which were adopted by the 15th and 17th International Conference of Labour Statisticians (ICLS) in January 1993 and December 2003. It also illustrate the practical application in household surveys of these definitions in providing examples of their translation into survey questions.

- **Feige, E. L. (1989). The Underground Economies: Tax Evasion and Information Distortion. Cambridge University Press** examines the growth of the underground economies and the problems of unreported and unrecorded income that are interrelated with it. The author suggests that the hidden economy not only establishes fiscal imbalance due to large tax evasion but also severely affect the nation's economic information system. The study suggests there are two problems associated with measuring the shadow economy - The first is the problem of non-compliance with the fiscal code and the second is the veracity and reliability of major indicators of the economic activity. The empirical results found out that the unreported income amounts to 24% percent of gross income in 1981. The study suggests that the expansion of the unobserved economy may indeed be linked to larger political problems of "Social Disorganization" and "Political Ungovernability".

- **Benjamin, N. (2014). Informal Economy and the World Bank. Policy Research Working Paper of World Bank, 6888** shows that Informal Sector is generally neglected while making policies and that results in ineffective policy implementation and poor results. Thus, informal sector should be taken into account while policy making. This study suggests four main areas where development policy can be improved by taking the informal sector into account -

[1] Improvement should be made along a continuum. The heterogeneity among informal firms points to different policy approaches for different types of firms.

[2] There should be public-private collaboration on mutual reforms. Many efforts to improve firm performance focus on elements of the production function (labor skills, credit) while treating government mainly as cost (taxes, cost of compliance with regulations)

[3] Research indicates a strong relation between the basic skills and labor outcomes, particularly in the informal sector despite lower average returns. Research also indicates benefit of targeted training programs.

[4] Informal trade is pervasive in developing countries and the networks developed in informal trade - wholesalers, credit suppliers and money-changers, transporters are a strong presence in informal sector. Yet these type of complex and nontransparent trading systems can be discouraging to foreign investors and can otherwise undermine trade policy and the international competitiveness of developing nations.

The literature review shows that estimating the size of the shadow economy is very essential both from the study point of view and for the effective policy formation. Most of the literature is focused on the employment in the informal sector, their characteristics and work

conditions. There is lack of a concrete method to estimate the size of the shadow economy for India and it is not studied much in the past.

## 2.1 Statement of the Problem

Through this research, an attempt is made to estimate the size of the shadow economy of India through a concrete and dynamic method. A macroeconomic approach is required to estimate the growth in the size of shadow economy in terms of percentage contribution to the total economy and the same is developed through the current study. This will answer the primary question of this study whether the share of shadow economy is shrinking or expanding in India since 1991?

# Chapter 3
# Aims & Objectives

❖ Aims

❖ Objectives

# 3. Aims & Objectives

## 3.1 Aims

The aim of the current study is to estimate the size of the shadow economy of India from 1991 to 2016. The size of an economy can be represented in two forms - labor force and percentage contribution to total economy. The later one captures the production and efficiency of the shadow economy so the size is estimated in the form of percentage contribution to total GDP. The other aim is to study the impact of recent economic changes and reforms i.e. Demonetization, Goods and Services tax and Online Economy on the size of the shadow economy.

## 3.2 Objectives

The objectives of this work can be summarized as follows -

- To understand the distinction between formal and shadow economy

- To study the Shadow Economy in Indian Scenario

- To study various methods to estimate the size of the shadow economy

- To estimate the growth of the shadow economy of India from 1991 to 2016

- To analyze the impact of recent economic reforms and changes on the size of shadow economy

# Chapter 4
# Data Sources & Methodology

❖ Data Sources

❖ Electricity Consumption Method

❖ Assumptions

❖ Biases in Indian Scenario

❖ Research Hypothesis

❖ Procedure

❖ Calculation

# 4.1. Data Sources

This study uses indirect method so <u>Secondary Data</u> is used in complete analysis. The data is collected for the time period 1990 to 2016 from following sources -

- Electricity Power Consumption (kWh per capita) by *World Bank*

- Population of India (Total) by *World Bank*

- GDP Growth (Annual %) by *World Bank*

- Share of unorganized sector in total GDP in base year (1990) by *NSSO[11], India*

# 4.2. Methodology

This study estimates of the size of the Shadow Economy using indirect method. Many methods are discussed thoroughly in previous chapters out of which Electricity Consumption Method is the most robust and reliable method. This method uses electricity consumption as a proxy for total economy. Due to availability of data and economic scenario of India, this method is used in the current study. The method is elaborated further in this chapter and applied for the time period 1991 to 2016.

## 4.2.1 Electricity Consumption Method

This method comes under the category of Indirect Methods to estimate the size of the shadow economy. Essentially, this method predicts the growth of the shadow economy from the base

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[11] NSSO: National Sample Survey Office, India under the Ministry of Statistics and Programme Implementation (MOSPI) which is a ministry of Govt. of India. The surveys conducted by the Ministry are based on scientific sampling methods.

year onwards. There are numerous variants to this method available in literature but a simpler version of this method developed by Kaufmann and Kaliberda[12] is used in the present study.

## 4.2.1.1 Approach

The fundamental concept behind this method is to estimate the overall economic activity and subtracting formal economy from it to get the estimation of shadow economy -

$$Shadow\ Economy\ = Overall\ Economy - Formal\ Economy \qquad [4.1]$$

The method assumes the total electricity consumption as a single best proxy for overall economy (or total economic activity) in a country. It is empirically observed that total economic activity and total electricity consumption have good correlation in all countries[13]. In other words, total GDP (Formal + Informal) - electricity consumption elasticity is close to one throughout the world. Thus, electricity consumption is chosen as a parameter to represent the total GDP of India.

$$Total\ GDP\ /\ Electricity\ Consumption \sim 1 \qquad [4.2]$$

The parameter for formal economy is taken as Official Gross Domestic Product (GDP) since it essentially captures the official or formal economy completely. The difference between these two parameters represents the shadow economy of Unofficial GDP.

Parameters -

$$Overall\ Economy\ (Total\ GDP) \sim Total\ Electricity\ Consumption$$
$$Formal\ Economy \sim Official\ GDP$$
$$Shadow\ Economy \sim Unofficial\ GDP$$

[12] Kaufmann, D., & Kaliberda, A. (1996). Integrating the Unofficial Economy into the dynamics of post-socialist Economies: A Framework of Analysis and Evidence. Policy Research Working Paper of World Bank
[13] Siggel, E. (2010). The Indian informal sector: The impact of globalization and reform. International Labour Review

A base year is considered (In this case: 1990) and using these parameters the change in the size of the shadow economy is calculated for the years 1991 to 2016.

## 4.2.1.2 Biases in utilizing electricity consumption as proxy for total economic activity

The assumption of using electricity consumption as a proxy for total economic activity may suffered from biases depend on the nature of economy of the nation. Biases in assumption affects the results significantly so it is necessary to consider possible biases before applying the method.

In this approach, it has been shown that the unofficial GDP is linearly related total GDP and total GDP (Equation 4.1) is assumed to be equal to total electricity consumption. Any bias in this assumption will result in bias in the estimation of the shadow economy because of the linear relation. There can be two biases that can affect the result - Upward Bias (Positive Bias) and Downward Bias (Conservative Bias).

**[A] Upward Bias (Positive Bias):** Upward bias means the estimation of total GDP is more than in reality. If there is an upward bias then electricity consumption may increase or remain the same even in the case of economic slowdown. There are many factors that can cause upward bias in using the electricity consumption as a proxy for total economy -

**A1.** Capacity Underutilization: If there is high overhead requirement and fixed electricity consumption per unit of output, then electricity consumption will not reduce in proportion to reduction in production. Therefore the economic slowdown will not be reflected in electricity consumption and calculated total economy growth will be more than reality.

**A2.** Some technological redresses due to lack of maintenance may reflects higher electricity consumption growth than total economic activity in reality. This factor increases the electricity consumption while the production is still the same.

**A3.** Substitution of electricity for other energy sources: Due to technological advancement, many enterprises shift to electricity based production from conventional energy sources such as gas heating, petroleum etc. This will show growth in electricity consumption while economic activity has not grown in that proportion. This factor is more relevant in developing nation that are rapidly shifting to electronic instruments for production.

**[B] Downward Bias (Conservative Bias):** In this bias, the electricity consumption growth is less than the total economic activity in reality. There are many factor that can cause downward bias -

**B1.** Improved efficiency or power saving reforms: Due to technological advancement, more efficient instrument and machinery can be made and that reduces the electricity consumption so even if the economic activity is increasing, it can show decrement. Apart from this, government can also have power saving reforms such as, in India, a campaign to promote LED bulb that consume very less power so such kind of reforms can cause reduction in electricity consumption while the overall economy is growing.

**B2.** Increase in Electricity Prices: Increase in electricity prices may cause small enterprises to shift to another energy resources and that result in decrement in electricity consumption while the economic activity is not stopped. This is not a major factor for medium and big enterprises but small production units and households are affected by electricity prices because of low operating capital. It can cause them to shift to manual labor or other energy

sources so the electricity consumption decreased but not in same proportion as the economic activity.

**B3.** Increased under reporting of electricity consumption: Due to lack of stringent regulations and corrupt system, stealing of electricity can happen and thus, reported electricity consumption is lesser than total economic activity. Sometimes, government agencies also manipulate electricity consumption data for political purposes so this reflects slowdown in economic activity in contrast to reality. In the case of India, this factor is more prevalent so downward bias is seen in the assumption.

**B4.** Shift from electricity intensive industries: A shift from electricity intensive industries to less electricity consumption enterprises causes slowdown in electricity consumption growth while the total economic activity may increase. This is more relevant factor for developed nation where there is a shift to service industries from manufacturing industries so there is reduction in electricity consumption.

**B5.** Shift to non-conventional energy sources: In recent time, the solar power production has increased considerably, especially in the case of India. Enterprises use own solar electricity production units so there electricity consumption is not captured in total electricity consumption, thus cause reduction in electricity consumption while economic activity has not decreased or increased. This factor also causes conservative bias especially in recent time of global warming campaigning.

These upward and downward biases are incorporated in the total GDP - electricity consumption elasticity (Referred as "Elasticity" from here onwards)

$$Elasticity = \frac{Total\ GDP}{Total\ Electricity\ Consumption} \qquad [4.3]$$

$$Elasticity = \frac{\%\ change\ in\ total\ GDP}{\%\ change\ in\ total\ electricity\ consumption} \qquad [4.4]$$

$$\% \; Change \; in \; total \; GDP = Elasticity * (\% \; change \; in \; total \; electricity \; consumption)$$

[4.5]

**[C]** Unitary Elasticity means the positive and negative biases cancel each other so the growth rate of electricity consumption is equal to the growth rate of total economy.

Cases of Elasticity - It can be inferred from the above discussion that the biases are mainly caused by the changing electricity consumption pattern so economy of a country can be divided into three categories - "Energy Efficient", "Energy Neutral" and "Energy Inefficient" according to upward bias, no bias and downward bias. Kaufmann and Kaliberda used the elasticity values 0.9 and 1.15 for positive and negative biases respectively and the same values are used in the current study.

Upward Bias: Elasticity < 1 (0.9)

Downward Bias: Elasticity > 1 (1.15)

No Bias: Elasticity = 1

## 4.2.1.3 Assumptions

Following assumptions are taken while using the electricity consumption method -

- Total electricity consumption of India represent the total economy (total GDP) of the nation so growth in total electricity consumption is approximately equal to growth in total GDP.

- Total GDP - Electricity Consumption Elasticity remains constant during the time period considered in analysis.

- Official GDP growth only represents the growth in formal economy since the government data does not capture the shadow economy effectively.

## 4.2.1.4 Biases in Indian Scenario

India is a developing country with growth rate greater than developed countries. Technological development and adaption is also happening at a rapid rate in India. In the time period considered here i.e. 1991 to 2016, Indian economy has changed profoundly so the biasness will also change over the years. Hence, the method is applied for all the three elasticity scenario and results are compared with the data available on shadow economy.

The major factor that can cause upward bias in the case of India is substitution of electricity for other energy resources such as manual labour, gas heating, coal heating, combustion engine etc. Enterprises are shifting towards new production technology that is based on electricity. Especially for the years 2005 onwards upward bias is more relevant.

The downward bias is seen especially during the starting period of our study i.e. 1990s because of inefficient production techniques used by enterprises. Apart from this, a considerable part of shadow economy is not run by electricity based production techniques so electricity consumption will not reflect actual total economy. Hence, downward bias is more relevant during starting period.

## 4.2.2 Research Hypothesis

After analysing both the upward bias and downward bias in the context of India, It can be predicted that the elasticity will not remain constant for the complete time period of our study. It is hypothesize that the elasticity will shift from downward bias during staring period (1991 - 2000), to no bias during mid period (2001-2005) and upward bias at the end (2006-2016). The hypothesis will be tested in the results and discussions.

## 4.2.3 Data Analysis

Electricity Consumption Method is an indirect method to estimate the shadow economy so Secondary Data is required as available in literature. The base year for the study is 1990 and the data is analysed from 1991 to 2016.

[A] Total Electricity Consumption Data (Figure 4.3): Official Electricity Consumption data is available only for the year 1990 to 2014 so provisional data is used for 2015 and 2016. Electricity consumption data is available in the form of electricity consumption per capita (Figure 4.1) so total electricity consumption is calculated using population data (Figure 4.2). The calculation for the above data is performed in Appendix (Table - 4).

**Figure 4.1: Total Electricity Consumption per Capita (1990 - 2014)**
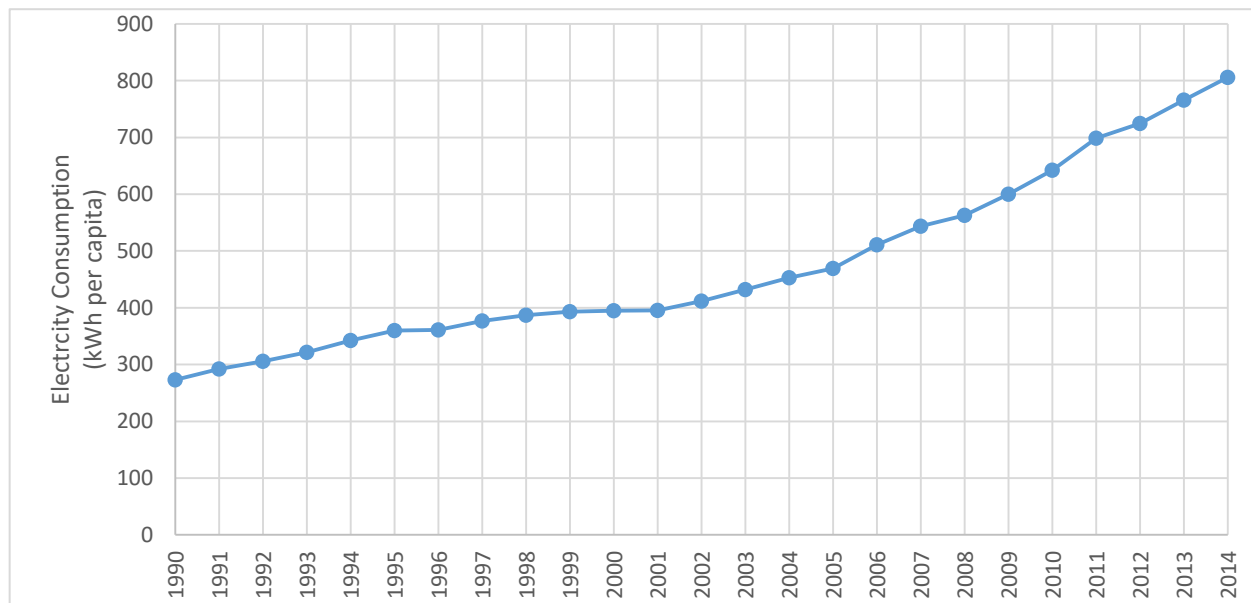


*Source: World Bank*

| Year | Electricity Consumption per Capita (kWh per capita) |
|------|------------------------------------------------------|
| 2015 | 1010* |
| 2016 | 1075* |

*\* Provisional Data (NSSO, India)*

It can be seen from the figure 4.1 that the growth rate of electricity consumption per capita is very low during 1990-2000 and it increases at a faster rate after entering in 21$^{st}$ century. This

may be due to rapid technological advancement in 21st century that has caused the change the

traditional production methods (Based on coal, gas heating etc.) to electricity based methods.

**Figure 4.2: Population of India in millions (1990 - 2016)**
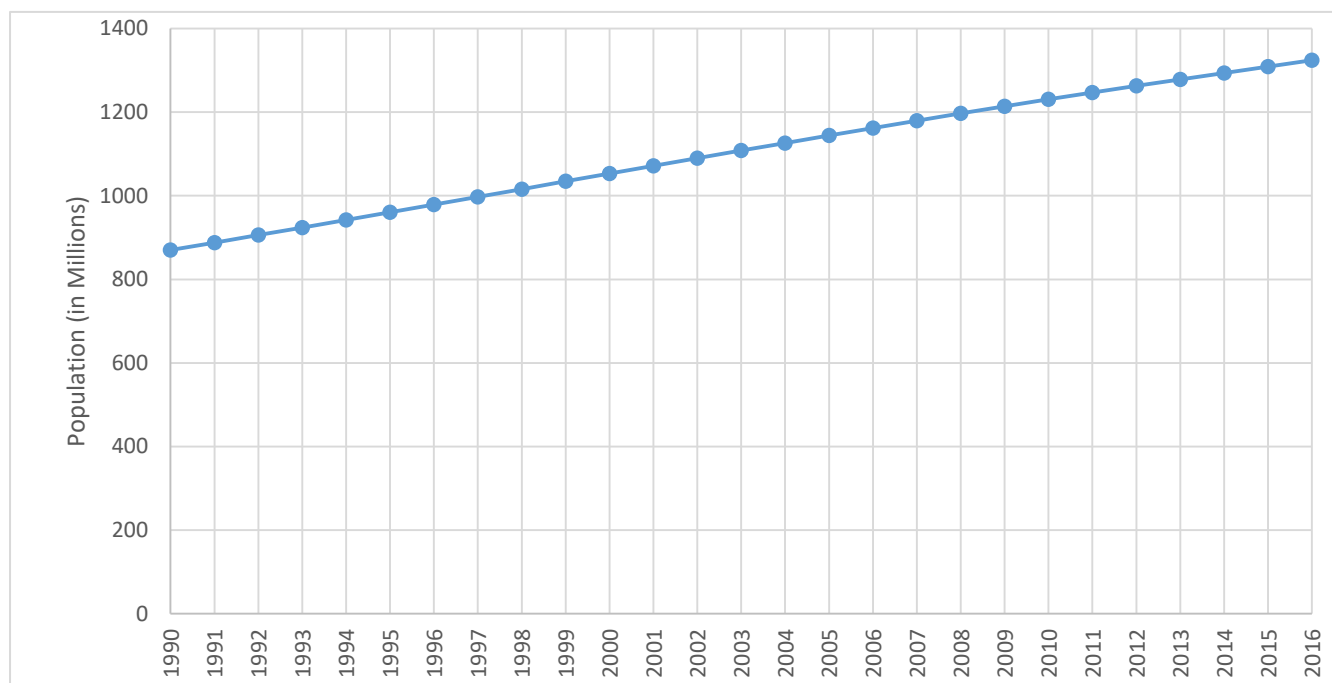


*Source: World Bank*

**Figure 4.3: Total Electricity Consumption of India (1990 - 2014)**
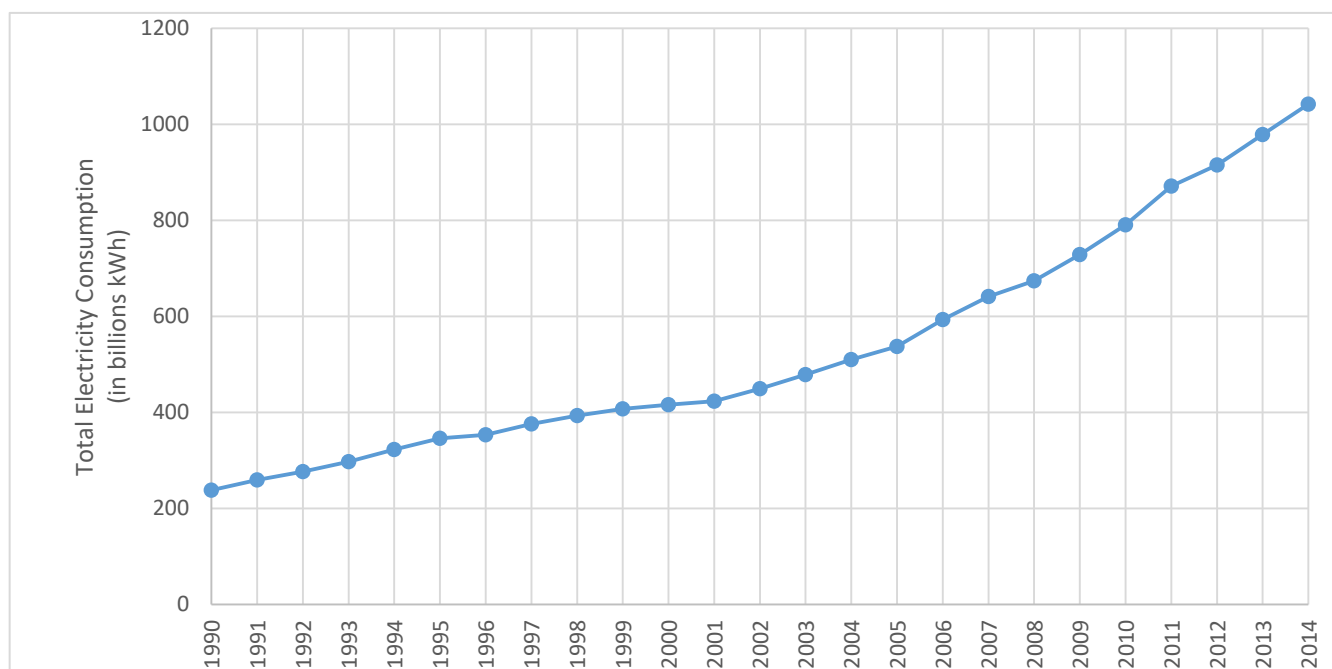
| Year | Total Electricity Consumption (in Billions kWh) |
|---|---|
| 2015 | 1322.14* |
| 2016 | 1423.48* |

*\*Based on Provisional Data*

[B] Official GDP Data (Figure 4.4): In the current method, annual official GDP growth data is required. The figure 4.4 shows that the official GDP growth rate has very much fluctuation, thus the economic growth is not consistent in India. This may be the result of continuously changing economic policies and introducing new economic reforms by the government.

**Figure 4.4: Official GDP Growth Rate of India (1990 - 2016)**
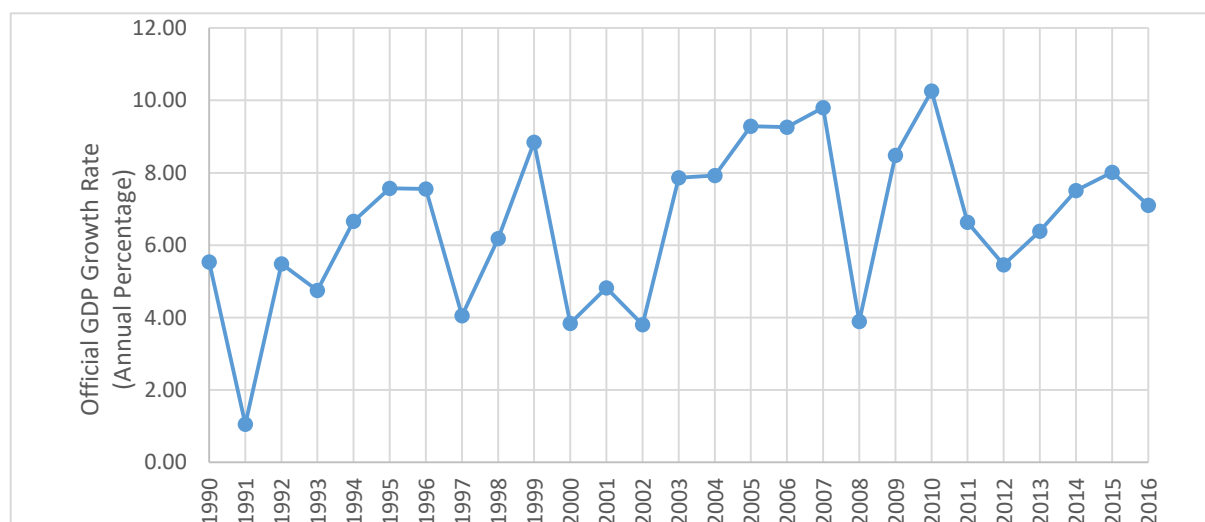


*Source: World Bank*

[C] Apart from this, percentage of unofficial GDP to the total GDP is required to calculate the official GDP index in the base year 1990. Figure 4.5 shows that a large part of total GDP is contributed by unorganized sector.

**Figure 4.5: Share of Unofficial GDP to Total GDP (1990)**
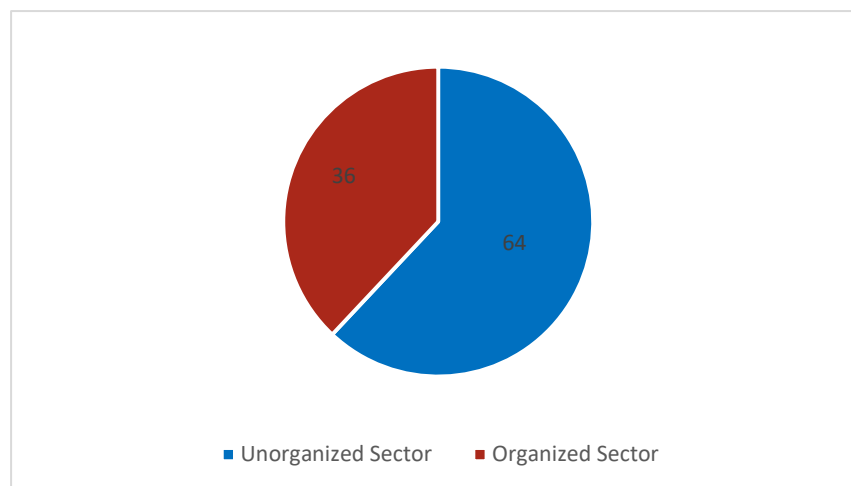


*Source: NSSO, India*

## 4.2.4 Procedure

The method is applied for the years 1991 to 2016. A year before the first year i.e. 1990 is considered as base year. For the year 2015 and 2016, provisional data is available so the method is separately applied for these year by considering 2014 as base year.

Total GDP, Unofficial GDP, and Official GDP is considered in the form of Indexes, i.e., Total GDP Index, Unofficial GDP Index, and Official GDP Index respectively. The total GDP index is taken as 100 for the base year and indexes are calculated for subsequent years using total GDP growth rate (Equation 4.6).

$$Total\ GDP\ Index\ [t] = Total\ GDP\ Index\ [t-1] * (1 + Growth\ Rate) \quad [4.6]$$

Official and Unofficial GDP index is calculated from Data [C] in the base year and similar formula is applied to calculate subsequent indexes (Equation 4.7, Equation 4.8).

$$Official\ GDP\ Index\ [t] = Official\ GDP\ Index\ [t-1] * (1 + Growth\ Rate) \quad [4.7]$$
$$Unofficial\ GDP\ Index\ [t] = Total\ GDP\ Index\ [t] - Official\ GDP\ Index\ [t] \quad [4.8]$$

Unofficial GDP Index represents the size of the shadow economy relative to the base year.

## 4.2.5 Calculation

The base year for calculation is taken as 1990 and the Indexes in base year are -

$$Total\ GDP\ Index = 100$$

$$Unofficial\ GDP\ Index = 64$$

$$Official\ GDP\ Index = 36$$

For calculation of indexes in subsequent years, electricity consumption growth rate (Figure 4.6) is required. Calculation for the same is performed in Appendix (Table - 4).

$$Electricity\ Consumption\ Growth\ Rate\ [t]$$
$$= \frac{(Electricity\ Consumption\ [t] - Electricity\ Consumption\ [t-1])}{Electricity\ Consumption\ [t-1]}$$
$$* 100$$

[4.9]

**Figure 4.6: Electricity Consumption Growth Rate of India (1991 - 2014)**
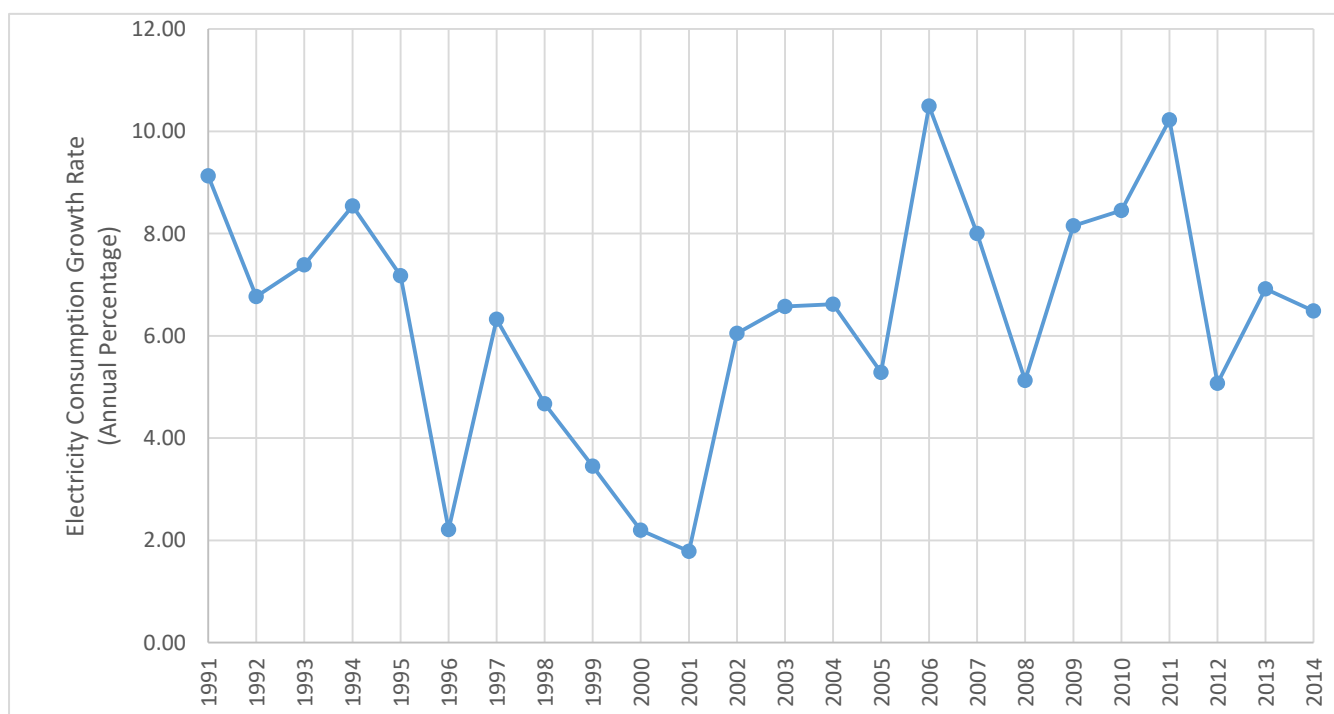


*Refer to Appendix (Table-4) for calculation*

| Year | Electricity Consumption Growth Rate (Annual Percentage) |
|---|---|
| 2015* | 6.78 |
| 2016* | 7.66 |

*\* Based on Provisional Data*

It is discussed earlier (Section 4.1.3) that elasticity will not be constant in the case of India due to rapid growth and technological development so method is applied for all the three elasticity scenarios (Figure 4.7 to 4.9) -

[1] Elasticity = 1.0

**Figure 4.7 (A): Official and Unofficial GDP Indexes for elasticity = 1.0 (1991 - 2014)**
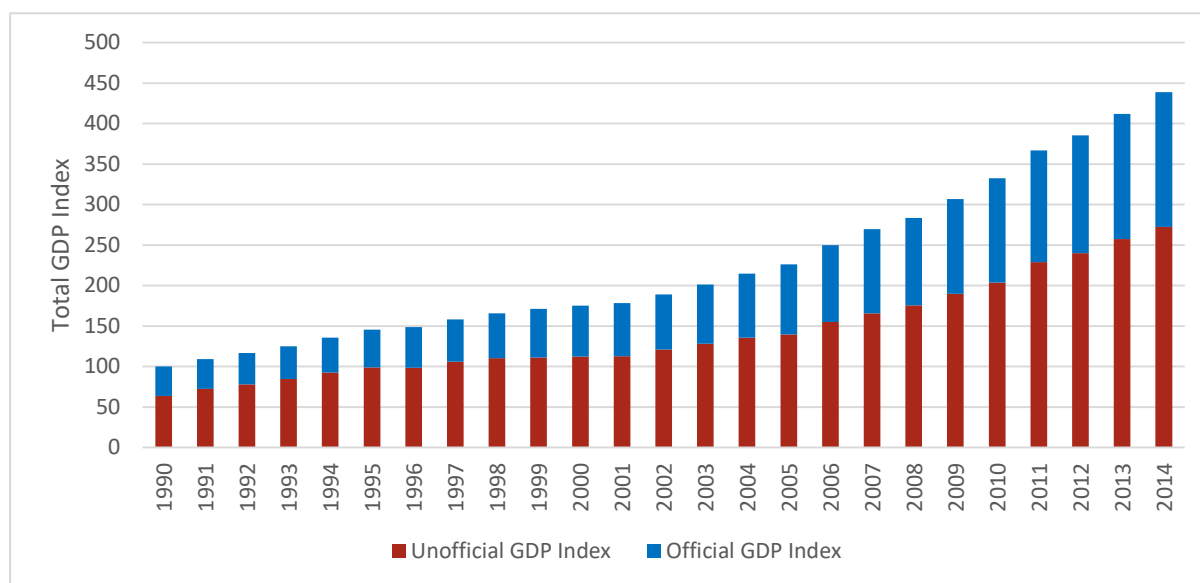


*Refer to Appendix (Table-5) for calculation*

**Figure 4.7 (B): Official and Unofficial GDP Indexes for elasticity = 1.0 (2014 - 2016)**
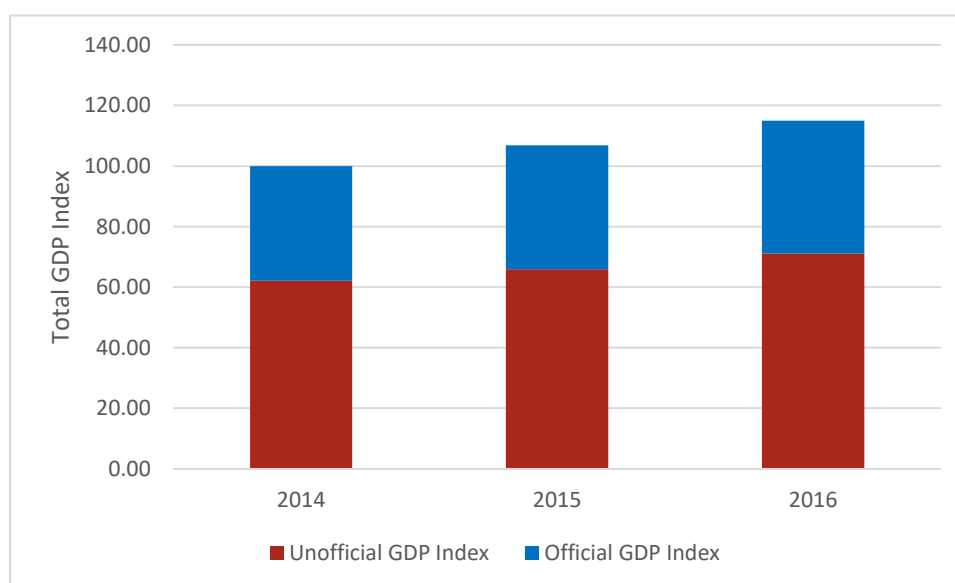


*Based on Provisional Data*

[2] Elasticity = 1.15

**Figure 4.8(A): Official and Unofficial GDP Indexes for elasticity = 1.15 (1991 - 2014)**
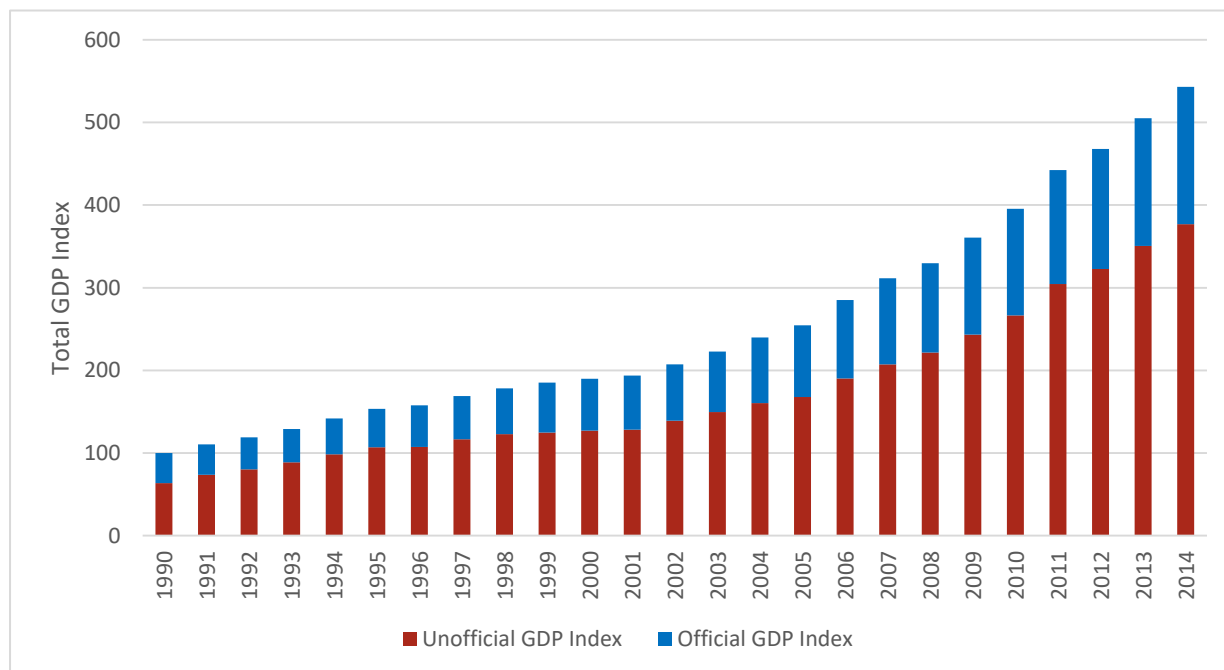


*Refer to Appendix (Table-6) for calculation*

**Figure 4.8 (B): Official and Unofficial GDP Indexes for elasticity = 1.15 (2014 - 2016)**
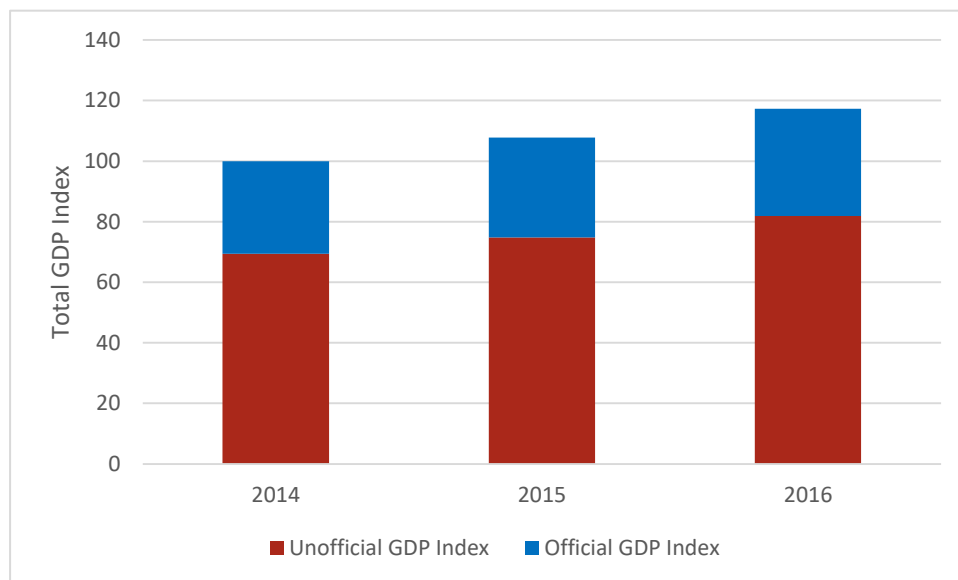


*Based on Provisional Data*

[3] Elasticity = 0.9

**Figure 4.9(A): Official and Unofficial GDP Indexes for elasticity = 0.9 (1991 - 2014)**
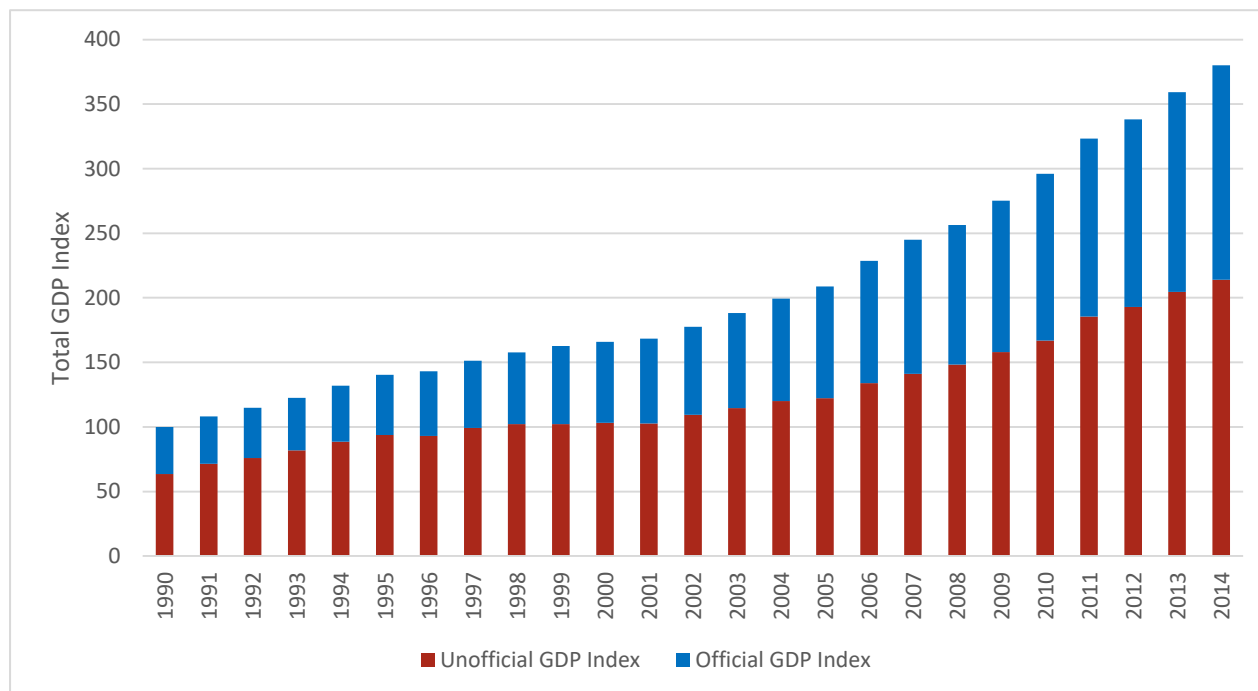


*Refer to Appendix (Table-7) for calculation*

**Figure 4.9 (B): Official and Unofficial GDP Indexes for elasticity = 0.9 (2014 - 2016)**
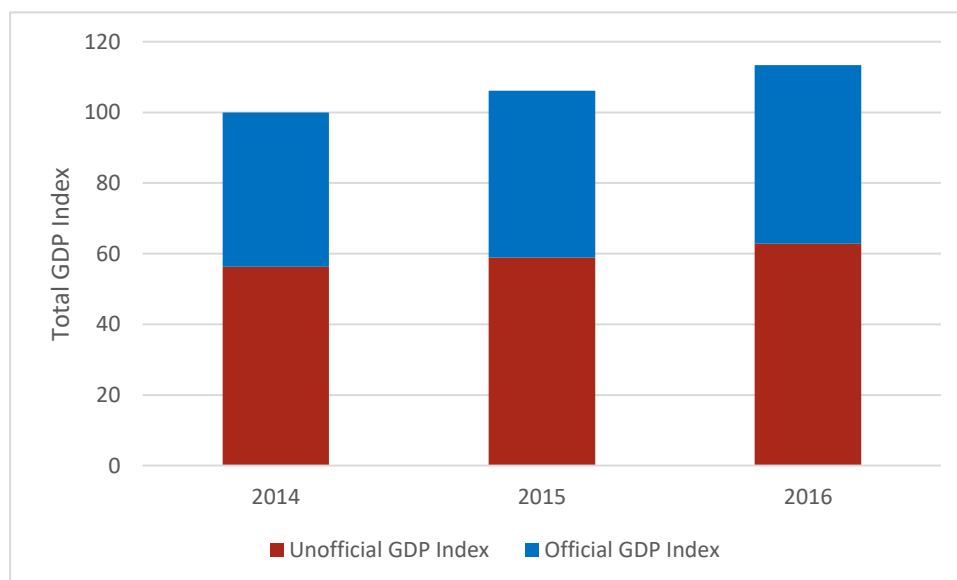


*Based on Provisional Data*

It can be seen from the figure 4.7 to 4.9 that the total GDP Index is increasing in all of the three elasticity scenarios. This shows the developing nature of Indian Economy and a considerable part of the economy formed by unofficial GDP.

# Chapter 5
# Results & Discussions

❖ Results and Discussion

❖ Recent Economic Changes and
   Impact on Shadow Economy

# 5. Results & Discussions

The growth rate of shadow economy is estimated using Electricity Consumption Method for the years 1991 - 2016 (Base Year: 1990). The method is applied for all the three elasticity scenarios. The method is separately applied for the year 2015 and 2016 (Base Year: 2014) because of unavailability of Official Data. Provisional Data is used in this case.

It can be seen from Figure 5.1 that the total GDP index is continuously increasing in all three elasticity Scenario which shows the developing nature of Indian Economy in contrast to saturated economies of developed nations.

**Figure 5.1: Total GDP Index in all the three elasticity scenarios (1990 - 2016)**



*based on provisional data*
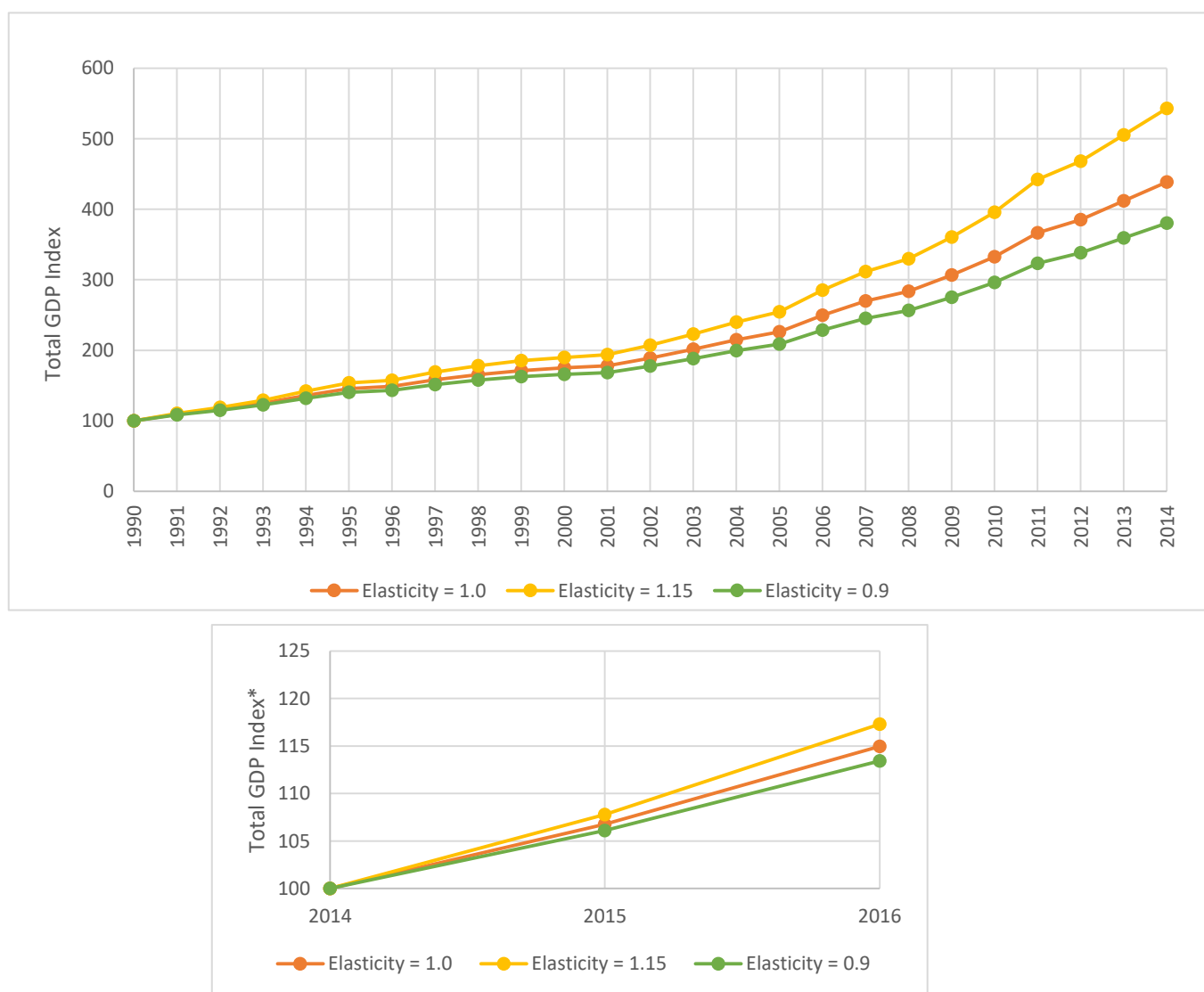
One of the parameter to represent the size of the Shadow Economy is percentage share of total economy (or Total GDP). Official and Unofficial GDP Indexes are calculated as percentage of total GDP Index for all the three elasticity scenarios.

**Figure 5.2: Share of Official and Unofficial GDP from 1990 to 2016 (Elasticity = 1.0)**
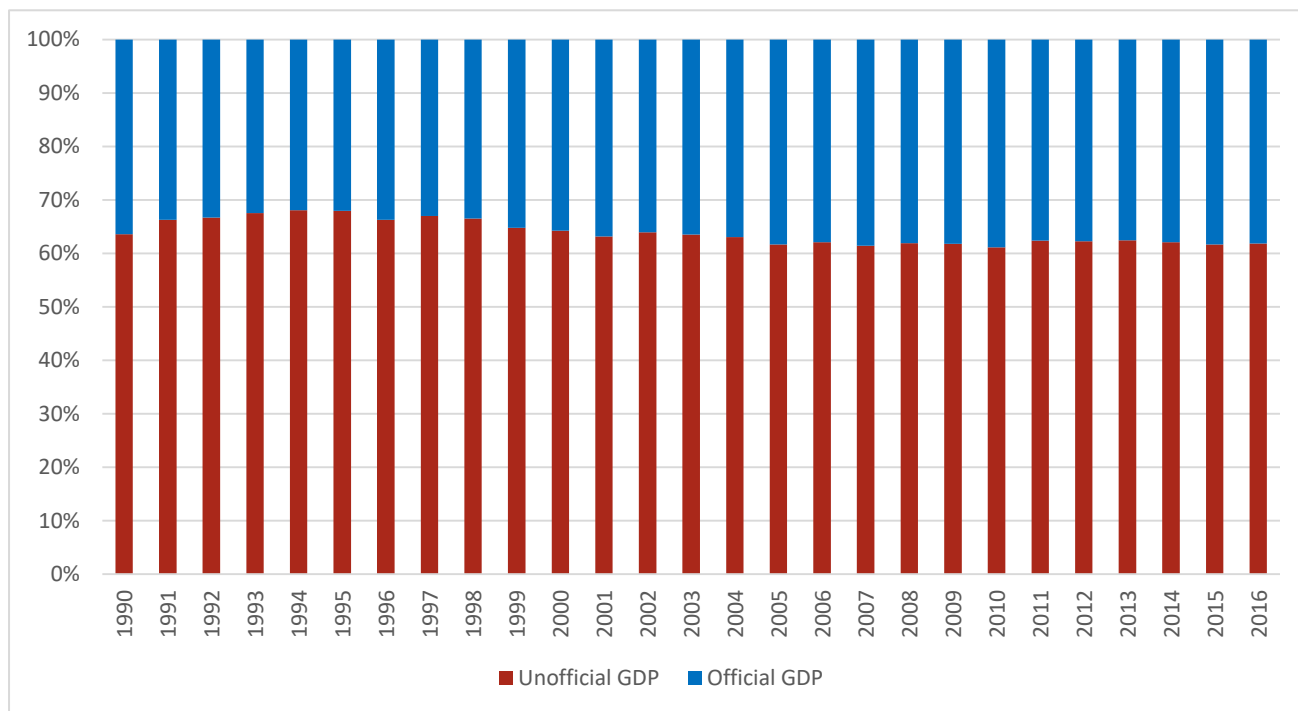


**Figure 5.3: Share of Official and Unofficial GDP from 1990 to 2016 (Elasticity = 1.15)**
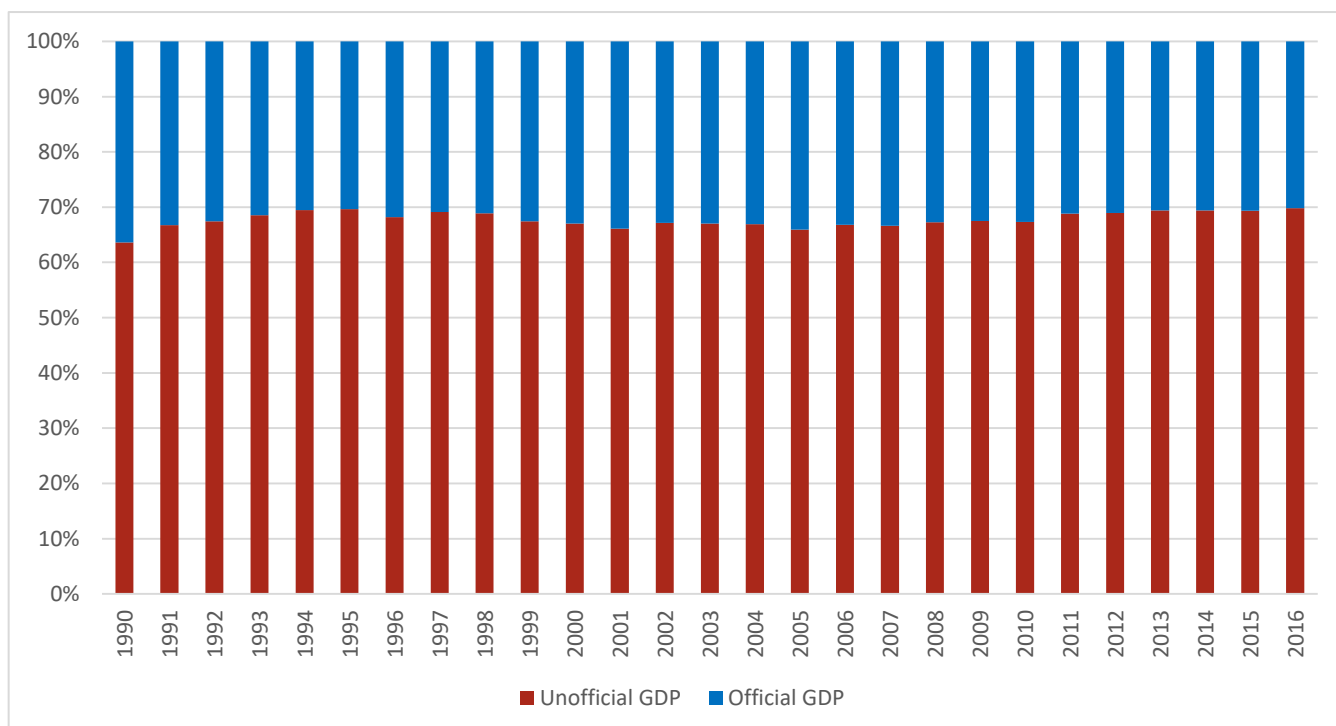
**Figure 5.4: Share of Official and Unofficial GDP from 1990 to 2016 (Elasticity = 0.9)**
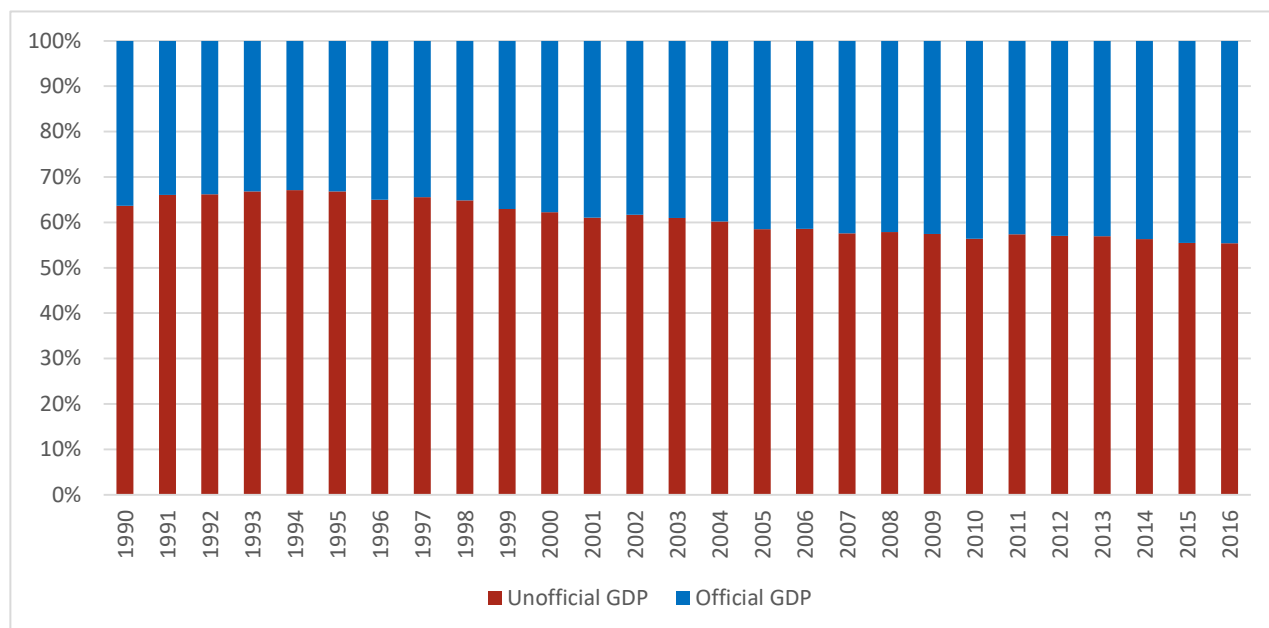


**Figure 5.5: Share of Unofficial GDP for all the three elasticity scenarios**
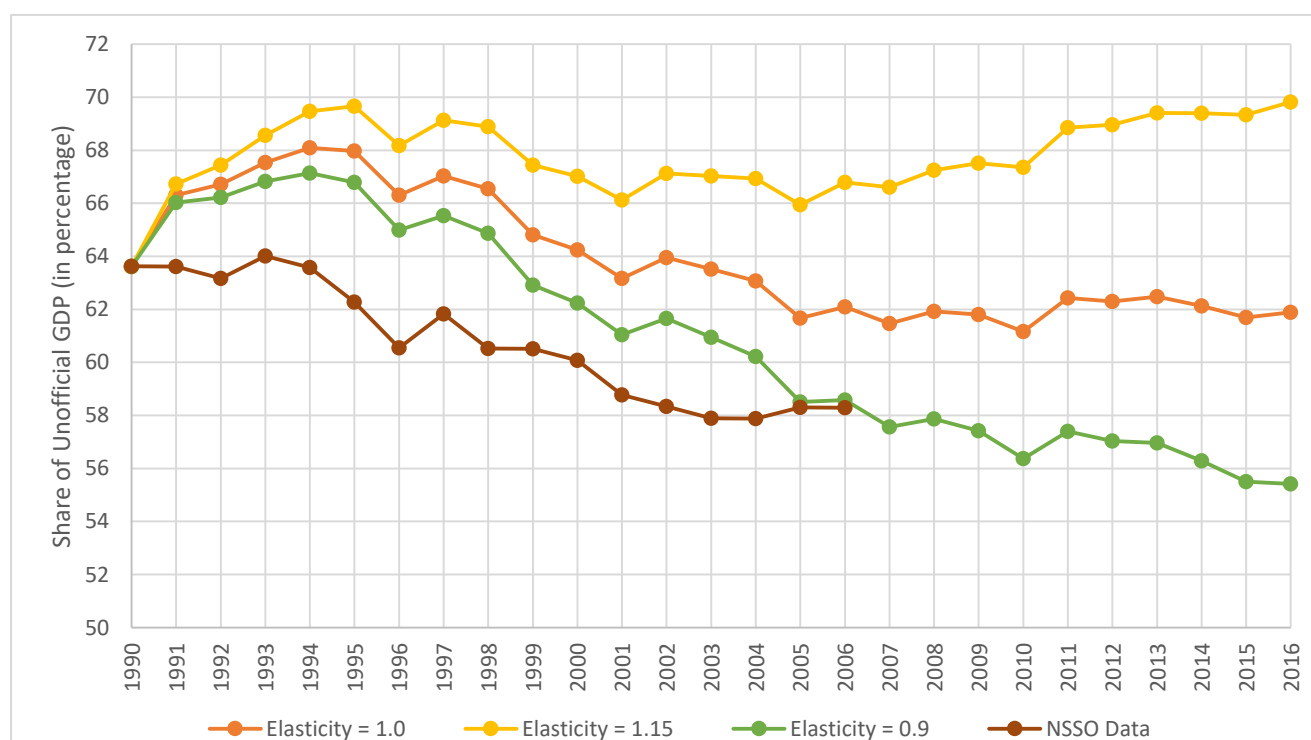
It can be seen from Figure 5.5 that the size of the Shadow Economy (or Unofficial GDP) increases for the initial time period, then saturate for some time and after that the size depends on the elasticity. For the Unitary Elasticity (= 1.0) scenario, the size of the Shadow Economy saturate with time period while it increases and decreases for other two elasticity scenarios.

The initial increase in the shadow economy is due to economic liberalization in 1991. This caused the job reduction in the formal economy to increase the production efficiency of enterprises so that they can compete at international level. Jobless workers shifted to informal economy, thus caused the increment.

The results for all the three scenarios are compared with the official data on unorganized sector provided by NSSO available up to the year 2006. It can be seen from the figure that trend of the results matches with the official data. The official data shows conservative estimates of the unorganized sector because it is not completely captured by the official data. The difference between the results is due to the assumption taken in the method.

Unitary elasticity (elasticity = 1.0) assumption corresponds to "Energy Neutral" economy while positive and negative elasticity (elasticity < 1 and elasticity > 1) corresponds to "Energy Efficient" and "Energy Inefficient" economies respectively. India is a rapidly developing country with increasing technical efficiency so the elasticity will change over the time period. From the results, it can be seen that initial estimation matches with negative elasticity scenario, then unitary elasticity scenario and with positive elasticity scenario afterwards. This shows that India is proceeding towards energy efficient economy from energy inefficient economy in 1990s. These results prove the hypothesis in the case of India that total GDP- electricity consumption elasticity changes over the time period.

Electricity Consumption Method presents a macroeconomic perspective of growth of the shadow economy. The results shows that the size of the shadow economy may be fluctuating

for a small time period but in a larger time scale, the shadow economy is shrinking over the years in terms of its contribution to the total economy. Apart from this broader picture, there are some recent economic changes and policies introduced by the government that affected the shadow economy for a small time period. An analysis of these economic changes give better understanding about the vulnerability of shadow economy against them.

## 5.1 Recent Economic Changes in India and Impact on Shadow Economy

In the last couple of years, Indian economy has witnessed some major economic changes and reforms such as Demonetization, Goods and Services Tax etc. which disrupted the economy for a small period of time and has long time implications in terms of changing the economic scenario of the country. Both of these reforms have given push to digital economy and affected the shadow economy the most. Thus, it is essential to study the effect of these economic reforms and changes. On the other side, Online Shopping is exponentially increasing its presence in the country and has disrupted the businesses of small enterprises that belong to shadow economy. All the three economic changes are discussed thoroughly in the following section.

### 5.1.1 Demonetization

The government caused a major economy disruption by demonetizing the high value currency notes of Rs. 500 and Rs. 1000 denomination on 8th of November 2016. The purpose of the government was to eliminate these existing notes and gradually replace them with new notes. The reasons offered for demonetization by the government are two-fold: one to control counterfeit notes that are contributing to terrorism and other to eliminate black money from the economy. How far these aims are achieved by the government is different topic but demonetization has certainly caused major disruption in Shadow Economy of India because of severely reduced liquidity. Shadow Economy is dependent on cash transaction so not only unorganized sector completely disrupted but organized sector also had major hit. The negative

effect of demonetization can be clearly seen in GDP growth rate which declined to 6.1 percent from 7.9 percent and India also lost its status of the fastest growing economy.

Agriculture, manufacturing, construction and other MSME (Micro, Small and Medium Enterprises) employ large number of unorganized labor and completely run by cash so demonetization caused severe destruction in their activities. A large number of people became jobless due to unavailability of cash. From a report of "Business Standard" newspaper, construction activities contracted 3.7 percent in succeeding quarter. The negative impact of demonetization clearly predict that overall Shadow Economy is contracted due to unavailability of cash for a small period of time.

## 5.1.2 Goods & Services Tax

The Goods and Services Tax (GST)[14] is a transition from multiple taxation levies to a country wide single tax system. Apart from this, GST is technology driven taxation system which requires mandatory compliance through digital technology only. For big business and industries (Formal enterprises) it is easy to shift to technology driven taxation system but it will be daunting transition for small, medium (informal / unorganized) enterprises as nearly 60 percent of small businesses in the country have yet to adopt computerization in their existing format.

Mandatory digital compliance through GST will surely cause the shift from unorganized sector to organized sector and this is likely to cause decrease of unorganized sector in the economy. According to a news report of "First Post", the share of informal segment in the tiles industry declined from 40 percent to 20 percent only because unorganized player shifted to organized activities because of GST. Tiles, construction, dairy, jewellery etc. industries have highest component of informal segment. Because of GST, these industries

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[14] The Goods and Services Tax was introduced in July 1st ,2017

witness difficulties in complying with GST so initially slowdown is seen and after that transition period, the share of unorganized segment is decreased significantly in these industries. So overall the unorganized sector is anticipated to decrease due to GST.

### 5.1.3 Online Economy

The rapidly evolving online economy touches virtually every aspects of lives of people. Online Economy is spreading its roots in India rapidly in the form of online businesses and online payments such as, choosing a restaurant through Yelp, Airbnb for a weekend getaway, and Uber for a ride. A large number of consumers are shifting towards online shopping from traditional small enterprises that comes under shadow economy. It has reached to each segment to industries from electronics to tiles to grocery also now a days. This shift in economy has direct impact on unorganized retailers. The unorganized retailers are facing a gradual decline in their volume of business and profit year by year. The closure of unorganized retails shops are increasing[15] and growth of new unorganized retails is decreasing in last couple of years. The main disadvantages for unorganized retailers are unable to offer significant discount that attract the customer in online shopping. The employment in unorganized sector is also declining due to online economy.

Not only online shopping, online taxi services such as, Ola, Uber, etc. has also caused the shift of labor from unorganized sector to organized sector since the drivers are now become the employee of an organized company. So overall the online economy is causing the shrink in unorganized sector.

All the three economic changes and reforms cause temporary disruption in Shadow Economy and it shrinks in all cases. However, shadow economy can expand if the complete financial year is considered. If the elasticity is taken as 0.9 then, the results (Figure 5.4) shows

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[15] A report on *"Impact of organized retiling on the unorganized sector"* by Mathew Joseph has shown that rate of closure of unorganized retailer is 4 percent per annum.

that the shadow economy has shrunk in the year 2015-16 which match with the prediction through the theoretical analysis of impact of recent economic reforms on shadow economy.

# Chapter 6
# Conclusions

# 6. Conclusions

The study examines the change in the size of the shadow economy of India in terms of percentage contribution to total GDP for the time period 1991 to 2016. Electricity Consumption Method is applied for the study and results are compared with the official data available on the shadow economy. The method is applied for all the three elasticity (total GDP - electricity consumption elasticity) scenarios - energy efficient, energy neutral, and energy inefficient. In the end, the effect of the recent economic reforms and changes, i.e., Demonetization, Goods and Services Tax, Online Economy on shadow economy is also discussed briefly.

The study reveals that the size of the shadow economy is decreasing over the years which is agreement with the official data provided by NSSO, India. During the initial time period of study, the shadow economy increases but it shows decreasing trend after the starting of $21^{st}$ century which is a result of technological advancement in formal economy that the shadow economy could not adopt and formalization of the economy due to economic reforms by the government. One of the limitation of electricity consumption method is constant elasticity assumption especially for the long time period as considered in the current study. Over the time period, production efficiency of the enterprises changes due to technological advancement thus elasticity of the country also changes from energy inefficient to energy efficient. Same trend can be seen in the results where the official data matches with energy inefficient elasticity results during initial time period and with energy efficient elasticity results after 2000. It can be concluded that variable elasticity will give very good results but could not be incorporated in current study due to mathematical complexity.

Finally, recent economic changes and reforms introduced by the government cause disruption in shadow economy temporarily so cannot be captured in large time period as considered in the study. However, the brief study shows that all the recent economic changes and reforms have shrunken the shadow economy for the considered time period.

# Appendix

# Appendix

**Table 1:** *Total Electricity Consumption per Capita of India (1990 - 2016)*

| S. No. | Year | Electricity Consumption per Capita (kWh per capita) |
|--------|------|------------------------------------------------------|
| 1 | 1990 | 273.05 |
| 2 | 1991 | 291.95 |
| 3 | 1992 | 305.54 |
| 4 | 1993 | 321.71 |
| 5 | 1994 | 342.46 |
| 6 | 1995 | 360.05 |
| 7 | 1996 | 361.09 |
| 8 | 1997 | 376.80 |
| 9 | 1998 | 387.20 |
| 10 | 1999 | 393.37 |
| 11 | 2000 | 394.96 |
| 12 | 2001 | 395.10 |
| 13 | 2002 | 411.97 |
| 14 | 2003 | 431.84 |
| 15 | 2004 | 453.01 |
| 16 | 2005 | 469.45 |
| 17 | 2006 | 510.75 |
| 18 | 2007 | 543.36 |
| 19 | 2008 | 562.90 |
| 20 | 2009 | 600.20 |
| 21 | 2010 | 642.11 |
| 22 | 2011 | 698.55 |
| 23 | 2012 | 724.79 |
| 24 | 2013 | 765.56 |
| 25 | 2014 | 805.60 |
| 26 | 2015 | 1010.00* |
| 27 | 2016 | 1075.00* |

*Source: World Bank*                    *\* Provisional Data*

**Table 2:** *Population of India (1990 - 2016)*

| S. No. | Year | Population (in Millions) |
|---|---|---|
| 1 | 1990 | 870 |
| 2 | 1991 | 888 |
| 3 | 1992 | 906 |
| 4 | 1993 | 924 |
| 5 | 1994 | 942 |
| 6 | 1995 | 960 |
| 7 | 1996 | 979 |
| 8 | 1997 | 997 |
| 9 | 1998 | 1016 |
| 10 | 1999 | 1035 |
| 11 | 2000 | 1053 |
| 12 | 2001 | 1071 |
| 13 | 2002 | 1090 |
| 14 | 2003 | 1108 |
| 15 | 2004 | 1126 |
| 16 | 2005 | 1144 |
| 17 | 2006 | 1162 |
| 18 | 2007 | 1180 |
| 19 | 2008 | 1197 |
| 20 | 2009 | 1214 |
| 21 | 2010 | 1231 |
| 22 | 2011 | 1247 |
| 23 | 2012 | 1263 |
| 24 | 2013 | 1279 |
| 25 | 2014 | 1294 |
| 26 | 2015 | 1309 |
| 27 | 2016 | 1324 |

*Source: World Bank*

**Table 3:** *Official GDP Growth Rate of India (1990 - 2016)*

| S. No. | Year | Official GDP Growth Rate (in Percentage) |
|---|---|---|
| 1 | 1990 | 5.53 |
| 2 | 1991 | 1.06 |
| 3 | 1992 | 5.48 |
| 4 | 1993 | 4.75 |
| 5 | 1994 | 6.66 |
| 6 | 1995 | 7.57 |
| 7 | 1996 | 7.55 |
| 8 | 1997 | 4.05 |
| 9 | 1998 | 6.18 |
| 10 | 1999 | 8.85 |
| 11 | 2000 | 3.84 |
| 12 | 2001 | 4.82 |
| 13 | 2002 | 3.80 |
| 14 | 2003 | 7.86 |
| 15 | 2004 | 7.92 |
| 16 | 2005 | 9.28 |
| 17 | 2006 | 9.26 |
| 18 | 2007 | 9.80 |
| 19 | 2008 | 3.89 |
| 20 | 2009 | 8.48 |
| 21 | 2010 | 10.26 |
| 22 | 2011 | 6.64 |
| 23 | 2012 | 5.46 |
| 24 | 2013 | 6.39 |
| 25 | 2014 | 7.51 |
| 26 | 2015 | 8.01 |
| 27 | 2016 | 7.11 |

*Source: World Bank*

**Table 4:** *Calculation of electricity consumption growth rate (1990 - 2016)*

| S. No. | Year | Electricity Consumption per capita [A] | Population (in Millions) [B] | Total Electricity Consumption (in Billion kWh) [C] = [A] x [B] | Electricity Consumption Growth Rate (in Percentage) |
|---|---|---|---|---|---|
| 1 | 1990 | 273.05 | 870 | 238 | - |
| 2 | 1991 | 291.95 | 888 | 259 | 9.13 |
| 3 | 1992 | 305.54 | 906 | 277 | 6.77 |
| 4 | 1993 | 321.71 | 924 | 297 | 7.39 |
| 5 | 1994 | 342.46 | 942 | 323 | 8.54 |
| 6 | 1995 | 360.05 | 960 | 346 | 7.17 |
| 7 | 1996 | 361.09 | 979 | 353 | 2.21 |
| 8 | 1997 | 376.80 | 997 | 376 | 6.32 |
| 9 | 1998 | 387.20 | 1016 | 393 | 4.67 |
| 10 | 1999 | 393.37 | 1035 | 407 | 3.45 |
| 11 | 2000 | 394.96 | 1053 | 416 | 2.20 |
| 12 | 2001 | 395.10 | 1071 | 423 | 1.79 |
| 13 | 2002 | 411.97 | 1090 | 449 | 6.05 |
| 14 | 2003 | 431.84 | 1108 | 478 | 6.58 |
| 15 | 2004 | 453.01 | 1126 | 510 | 6.62 |
| 16 | 2005 | 469.45 | 1144 | 537 | 5.28 |
| 17 | 2006 | 510.75 | 1162 | 593 | 10.50 |
| 18 | 2007 | 543.36 | 1180 | 641 | 8.00 |
| 19 | 2008 | 562.90 | 1197 | 674 | 5.13 |
| 20 | 2009 | 600.20 | 1214 | 729 | 8.15 |
| 21 | 2010 | 642.11 | 1231 | 790 | 8.45 |
| 22 | 2011 | 698.55 | 1247 | 871 | 10.23 |
| 23 | 2012 | 724.79 | 1263 | 915 | 5.07 |
| 24 | 2013 | 765.56 | 1279 | 979 | 6.92 |
| 25 | 2014 | 805.60 | 1294 | 1042 | 6.49 |

*\* Calculation is performed separately for provisional data (2015 and 2016)*

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2014* | 957 | 1294 | 1238 | - |
| 2 | 2015* | 1010 | 1309 | 1322 | 6.78 |
| 3 | 2016* | 1075 | 1324 | 1423 | 7.66 |

$$Electricity\ Consumption\ Growth\ Rate\ [t]$$
$$= \frac{(Electricity\ Consumption\ [t] - Electricity\ Consumption\ [t-1])}{Electricity\ Consumption\ [t-1]} * 100$$

**Table 5:** *Calculation of Unofficial GDP Index for elasticity = 1.0 (1990 - 2016)*

| S. No. | Year | Total GDP Growth Rate (Percentage) | Total GDP Index [A] | Official GDP Growth Rate (Percentage) | Official GDP Index [B] | Unofficial GDP Index [C] = [A]-[B] |
|---|---|---|---|---|---|---|
| 1 | 1990 | - | 100.00 | 5.53 | 36.38 | 63.62 |
| 2 | 1991 | 9.13 | 109.13 | 1.06 | 36.76 | 72.36 |
| 3 | 1992 | 6.77 | 116.51 | 5.48 | 38.78 | 77.73 |
| 4 | 1993 | 7.39 | 125.12 | 4.75 | 40.62 | 84.50 |
| 5 | 1994 | 8.54 | 135.81 | 6.66 | 43.33 | 92.48 |
| 6 | 1995 | 7.17 | 145.55 | 7.57 | 46.61 | 98.95 |
| 7 | 1996 | 2.21 | 148.78 | 7.55 | 50.13 | 98.65 |
| 8 | 1997 | 6.32 | 158.18 | 4.05 | 52.16 | 106.03 |
| 9 | 1998 | 4.67 | 165.57 | 6.18 | 55.38 | 110.19 |
| 10 | 1999 | 3.45 | 171.29 | 8.85 | 60.28 | 111.01 |
| 11 | 2000 | 2.20 | 175.06 | 3.84 | 62.60 | 112.46 |
| 12 | 2001 | 1.79 | 178.19 | 4.82 | 65.62 | 112.57 |
| 13 | 2002 | 6.05 | 188.97 | 3.80 | 68.11 | 120.85 |
| 14 | 2003 | 6.58 | 201.40 | 7.86 | 73.47 | 127.93 |
| 15 | 2004 | 6.62 | 214.72 | 7.92 | 79.29 | 135.43 |
| 16 | 2005 | 5.28 | 226.07 | 9.28 | 86.65 | 139.42 |
| 17 | 2006 | 10.50 | 249.80 | 9.26 | 94.68 | 155.12 |
| 18 | 2007 | 8.00 | 269.79 | 9.80 | 103.96 | 165.83 |
| 19 | 2008 | 5.13 | 283.63 | 3.89 | 108.00 | 175.63 |
| 20 | 2009 | 8.15 | 306.75 | 8.48 | 117.16 | 189.59 |
| 21 | 2010 | 8.45 | 332.69 | 10.26 | 129.18 | 203.51 |
| 22 | 2011 | 10.23 | 366.71 | 6.64 | 137.76 | 228.95 |
| 23 | 2012 | 5.07 | 385.32 | 5.46 | 145.27 | 240.04 |
| 24 | 2013 | 6.92 | 411.98 | 6.39 | 154.55 | 257.43 |
| 25 | 2014 | 6.49 | 438.72 | 7.51 | 166.15 | 272.56 |

*\* Calculation is performed separately for provisional data (2015 and 2016)*

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2014* | - | 100.00 | 7.51 | 37.87 | 62.13 |
| 2 | 2015* | 6.78 | 106.78 | 8.01 | 40.91 | 65.87 |
| 3 | 2016* | 7.66 | 114.96 | 7.11 | 43.81 | 71.15 |

- $Total\ GDP\ Growth\ Rate = Elasticity * Electricity\ Consumption\ Growth\ Rate$
- $Total\ GDP\ Index\ [t] = Total\ GDP\ Index\ [t-1] * (1 + Growth\ Rate)$
- $Official\ GDP\ Index\ [t] = Official\ GDP\ Index\ [t-1] * (1 + Growth\ Rate)$
- $Unofficial\ GDP\ Index\ [t] = Total\ GDP\ Index\ [t] - Official\ GDP\ Index\ [t]$

**Table 6:** *Calculation of Unofficial GDP Index for elasticity = 1.15 (1990 - 2016)*

| S. No. | Year | Total GDP Growth Rate (Percentage) | Total GDP Index [A] | Official GDP Growth Rate (Percentage) | Official GDP Index [B] | Unofficial GDP Index [C] = [A]-[B] |
|---|---|---|---|---|---|---|
| 1 | 1990 | - | 100.00 | 5.53 | 36.38 | 63.62 |
| 2 | 1991 | 10.50 | 110.50 | 1.06 | 36.76 | 73.73 |
| 3 | 1992 | 7.78 | 119.10 | 5.48 | 38.78 | 80.32 |
| 4 | 1993 | 8.50 | 129.22 | 4.75 | 40.62 | 88.60 |
| 5 | 1994 | 9.82 | 141.91 | 6.66 | 43.33 | 98.58 |
| 6 | 1995 | 8.25 | 153.62 | 7.57 | 46.61 | 107.01 |
| 7 | 1996 | 2.54 | 157.53 | 7.55 | 50.13 | 107.40 |
| 8 | 1997 | 7.27 | 168.98 | 4.05 | 52.16 | 116.83 |
| 9 | 1998 | 5.37 | 178.06 | 6.18 | 55.38 | 122.68 |
| 10 | 1999 | 3.97 | 185.13 | 8.85 | 60.28 | 124.85 |
| 11 | 2000 | 2.53 | 189.82 | 3.84 | 62.60 | 127.22 |
| 12 | 2001 | 2.05 | 193.72 | 4.82 | 65.62 | 128.10 |
| 13 | 2002 | 6.96 | 207.20 | 3.80 | 68.11 | 139.08 |
| 14 | 2003 | 7.56 | 222.87 | 7.86 | 73.47 | 149.40 |
| 15 | 2004 | 7.61 | 239.83 | 7.92 | 79.29 | 160.54 |
| 16 | 2005 | 6.08 | 254.40 | 9.28 | 86.65 | 167.75 |
| 17 | 2006 | 12.07 | 285.11 | 9.26 | 94.68 | 190.43 |
| 18 | 2007 | 9.21 | 311.35 | 9.80 | 103.96 | 207.39 |
| 19 | 2008 | 5.90 | 329.72 | 3.89 | 108.00 | 221.72 |
| 20 | 2009 | 9.37 | 360.63 | 8.48 | 117.16 | 243.47 |
| 21 | 2010 | 9.72 | 395.70 | 10.26 | 129.18 | 266.51 |
| 22 | 2011 | 11.76 | 442.23 | 6.64 | 137.76 | 304.47 |
| 23 | 2012 | 5.83 | 468.03 | 5.46 | 145.27 | 322.76 |
| 24 | 2013 | 7.96 | 505.29 | 6.39 | 154.55 | 350.73 |
| 25 | 2014 | 7.46 | 542.99 | 7.51 | 166.15 | 376.84 |

* *Calculation is performed separately for provisional data (2015 and 2016)*

| 1 | 2014* | - | 100.00 | 7.51 | 30.60 | 69.40 |
|---|---|---|---|---|---|---|
| 2 | 2015* | 7.79 | 107.79 | 8.01 | 33.05 | 74.74 |
| 3 | 2016* | 8.81 | 117.29 | 7.11 | 35.40 | 81.90 |

- *Total GDP Growth Rate = Elasticity ∗ Electricity Consumption Growth Rate*
- *Total GDP Index* $[t]$ *= Total GDP Index* $[t-1]$ ∗ $(1 + Growth\ Rate)$
- *Official GDP Index* $[t]$ *= Official GDP Index* $[t-1]$ ∗ $(1 + Growth\ Rate)$
- *Unofficial GDP Index* $[t]$ *= Total GDP Index* $[t]$ − *Official GDP Index* $[t]$

**Table 7:** *Calculation of Unofficial GDP Index for elasticity = 0.9 (1990 - 2016)*

| S. No. | Year | Total GDP Growth Rate (Percentage) | Total GDP Index [A] | Official GDP Growth Rate (Percentage) | Official GDP Index [B] | Unofficial GDP Index [C] = [A]-[B] |
|---|---|---|---|---|---|---|
| 1 | 1990 | - | 100.00 | 5.53 | 36.38 | 63.62 |
| 2 | 1991 | 8.21 | 108.21 | 1.06 | 36.76 | 71.45 |
| 3 | 1992 | 6.09 | 114.81 | 5.48 | 38.78 | 76.03 |
| 4 | 1993 | 6.65 | 122.44 | 4.75 | 40.62 | 81.82 |
| 5 | 1994 | 7.69 | 131.85 | 6.66 | 43.33 | 88.53 |
| 6 | 1995 | 6.46 | 140.37 | 7.57 | 46.61 | 93.76 |
| 7 | 1996 | 1.99 | 143.16 | 7.55 | 50.13 | 93.04 |
| 8 | 1997 | 5.69 | 151.31 | 4.05 | 52.16 | 99.15 |
| 9 | 1998 | 4.20 | 157.67 | 6.18 | 55.38 | 102.29 |
| 10 | 1999 | 3.11 | 162.57 | 8.85 | 60.28 | 102.29 |
| 11 | 2000 | 1.98 | 165.79 | 3.84 | 62.60 | 103.19 |
| 12 | 2001 | 1.61 | 168.46 | 4.82 | 65.62 | 102.84 |
| 13 | 2002 | 5.45 | 177.63 | 3.80 | 68.11 | 109.52 |
| 14 | 2003 | 5.92 | 188.15 | 7.86 | 73.47 | 114.68 |
| 15 | 2004 | 5.95 | 199.35 | 7.92 | 79.29 | 120.06 |
| 16 | 2005 | 4.76 | 208.83 | 9.28 | 86.65 | 122.18 |
| 17 | 2006 | 9.45 | 228.56 | 9.26 | 94.68 | 133.88 |
| 18 | 2007 | 7.20 | 245.02 | 9.80 | 103.96 | 141.07 |
| 19 | 2008 | 4.62 | 256.34 | 3.89 | 108.00 | 148.33 |
| 20 | 2009 | 7.34 | 275.14 | 8.48 | 117.16 | 157.98 |
| 21 | 2010 | 7.61 | 296.08 | 10.26 | 129.18 | 166.90 |
| 22 | 2011 | 9.20 | 323.33 | 6.64 | 137.76 | 185.57 |
| 23 | 2012 | 4.57 | 338.09 | 5.46 | 145.27 | 192.82 |
| 24 | 2013 | 6.23 | 359.15 | 6.39 | 154.55 | 204.60 |
| 25 | 2014 | 5.84 | 380.13 | 7.51 | 166.15 | 213.98 |

* *Calculation is performed separately for provisional data (2015 and 2016)*

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2014* | - | 100.00 | 7.51 | 43.71 | 56.29 |
| 2 | 2015* | 6.10 | 106.10 | 8.01 | 47.21 | 58.90 |
| 3 | 2016* | 6.90 | 113.42 | 7.11 | 50.56 | 62.85 |

- *Total GDP Growth Rate = Elasticity ∗ Electricity Consumption Growth Rate*
- *Total GDP Index* $[t]$ = *Total GDP Index* $[t-1] * (1 + Growth\ Rate)$
- *Official GDP Index* $[t]$ = *Official GDP Index* $[t-1] * (1 + Growth\ Rate)$
- *Unofficial GDP Index* $[t]$ = *Total GDP Indx* $[t]$ − *Official GDP Index* $[t]$

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