Ramjas Economic Review 2019-20

Volume II

Department of Economics
Ramjas College
University of Delhi

Ramjas Economic Review 2019-20

CONTENTS

Staff Advisor's Note

I am happy to introduce the second issue of the Ramjas Economic Review. The journal has seen many versions, starting with a print version more than a decade back and then published online as the Journal of Ramjas Economics Society before assuming its present form. It is now a completely academic journal with peer reviewed articles. The Ramjas Economic Review encourages undergraduate economics students to pursue their academic interest of writing scholarly articles. It provides a platform for publishing which is otherwise not easily available to undergraduate students.

The Editorial Board has worked for months on end to bring the journal to its present form. The process started shortly after the Editorial Board was constituted. A large number of articles were submitted by students from across the country after the call was sent out. The Editorial Board went through every article and a large number of shortlisted articles were subsequently reviewed by at least two reviewers. The articles that have been finally included in this issue have gone through many stages of revisions by the authors and editing by the Editorial Board.

The editorial team has brought out the journal in the face of many uncertainties during this academic year. I hope that you find this edition engaging and informative, and enjoy reading it as much as the Ramjas Economic Review team did in publishing it.

Dr. Mihir Pandey
Staff Advisor
Ramjas Economic Review

Editor-in-Chief's Note

I, on behalf of the Editorial Board, take pleasure in presenting before our readers the second volume of Ramjas Economic Review. The Department of Economics, Ramjas College has year on year, made attempts to promote a culture of academic writing and critical thinking amongst its students and Ramjas Economic Review is a proof of its success. This student-run journal's journey began in the year 2018 when a group of enthusiastic students decided to revamp its older versions. After one year of hard work and discussions with the students and faculty alike, they were able to give a new shape to the journal while fulfilling the expectations set by their seniors. This year, in the second edition, we have not only maintained the standards set by the previous versions but have also attempted to surpass them at times. A significant change worth mentioning is that the journal received an International Standard Serial Number (ISSN) making it one of the handful registered journals in Economics at the University of Delhi. The Board also worked towards the creation of a new website for hosting the journal and to make sure that the guidelines regarding submission, deadlines, information about the Review Board and details of other events can be found conveniently in one place for all those who are interested in engaging with us. I consider these to be milestones for this journal which will prove to be useful for the coming editions.

Through our journal, we aim to provide a space for undergraduate students to get their research published. Research in economics at the undergraduate level can help in several ways. From engaging with peers for discussing probable topics, understanding existing theories, forming a hypothesis, collecting and analyzing data, forming one's conclusions to finally writing and publishing it, each step provides tremendous exposure and Ramjas Economic Review works as the final platform wherein students can show the result of their successful research while getting valuable feedback during the process. It is a matter of pride for us that not only did we receive a brilliant pool of papers from top institutions around the country but also from a number of students from Ramjas College who involved themselves in research in the past year and kept the academic activity alive. I would like to thank all the authors for their submissions and patience during the entire process. Selecting only a few entries was difficult as well as disheartening for we realize the amount of hard work and effort of the authors behind every paper.

After an initial screening, the selected entries were sent to two reviewers for a blind review. This was followed by revisions, two rounds of editing and a final plagiarism test to give it the shape of a journal. I extend my gratitude to the reviewers who were considerate and detailed in their analysis and our faculty members for always extending a helping hand to the Board. It is no exaggeration to mention that Dr Sonia Goel, Teacher in Charge, went to great lengths to ensure the Board functioned without any hindrance while maintaining smooth coordination with the administration. Our Staff Advisor, Dr Mihir Pandey, was extremely supportive of every activity of the Board and provided us with guidance and mentorship, the lessons from which will be with us

long after we leave the gates of Ramjas. I am thankful to our Publisher, Mr Alok Dash for his constant cooperation for the ISSN registration and guidance since the inception of Ramjas Economic Review. Dr Apoorva Gupta deserves a special mention for being nothing less than an extended member of the Editorial Board as she was always available for us and constantly coordinated with the team and the faculty members. I would also like to thank the council members of The Ramjas Economics Society (2019-20) for their close collaboration throughout the year.

In the end, I would like to express my deepest gratitude to the Editorial Board of Ramjas Economic Review. A year ago when this team was formed, these eight students had set a goal for themselves which was to create an inclusive space for college students to learn from each other while exploring new ideas and research. Never did we limit our work to the formulation of this journal. We considered it our responsibility to catch hold of our batchmates in the corridors of Ramjas and ask them about their ongoing research or a seminar they might be interested in or maybe just casually make them stay back after class to attend a study circle reading session. Such was the enthusiasm of this team and even though we thought we had a few more months of discussions about the journal and lunch meetings in the famous Delhi School of Economics canteen, the sudden disruption due to the coronavirus pandemic did not let our passion die. I thank the Deputy Editor in Chief, Samvid Uday for being extremely reliable, rational and swift with decision making and administration of the Board. He remained true to his responsibilities and considered this journal as his top priority. However, Samvid and I could not have imagined putting together a journal of such standards without the contribution of our Editors. Ritik Goel showed utmost punctuality and accommodativeness in his work while Tanvi Vipra went beyond her responsibilities to take the additional initiative of conceptualizing our website. Udeshay Khurana, a self-driven individual, took complete charge of the design of the journal alongside his duty as an Editor. Kshitiz Aggarwal had new and creative ideas to offer to the table and Rijul A. Das always took charge in the face of difficult situations. Vedant Deshpande proved himself to be the most trustworthy and aware person of the lot. Even though I have tried to sum up their contribution in a few lines, it is this journal which speaks volume of their efforts. I hope in the coming editions the Editorial Board will continue to be a close group of individuals who work beyond hierarchies in creating this platform for students' publications in the form of Ramjas Economic Review.

Fizza Suhel
Editor in Chief
Ramjas Economic Review

ANALYSIS OF FRACTAL PATTERNS IN THE PRICES OF AGRO–BASED COMMODITIES

NEHA SAM*, VIDHI VASHISHTH and YUKTI

Jesus and Mary College, University of Delhi

Abstract

This paper aims to investigate whether commodity markets follow a pattern with respect to prices and if they do, then whether this could be determined by using basic fractal theory and determination of Hurst exponent. The determination of Hurst exponent will help us to classify the time series as persistent or anti persistent i.e. how strongly does the time series tend to revert to its long term mean value. This result would thus lead us to understand if prices in the commodity market could be remotely predicted. Hence this fractal analysis can be used to determine the characteristics of the prices in an agro-based economy.

Keywords: Prices; Pattern; Fractal Theory

1. INTRODUCTION

When we talk of patterns with respect to economic variables, the concept of memory comes to play instinctively. As per the Concept of Dynamic Memory in Economics by Valentina V. Tarasova and Vasily E. Tarasov, "the concept of memory is considered from the standpoint of economic models in the framework of continuous-time approach". With this approach in mind, we have attempted to investigate if prices in the Indian Agro-Based commodity market tend to show this behavior of possessing a long term memory. The investigation in this paper is streamlined towards the market for onions in the National Capital Delhi region. (Tarasova and Tarasov, 2017)

On an average, the last few years have seen fluctuations and volatilities in all sectors of the Indian Economy. This includes some notable price variations in the commodity market. For an agro-based economy like India, even the slightest changes in the agro-based commodity market can prove to be detrimental to the country's growth. Amongst all the agro-based products, onions nevertheless, have shown a high degree of instability in prices. Hence a study on onion prices in the Indian Economy might lead to a good insight into whether the market, in general, can be remotely predicted.

The paper is inspired by the Fractal Market Hypothesis (FMH) which analyses the daily randomness of the market and focuses on the price movements of assets and to understand the same, the Hurst Exponent approach has been used which is explained in detail in the methodology of the paper.

This paper would unfold a suitable algorithm to find the Hurst exponent using statistical methods, specifically linear regression and time series analysis, wherein time is the independent variable and price of the commodity considered is dependent. The reason why time series analysis is chosen is because of the tendency of a time series to regress strongly to its mean. The statistical measure chosen to classify time series is the Hurst exponent. (Subir Mansukhani, 2012)

2. LITERATURE REVIEW

It is quite evident that India has always been an agriculturally driven economy with an enormous section of its GDP being derived from agriculture and allied activities. Politically speaking, a lot of emphasis is laid upon policies that are directly targeted towards the welfare of the agriculture sector. Agricultural price policies in India are aimed at poverty alleviation and food security and hence have played a pivotal role in the country's development ever since Independence. With this aspect in mind if a pattern is found to exist in the prices of agro-based commodities, then this could lead to path-breaking developments in the formulation of new policies for the sector.

* *Corresponding author's email address: nehasam0799@gmail.com*

In pursuit of finding such a pattern, the mathematical concept of fractals seemed not just the most intriguing but also the most suitable concept. A fractal is a never-ending pattern that is self-similar. Fractal patterns were first used in investment wherein research proved that stock markets follow a repeatable, cyclical fractal-like pattern.

This motivated us to extend this approach to agro-based commodities as the results could be quite fruitful to the economy. Based on the belief that history repeats itself, the Fractal Market Hypothesis focuses on the price movements of assets. Through the course of this research, if a similar fractal-like pattern is found to persist in the specified commodity market, then the hypothesis which previously was known to be applicable only for financial markets, will find a new domain of existence. (Kristoufek, 2012)

The research is streamlined towards the market for onions, taking onion as a representative of the agro-based commodities. Onion was chosen as the prime commodity since India is the second-largest producer of onions after China and in India, onion is more than just a vegetable. Apart from being a diet staple and hoarder's favourite, onion prices are often used as an indicator of inflation – and the attendant anger aimed at the government in charge. Moreover, onion prices have always been a mystery, as recent reports have suggested that onion prices have risen despite increased production which makes it relevant for research as it can be studied (to some extent) independent of external factors. (Ahluwalia, 2015).

It has to be noted that a similar research was done in the Chinese economy by eminent mathematicians Yi Wang, Xin Su and Xueli Zhan in 2015 taking celery as a prime product which concluded that the price series of the same was multifractal and that this result could be safely used to deal with price prediction and risk assessment in future.

Moreover, the research is inspired by V. Tarasova and Tarasov, 2015 paper on the concept of dynamic memory in economics and it seemed quite innovative to apply such a concept using mathematical methods to solve an economic problem. Lastly, the paper by L. Kristoufek, 2012 gave a detailed analysis of the Fractal Market Hypothesis being used to give reasonable predictions about the dynamics of financial markets, which served as a driving force for this research.

3. METHODOLOGY

3.1. Hurst Exponent
In order to investigate the existence of any such patterns in the agro-based commodity market, we have used the Hurst Exponent approach. The Hurst Exponent (H) can be used to quantify the character of randomness exhibited in a time series via an autocorrelation measurement.

$0 < H < 0.5$ represents anti-correlated behavior between variables
$H = 0.5$ represents a process that is purely random
$0.5 < H < 1$ represents positively correlated behavior and the persistence of definite patterns.

Autocorrelation function can be obtained by $C = 2^{2H-1} - 1$, which is used to describe the influence of the present on the future. The Fractal Dimension can also be calculated from Hurst exponent by using the simple relation $D = 2 - H$, which is a statistical quantity that gives an indication of how completely a fractal appears to fill space, as one zooms down to finer and finer scales. (Wang, Su and Zhan, 2015 and Mansukhani, 2012)

3.2. Data Collection
Onion prices for the years 2013-2017 are considered. This data set has been derived from the official website of the Consumer Affairs Department of the Government of India. The daily retail prices for Delhi for the month of July, August and September were observed and analysed. Onion is grown as an annual crop in India. Therefore it was suitable to take these three months such that the external factors do not differ month-wise.

3.3. Method: Determination Of Hurst Exponent By Monofractal Analysis
(R/S) Analysis has been used to apply monofractal analysis which basically consists of finding the Hurst exponent.

The algorithm of finding Hurst exponent using R/S analysis is the following :

1. Split the time series of size N into disjoint subsets of time intervals $T_a(a=1,..., A)$, each of size n. Calculate the mean of values of the commodity in each of these subsets denoted by $\overline{x_a}$. Also, each value to the corresponding time value is represented by $x_{i,a}$, i=1,...,n.

2. The cumulative deviation $\widehat{x_{k,a}}$ (k=1,...,n) is calculated for each T_a.

3. Range $R_a = \max(\widehat{x_{k,a}}, k=1,...,n) - \min(\widehat{x_{k,a}}, k=1,...,n)$

4. S_a = Standard Deviation for each T_a

5. $(R/S)_n$ = average of R_a/S_a for a=1,..., A.
   Then on applying linear regression to the equation
   $$log(R/S)_n = log\ c + H\ log\ n, (c = constant) \quad (1)$$
   the value of H, Hurst exponent is estimated. (Wang, Su and Zhan, 2015)

4. RESULTS AND ANALYSIS

4.1. Data

Figure 1 is the price graph of daily retail prices (in Rs. per kg) of onions in Delhi from the year 2013-2017 for the months of July, August and September.

Here, the x-axis represents the time period and the y-axis represents the price per kg in INR. The graph has been plotted using R software.

Figure 1: Daily retail prices (in Rs. per kg) of onions in Delhi from the year 2013-2017 for the months of July, August and September
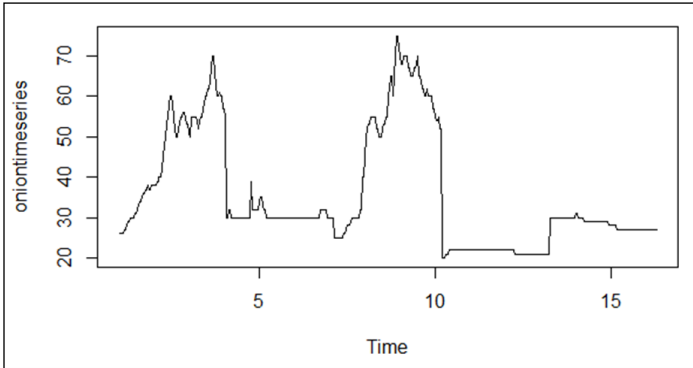
Source: Plotted by authors in R software using data from the official website of the Consumer Affairs Department of the Government of India.

4.2. Monofractal Analysis Results

Table 1: Monofractal Analysis Results

Year	Value of Hurst exponent(H)	$C=2^{2H-1}-1$ (Autocorrelation function)	D=2-H (Dimension)
2013	0.8096	0.5360	1.1904
2014	0.5028	0.0039	1.4972
2015	0.6175	0.1769	1.3825
2016	0.5281	0.0397	1.4719
2017	0.8018	0.5195	1.1982

Source: Authors' calculation

Table 1 lists the Hurst exponent values for each year from 2013-17. It also lists the autocorrelation function value and fractal dimension for each year. Autocorrelation function value describes the influence of present on the future. Fractal dimensions indicate how completely a fractal appears to fill up space as one zooms down to finer and finer scales. Also, as it is clear from the values calculated in the table, fractal dimensions are fractional in nature unlike dimensions of shapes in classical geometry.

Hurst exponent has been calculated by running a suitable code in R software.

Since the Hurst Exponent for each year is greater than 0.5, therefore the variations are not completely random and can be predicted in short terms. The variations show fractal characteristics.

V statistic is given by:

$$V_n = \frac{(R/S)_n}{\sqrt{n}}$$

V_n vs log(n) graph is used here to test for the stability of the Hurst exponent. If the process is persistent, the graphs should be upward sloping.

The following are V_n versus log(n) graphs for each year:

Figures 2-6: V_n versus log(n) graphs for each year
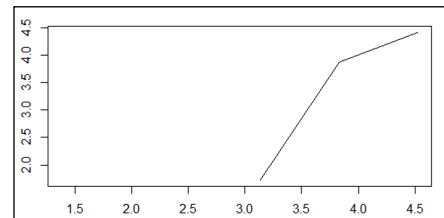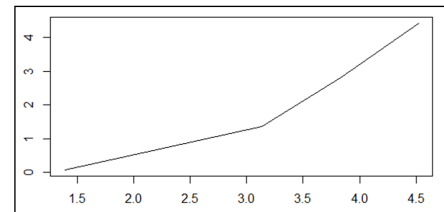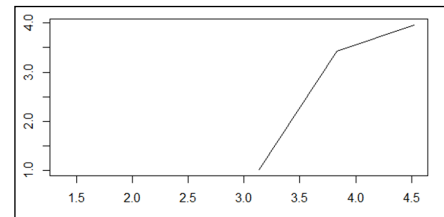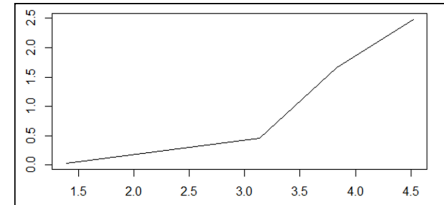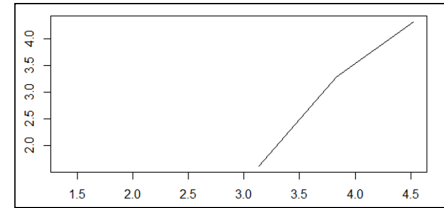
Source: Authors' calculation

Since the V_n versus log(n) graphs for all the years are upward sloping, and it was claimed that the process is persistent, therefore the stability of the Hurst exponent is established. (Wang, Su and Zhan, 2015)

5. CONCLUSIONS

By the values of the Hurst Exponent derived for onions for the year 2013-17 for the months of July, August and September, it is evident that the prices exhibit fractal characteristics. Therefore, the retail onion price series is Monofractal i.e. the price series is fractal in one characteristic of the fluctuation.

So, further scope of this research includes extending this analysis to Multifractal Analysis which can describe more than one characteristic of the fluctuation.

It can be observed that the fractal dimensions calculated are fractional in nature, unlike the usual dimensions which are natural numbers.

We also conclude that the time series of onion prices is persistent in nature. This may or may not be generalised to the other agro-based commodities of the Indian market but this fractal analysis can be used to determine the characteristics of the prices in an agro-based economy. Lastly, this result could be of benefit to the policymakers of India while drafting policies targeted towards the agriculture sector since this paper proves that prices can be remotely predicted and that they are not completely random. Hence agricultural price policies could be made more efficient via the scope of this research.

ACKNOWLEDGEMENTS

REFERENCES

1. Ahluwalia, Sanjeev (2015), Onion Prices and Indian Politics, ORF (Observer Research Foundation).

2. Andrew, W. L. (1991), Econometrica, Vol. 59.

3. Chatrath, A., B. Adrangi and K.K. Dhanda (2002), Agricultural Economics, Vol. 2, No. 27.

4. Daily – Retail and Wholesale Pricing – Price Monitoring Cell – Consumer Affairs Website of India – Ministry of Consumer Affairs, Food and Public Distribution – Government of India

5. Daily Price Arrival Market Bulletin – Price and Arrivals Statistics – Statistic and Market Info – National Horticulture Board – Ministry of Agriculture and Farmers Welfare – Government of India

6. Foster, K.A., A.M. Havenner and A.M. Walburger (1995), American Journal of Agricultural Economics, Vol. 11.

7. Geoffrey, A.P. (1994), International Journal of Forecasting, Vol. 1, No. 16.

8. Gustavsen, G.W. and K. Rickertsen (2006), Canadian Journal of Agricultural Economics, Vol. 4, No. 54.

9. Hurst, H.E. (1951), Transactions of the American Society of Civil Engineers, Vol. 116.

10. Kristoufek, Ladislav (2012), Fractal Markets Hypothesis and the Global Financial Crisis: Scaling, investment horizons and liquidity.

11. Li, G.Q., S.W. Xu and Z.M. Li (2010), Agriculture and Agricultural Science Procedia, Vol. 1.

12. Luo, C.S., Q.F. Wei, L.Y. Zhou, J.F. Zhang and S.F. Sun (2011), IFIP advances in information and communication technology, Vol. 346.

13. Mandelbrot, B.B. (1963), Journal of Business, Vol. 36.

14. Mandelbrot, B.B. (1967) Journal of Business, Vol. 40.

15. Mandelbrot, B.B. (1975), Probability Theory and Related Fields, Vol. 4, No. 31.

16. Mandelbrot, B.B. and J.R. Wallis (1969), Water Resources Research, Vol. 5, No. 5.

17. Mansukhani, Subir (2012), Analytics magazine by INFORMS (The Institute for Operations Research and the Management Sciences).

18. Melin, P. and I. Leal I (2007), Hybrid Intelligent Systems, Vol. 208.

19. Peters, E., Editor (1994), "Fractal market analysis: applying chaos theory to investment and economics", John Wiley & Son Inc, New York.

20. Schumann, A.Y. and J.W. Kantelhardt (2011), Physica A, Vol. 390.

21. Scott, C.D. and R.E. Smalley, J. Nanosci (2003), Nanotechnol, Vol. 3, No. 75.

22. Siokis, F.M. (2014), Physica A, Vol. 395.

23. Tarasova, Valentina V., Vasily E. Tarasov (2017), Concept of Dynamic Memory in Economics, Vol. 55.

24. Taylor, J.W. and D.W. Bunn (1999), Management Science, Vol. 2, No. 145.

25. Tzong, L., Ru and H.F. Cheng (2000), Journal of Agriculture and Forestry, Vol. 2, No. 49.

26. Wang, Yi, Xin Su and Xueli Zhan (2015), Fractal Analysis of the Agricultural Products Prices Time Series, Vol. 8, No. 10.

27. Yin, K., H. Zhang, W. Zhang and Q. Wei (2013), Romanian Journal of Economic Forecasting, Vol. 3, No.16.

INDIA VERSUS COVID-19: A CASE IN FAVOR OF SUPPLY-SIDE POLICY SOLUTIONS

VRINDA SAXENA

Ramjas College, University of Delhi

1. INTRODUCTION

Come March 2020 and the global public health outbreak, Covid-19, had made its presence felt big time in India. The virus, declared a global pandemic by the World Health Organization, not just overwhelmed India's public health infrastructure but also brought into limelight fundamental loopholes in the organisation of India's economic emergency response mechanism.

When Prime Minister Narendra Modi announced a nation-wide lockdown on March 24th, 2020 in order to enforce social distancing measures and stop the spread of the virus, a country like India with a massive population of self-employed and daily wage earners, was left to ponder the solutions to questions of sustaining livelihoods.

Addressing these concerns, the Central government of India (GoI) provided a fiscal stimulus in two stages. In the first fiscal injection in April 2020, a package of Rupees 1.7 lakh crore was announced, comprising of insurance cover for wage workers, food provisions and cash transfers. Wages under the MGNREGA scheme were increased from Rs 182 per day to Rs 202 per day and the Rs 2000/- payouts (of the annual Rs 6000) to 8.7 crore farmers of India under the PM Kisan Yojana, amounting to Rs 17,400 crore for the government, were ordered to be disbursed earlier in April. The next leg of the fiscal package announced relief operations worth Rupees 20 lakh crore to be delivered in tranches in May 2020. Dubbed as the PM Atmnirbhar Bharat Abhiyan (self-reliance campaign), it offers schemes of the provision of collateral-free loans amounting to Rs 3 lakh crore for MSMEs, Rs 45,000 crore partial credit guarantee schemes for NBFCs for which the first 20% would have GoI as the guarantor, liquidity injection of Rs 90,000 crore in Indian DISCOM sector, and liquidity relief of Rs 2,500 crore for EPF establishments, among others.

While the measures seem to have gone down well with a few economists and the electorate at large to douse momentary anxieties, the following article is an attempt to understand how cash transfers are not the policy solution

India needs to prevent another crisis after one the ongoing coronavirus-led immediate economic crisis.

2. WHY SUPPLY?

It has often been observed that failed policy measures stem from the minds of those who do not understand the nature of the problem in entirety. Thus, the following points explaining the characteristics of the crisis at hand are necessary to build the argument further:

1. The Covid-19 outbreak in India, as in the world, can be described as an exogenous shock rather than an endogenous one (Danielsson and Shin, 2002). In that sense, while the associated crisis is similar to the global financial crisis of 2007-08 with respect to shortages caused and liquidity crunch, the nature of the two crises are starkly different. Additionally, there is also a distinction in the nature and origin of the crisis- it may have originated like an exogenous crisis, but derives its damage from the endogenous risk amplification process which has made all financial crises as bad as they turned out to be.

2. The Coronavirus outbreak is more of a supply-side problem than a demand one. Studies show that the demand effect of the situation can be understood as dampening consumer spending and tilt of aggregate preferences towards essential and sustainable goods and services (Criteo, 2020). However, the bulk of other recession is stemming from the 'containment' measures adopted for social distancing that have brought manufacturing and production activities to a grinding halt (Baldwin, 2020).

3. POLICY MEASURES

The Indian government needs to be lauded for its promptness of action in ordering a large scale lockdown, even at the risk of appearing panicky. In hindsight, the initiative seems to have paid off in terms of preventing a steep acceleration in numbers of Covid-19 positive pa-

tients. However, while the move worked in favour of keeping a public health disaster at bay, it also had a significant and not-so-pleasant impact on production.

The lower panel in Figure 1 demonstrates how the impact of crisis with containment measures had a deeper impact on slowing down production than the crisis alone would have had. Work-from-home setup and information technology in India have made the service sector able to stay partially functional still. However, commodity manufacturing and a few backend ones like enabling IT infrastructure providers, which require physical proximity of workers and machines, have been deeply affected.

Figure 1: Impact of lockdown on production
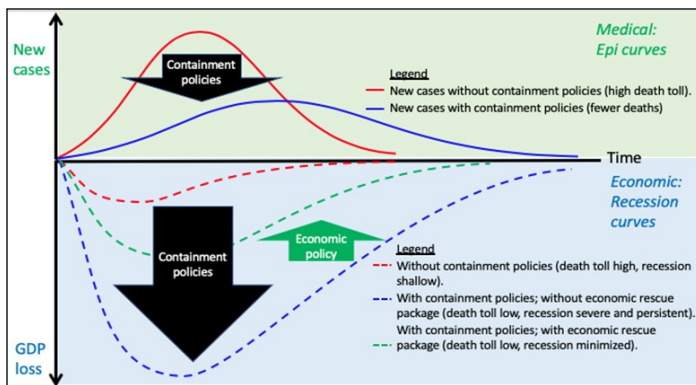
Source: Richard Baldwin: Gourinchas (2020)

The cash transfer scheme adopted by the government, which can be described as 'helicopter money' in the words of economist Milton Friedman, is good to achieve only so much as an appeased electorate. Shrunken demand can also be traced back to falling income and saving levels. The ideal approach, hence, in this scenario should be for the government to pursue a slightly modified version of the fiscal stimulus package, replete with food and wage subsidies, provision of social safety nets like insurance covers and a stream of money redirected towards producers rather than consumers. In his book, Poverty and Famine (1981), Nobel Laureate Amartya Sen provides support for the above rationale by stating, "Manipulating total demand, such as by printing money, will cause inflation and could make things much worse. Ensuring the supply of basic essentials, especially food, should be a priority". As in May 2020, even while the government maintains that most schemes of its latest fiscal packages are largely self-financing, the exchequer's strain is visible and economists like C Rangarajan are predicting debt monetisation as the next step, despite the 1997 norm against it. Production processes have been hit, value chains are near shut and firms have already started running down their inventories. In this scenario of limited supply, if the government provides more idle cash to consumers it is only going to stimulate demand further and inevitably create inflationary pressures.

My case to push for stimulus for producers in the economy hinges on three main considerations:

3.1. A blow to the manufacturing sector could imply its ruin in a service dominated economy

The International Monetary Fund (IMF) predicted a 3 per cent slowdown in global economic growth in 2019, and amidst this, India's predicted growth forecasts also received double cuts- from 6% to 5.8% and then to 4.9%. The automobile, FMCG, telecom and other sectors faced major blows and the ongoing crisis seems to have hit like a meteor.

Further, India's transition to a developing country from an under-developed one was different from that of others. We moved from being a majorly agrarian economy straight to a service-led growth pattern, skipping the phase of manufacturing activity booming. Given both these realities, it doubly becomes the government's priority to provide cushion to production activities. In an already slowing economy, hit so deeply by another crisis, if we are not careful today a number of manufacturing units might end up hitting the rock bottom with no hands to pull them back. Small and medium enterprises (SMEs) of India could be among the worst hit.

3.2. Biased effect on prices

As discussed above, many services such as financial services, communications, etc. are partially functional, thanks to India's IT infrastructure. Goods manufacturing, however, has taken a hit. If we operate with this assumption largely (although there are exceptions, such as enabling services), then we can observe that since labour supply is differently affected so will be the relative supply of the two (Baldwin, 2020). Containment policies that are aimed at avoiding community transmission of the notorious virus are going to reduce the supply of goods relatively more than the reduction of services (Figure 2). Among goods also, the luxury goods

Figure 2: Differentiated impact on supply
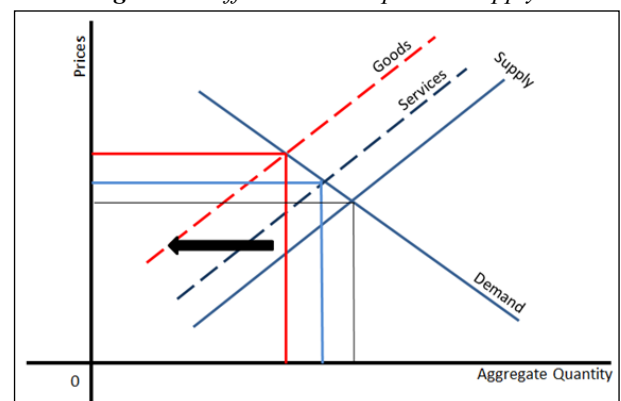
Source: Author's elaboration

market and FMCG that contribute a large portion of the revenue will be more deeply hit.

In an ideal laissez-faire economy or other types of economic shock, the government is not advised to step in for the producers. However, in the case of an exogenous shock such as this one where supply chains are globally affected, it is almost mandatory for the government to provide support in the form of price subsidies for market shares to recover, or cost subsidies on input procurement to manage the risk of cost-push inflation.

3.3. Credit constraint

The third and final argument stems from the nature of the crisis we are facing today. The good news is that since this crisis is exogenous in nature, there is not much of a culprit investigation to be done, but rather the focus is on damage control. Compared to the time of the global financial crisis of 2007-08, the banking system today is in better shape than what it was then. The crisis also did not originate in the financial system for massive bailouts to be essential. This simply implies that producers will not be facing lending crunches from the banks' end. However, there's also bad news. Compared to 2007-08, the maximum amount of lending today to suppliers and companies comes from the Non-Banking Financial Corporations (NBFCs). These NBFCs are not privy to as much support by the government as the banks, and in the Indian context NBFCs are not particularly in the best of shape today. To add to it, the degree of leverage that defines lending ecosystem today is also the reason why suppliers are at maximum risk. The great degree of indebtedness in the private sector is a major cause of concern (Csullag et al, 2016). It will hence not be long before credit dries up for producers in the country, compounding the adverse supply shock. While the Reserve Bank of India (RBI) is also undertaking monetary policy measures of repo rate cuts, what we seem to be forgetting is that while the ongoing crisis is a massive financial crisis like the 2007 crisis, it is also not a liquidity crisis that developed within the system, unlike the 2007 crisis! Monetary policy measures are only so much effective (Danielsson et al, 2020). The real stimulus to production and investment has to be fiscal in nature.

Former RBI Governor and Chief Economist of IMF, Raghuram Rajan puts it in his book, Fault Lines: How Hidden Fractures Still Threaten the World Economy (2010), governments of the world are often more concerned with jobs than inflation in economic policy responses. Economists who side with the cash transfer scheme have thus often cited the Phillips Curve argument to support the scheme, arguing for accepting more infla-

tion in lieu of decreased unemployment. It is true indeed that the world is looking at massive job cuts, but the Phillips Curve does not have all answers to give this time. As in the 1970s when the relation broke down due to stagflation (reduced output plus higher inflation) in the US economy, the government needs to understand that its scheme of cash transfers will only increase inflation with no corresponding effect on unemployment if nothing is done to boost output today. For economists who argue that inflation is a less than likely scenario, the aspect that needs to be considered is that, depending upon the tenacity of economies, it is quite likely that this recession may end up like a short-lived V-shaped one. It is also likely that pent up demand may shoot up suddenly post the lockdown (Loayaza and Penning, 2020). In that scenario, a sudden volatility led inflation might harm investor sentiment furthermore. Moreover, while supply chains of raw materials and labour have been hugely affected, a slight downward swing is observable in the demand side as well, given the fall in incentives to consume and in investment demand due to negative market sentiment. Monetary transmission is already weak and fiscal multiplier in developing countries especially has been noted to reduce too with the fall in aggregate estimates of consumption proportions and more than usual sluggishness of the goods market. Using a simple C+I+G model it can be observed that no matter how large the change in government expenditure, the magnitude of its final impact rests on the multiplier, hence making a demand-side fiscal stimulus diluted in its impact. In India, size of expenditure multipliers has been found to be greater than central government's and when we put this fact together with the current scenario when state governments spending is very less compared to the central government's (coupled with the minuscule increases in borrowing margins for the former), we understand the magnitude of the situation. Furthermore, the long-run aggregate expenditure impact multiplier was last estimated to be 1.03 (Mishra, 2019) for India, proving that a demand-side boost may not be very heavily impactful. State Bank of India's CEA, Dr. Soumya Kanti Ghosh has declared that the newest leg of fiscal stimulus is expected to create an impact of Rs.2.03 lakh crore, which is minuscule if we consider the 20 lakh crore injected, and similar analysis was made about the earlier Rupees 1.7 lakh crore stimulus.

4. WHERE DO WE GO FROM HERE?

The pandemic teaches us two things about our economic systems today. First, while immediate policy solutions may be good to deal with the problem at hand, a crisis like this exposes weak spots in the fundamentals that need immediate mending. Second, our perception of risk, the threshold limit of its tolerance, and premiums for it have changed substantially, but not necessarily for the better.

Elaborating on these, foremost, we need to see that the public health infrastructure of almost every country is overwhelmed. That speaks a lot about how much we value essential services and about our resources in case we need to flex in times of emergencies. There is an urgent need for the world at large to upgrade its development services and infrastructure because, in the age of globalism, a crisis anywhere can tense matters. Additionally, while modern technology is developing at an exponential pace, our adaptability to switch to alternate systems or 'backups' is still low. A case in point is that studies show how the sudden crisis has revealed to so many businesses around the world how business chains can be restructured to virtual ones yet they are reluctant from doing it. The ongoing crisis has brought the idea of mortality suddenly closer than what people presumed it to be and exposed the flaws of traditional systems. It is time now that we take lessons from these and work to reduce redundancies. Perhaps, the current exercise can serve as a vaccination to build the world economy's immunity to potential future threats like these.

REFERENCES

1. Baldwin, R., 2009, "The great trade collapse: causes, consequences and prospects," a VoxEU.org, eBook, *CEPR Press.*

2. Baldwin, R. 2020. "The supply side matters: Guns versus butter." COVID-style- voxexu.org

3. Csullag et al (2016), Why it doesn't make sense to hold bonds. VoxEU.org, article. Available at: voxeu.org/article/why-it-doesnt-make-sense-hold-bonds

4. Danielsson, et al. 2020. "Comparing the coronavirus crisis to 2008 is inevitable, but they're quite different." blogs.lse.ac.uk

5. Danielsson, J., Shin, H. 2002. " Endogenous risk. In Modern Risk Management — A History." *Risk Books*

6. Economic Times Online, 2020, "Summing up Modi's Covid Stimulus: Big takeaways from the big Covid package"

7. ETBFSI. 2020. "Coronavirus rescue: Time for helicopter money, universal basic Income, bridge loans?" *The Economic Times*, March 23, 2020. https://bfsi.economictimes.indiatimes.com/news/industry/coronavirus-rescue-time-for-helicopter-money-universal-basic-income-bridge-loans/74767155

8. IMF Blog, 2019, https://blogs.imf.org/2019/10/15/the-world-economy-synchronized-slowdown-precarious-outlook/

9. Loayaza, Pennings, 2020, "Macroeconomic Policy in the Time of COVID-19: A Primer for Developing Countries," *World Bank Group*

10. Mishra, BR. 2019. "The Size of Fiscal Multipliers in India: A State Level Analysis Using Panel Vector Autoregression Model." *Global Business Review*

11. Rubio, M. 2020. "The Case for a Coronavirus Supply Side Stimulus." *National Review*, March 3, 2020 https://www.nationalreview.com/2020/03/coronavirus-case-for-supply-side-stimulus/

12. Silman, R. 2020, "In a pandemic, the wrong economic policy can be fatal." *The Guardian*, March 18, 2020. https://www.theguardian.com/politics/2020/mar/18/in-a-pandemic-the-wrong-economic-policy-can-be-fatal

WAGE DIFFERENTIAL DETERMINANTS BETWEEN MIGRANT AND LOCAL CONSTRUCTION LABOURERS IN NOIDA AND GREATER NOIDA

MRINAL TOMAR

Ramjas College, University of Delhi

Abstract

The infrastructural development of Noida and Greater Noida has led to the creation of a major construction labour market in these cities. What started out as a surge in construction labour demand for their infrastructural projects has been meted out by both migrant and local construction workers. However, there appears to be a wage differential between these migrant and local labour classes. We investigate this differential and attribute its determinants through Blinder-Oaxaca decomposition analysis of Blinder's Wage Differential Equation (using primary data). We also find that the determinants are of varying magnitude in the case of both migrant and local labourers. This imparity necessitates for a revision of labour laws and wage policies of Uttar Pradesh.

1. INTRODUCTION

For any country, regardless of its status of development or its procurement of scientific automation, labour remains at the heart of its production activity. Labour is so crucial to the development of an economy that Adam Smith went on to call it "…the first price, the original purchase money that was paid for all things. It was not by gold or silver, but by labour, that all the wealth of the world was originally purchased." (Smith, 1776). Karl Marx too joined Smith on highlighting the importance of labour in his definition, addressing it as "…the sole power which can create an additional value over its subsistence, establishing its predominant role as a factor input that increases the economic value of products."(Marx, 1950). Thus, gains from labour are not only in the form of the wages that a country's workforce earns, but also in the form of economic progress as a whole that comes from each worker's contribution. However, wages must not be overlooked in this process. In a capitalist society, wages are indispensable for the welfare of its workforce. Reasonable wages drive workers to work and unreasonable ones lead to exploitation, while also being a disincentive to labourers. It is for this reason and other issues of morality that equal wages for equal work are institutionalised in many countries across the world (including ours). However, differences in wage across social groups do seem to find their way into our system. This is evident from the collegium of studies on social inequality. While gender is one such social group, wage differences are also visible between migrants and local natives of any place. This has been reported in many sectors, including construction (Srivastava and Sutradhar, 2016). As per the estimates of National Sample Survey Office (NSSO), the construction sector is one of the major sectors attracting migrants and is also a sector which has seen a rapid increase in employment in the recent years. The highest percentage of short duration migrants are workers in the construction sector (36.2%) (Srivastava, 2011). This isn't very surprising. After all, at a rate of 78%, construction is the second most absorptive sector (Mitra, 2006).

Theoretically, the primary reason for the movement of workforce from one sector and/or region to another is the differences in wages and this could reflect in the differentials in employment opportunities or wages or both. These are in turn, a result of development patterns, lead-

ing to the growth of certain sectors in specific locations. Hence, migration is a significant driver of development and promotes labour to make use of its optimum capabilities. In modern India, we find evidences of this in the inland migration of people towards metropolitan cities and other Tier 1 cities[1]. This influx of labour force and refugee settlements in Delhi made Sanjay Gandhi push for the enactment of UP Industrial Area Act of 1976 which provisioned for the creation of NOIDA (Guha, 2007). NOIDA has now developed into a fully-fledged city. NOIDA's shortage for accommodating further population was meted by Greater NOIDA, which also saw a similar boom in construction sector like NOIDA did. This created a boom in the demand for construction. The workforce needed for this was supplied by both migrant and local working classes (not just in construction, though). In addition to this, when NOIDA's market for labour is compared with other Tier 1 cities[2] (Bengaluru, Chennai, Delhi, Ahmedabad, Pune, Kolkata, Hyderabad), it is unique in its composition and structure. Part of it could be reasoned with its rapid development experience in just 15-20 years. Although the labour market has both migrant and local workers, it is the local workers which seem to show a reluctance to work (or at least that's what the contractors told us when we interviewed for our study). The labour-intensive requirements of the construction sector and the shortage of labour supply (especially locals) has implications for wage, employment and migration of workers. We set out to answer if there exists a wage differential between local and migrant workers of NOIDA and Greater NOIDA; and try to understand what attributes account for this differential.

2. LITERATURE REVIEW

The most eye-opening piece of work on migrant labourers in the construction sector of Delhi NCR is that of Srivastava and Sutradhar (2016). Their study, which dealt with migrants alone, found that "eight-hour wages of unskilled workers were below the legislated minimum in all the three administrative regions (Delhi, Gurgaon and Noida)"[3]. They added another surprising finding to this, about the status of migrant construction workers that there is no impact of labour regulations- "Provisions of various labour laws such as the Interstate Migrant Workmen's Act; Contract Labour Act, Minimum Wages Act, Workmen's Compensation Act, Payment of Wages Act etc. remain unimplemented." This highlights the abomi-

nable standards of work where migrant labourers are employed.

Another important thing the authors need to add here is that our study has been heavily modelled on and inspired from a similar study conducted in Kerala by KC Baiju and Shamna TC (2019). We adopt similar methodology for collection of data and analysis of wage equation. The equation which estimates the magnitude of each variable in widening/narrowing the wage differential was initially given by Alan Blinder (1973) when he estimated the determinants responsible for racial wage gap in Nixon's America. The decomposition analysis that follows is called Blinder-Oaxaca decomposition. Its etymology is eponymous to the economists who first used it to study racial (Blinder) and rural/urban (Oaxaca) wage gaps. Varinder Sharma (2014) further tweaked the equation a bit and extended it to decompose determinants of wage differential between local and migrant farm servants in Punjab. This study uses the same decomposition analysis and estimation methods to investigate the wage differences between local and migrant construction labourers in NOIDA and Greater NOIDA.

3. RESEARCH METHODOLOGY

This study uses primary data sources to determine the factors responsible for the wage gap between migrant and local labourers in the construction sector of Noida and Greater Noida. For this sector, short-term data on migrant labourers is unavailable in NSSO. The floating migration patterns (seasonal, occupational and temporary) of construction workers are further not captured in both NSSO and Census data. We used random sampling to locate 2 sectors in Noida and Greater Noida separately. These sectors turned out to be Sector 116 in Noida and Sector 16-B in Greater Noida.

We then scouted these sectors for active construction sites and randomly selected 3 sites from each of them to collect primary data. Quite interestingly, these sectors show high urban infrastructural development in the form of residential apartments, residential colonies, shopping malls and commercial spaces. A pilot survey also indicated that a large number of migrant construction labourers work on these sites. The target sample size was of 100 construction labourers which would contain a mix-up of both locals and migrants. Our survey had far more mi-

---

[1]*The tier-wise classification follows from the memorandum published by Ministry of Finance, Government of India. "Reclassification of cities/towns on the basis of 2001 Census – grant of House Rent Allowance (HRA) and Compensatory (City) Allowance (CCA) to Central Government employees."* No.2(21)/E. II. (B)/2004.

[2]*See 1.*

[3]*The minimum wages for eight hours of work, as set by the governments of UP for NOIDA when their study was conducted, are as follows- unskilled worker – INR 149, skilled worker – INR 187.08. These are not specific to the construction sector, as was mentioned in Srivastava & Sutradhar (2016).*

Figure 1: *A map of Delhi and Noida (not to be scaled)*

Figure 2: *A map of Delhi and Greater Noida (not to be scaled)*

Figure 3: *A map of Noida showing Sector 116 (marked with a yellow pointer) & Sector 16 B (marked with a red pointer).*

Source: Author's compilation

grant labourers than local workers and this was further confirmed with the contractors on these sites who told us that there are fewer local workers available in the market than migrant labourers. We also interviewed 4 contractors at these sites for qualitative inputs to our investigation. To better understand our analysis, we need to guide you through the structural components that make up our sample.

3.1 Sample Demography

We are going to walk through this section with the help of charts and descriptive data. Our sample sizes are- migrant workers (76) and local workers (27). Figure 1 and 2 tell us about the age wise composition of our samples. The migrant group is much younger than the local group, on average.

Figure 4: *Age of migrant construction workers*
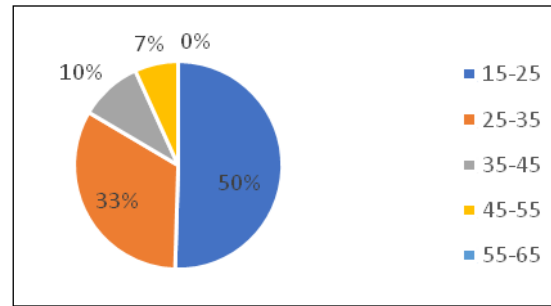
Figure 5: *Age of local construction workers*
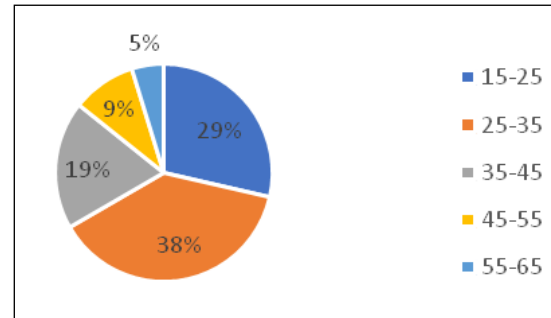
Source: Author's calculations

Next, we look at the gender-wise breakdown of our sample. Male workers compose 86% of our migrant sample and 80% of our local sample. Married workers make up 86% of our migrant sample and 85% of our local sample. A caste wise breakdown follows in the illustrations below:

Figure 6: *Caste wise composition of migrants*
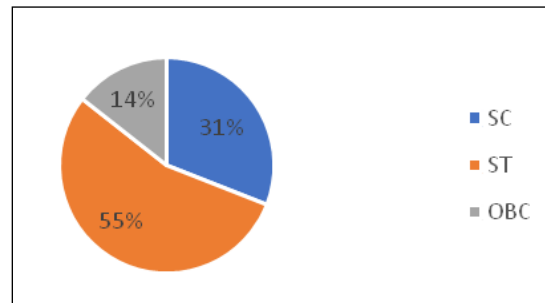
Figure 7: *Caste wise composition of locals*
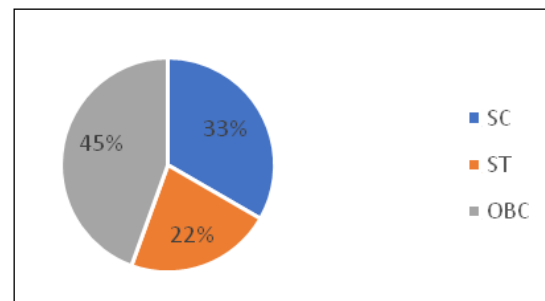
Source: Author's calculations

As far as educational qualifications are concerned, the migrant sample consists of 72 % literate and 28% illiterate workers. In the local sample, 70% of workers are literate and 30% of workers are illiterate.

Figure 8 gives us the state-wise make up of our migrant sample. We now turn to the kinds of jobs these workers do on sites. 88% of migrant workers are employed as masons and 11% as helpers/unskilled labour. The remaining of them work as painters. Whereas 60% of locals work as masons, 14% as carpenters, 9% as painters, 9% as plumbers and the rest of them work as helpers/unskilled labourers. Locals also earn wages per day at an average of INR 550 and migrants get an average of INR 410 for the same.

Figure 8: *State-wise composition of migrants*
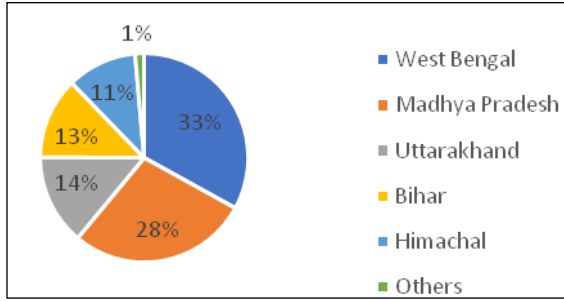
Source: Author's calculations

3.2 Blinder's Wage Equation

The wage equation which we deploy for our analysis was first introduced by Blinder in 1973. Another version of the same equation was formulated to estimate wage differences between local and migrant farm workers in rural Punjab (Sharma, 2014). Taking cue from this study, Baiju and Shamna (2019) replicated the same equation for their study in Kerala's construction sector. We use the same equation in our analysis to understand the factors behind the wage differential between migrants and local labourers.

The variables we observe in our estimation are- age, caste, education, gender, marital status, educational qualifications, work experience, channel of recruitment, skill at handling equipment and nature of construction sites[4].

The wage equation is:

$$lnW_L = \alpha_L X_L + u_L \qquad (1)$$
$$lnW_M = \alpha_M X_M + u_M \qquad (2)$$

W - wage rate in INR
X - variable being investigated as a determinant of wage differential
u_i - error term
α_i - slope coefficient (unit change in lnW_i for a unit increase in X_i)
Subscripts M and L- group for which the equations are being estimated (M for migrants and L for locals)

From the properties of ordinary least squares (OLS), we know that lines of regression pass through the mean values of variables being estimated. Therefore,

$$ln\overline{W_L} = \hat{\alpha}_L \bar{X}_L \qquad (3)$$
$$ln\overline{W_M} = \hat{\alpha}_M \bar{X}_M \qquad (4)$$

The bar on the variables indicates that these are their mean values and the hat indicates the OLS estimated values of coefficients. If migrants received the same wages as locals (for the migrants' endowment of the determinants), then their average wage would be:

$$ln\overline{W_M}' = \hat{\alpha}_L \bar{X}_M \qquad (5)$$

To estimate the difference in wages, we subtract (5) from (3). This gives us the difference between the mean wages of locals and mean wages that the migrants would get if they were paid on the same terms as locals. This difference translates into how difference in endowments affects the differential (as shown here):

$$ln\overline{W_L} - ln\overline{W_M}' = \hat{\alpha}_L \bar{X}_L - \hat{\alpha}_L \bar{X}_M = \hat{\alpha}_L(\bar{X}_L - \bar{X}_M) \qquad (6)$$

Likewise, subtracting (4) from (5) gives the difference between the wages that migrants would get if paid on same terms as locals and what they're actually being paid (as shown here):

$$ln\overline{W_M}' - ln\overline{W_M} = \hat{\alpha}_L \bar{X}_M - \hat{\alpha}_M \bar{X}_M = \bar{X}_M(\hat{\alpha}_L - \hat{\alpha}_M) \qquad (7)$$

Adding equation (6) and (7) we get

$$ln\overline{W_L} - ln\overline{W_M} = \hat{\alpha}_L(\bar{X}_L - \bar{X}_M) + \bar{X}_M(\hat{\alpha}_L - \hat{\alpha}_M) \qquad (8)$$

$$\mathbf{ln\overline{W_L} - ln\overline{W_M} = \hat{\alpha}_L\Sigma(\bar{X}_L - \bar{X}_M) + \bar{X}_M\Sigma(\hat{\alpha}_L - \hat{\alpha}_M)} \qquad (9)$$

Equation (9) gives us the overall wage gap between local and migrant workers. It is important to note that there are two components to this difference- firstly, difference in endowments of the variables being observed $(\bar{X}_L - \bar{X}_M)$ if they were evaluated on the same terms as locals; and secondly, difference between the rates of return $(\hat{\alpha}_L - \hat{\alpha}_M)$ if both locals and migrants had the same endowments of variables being observed. The latter is also taken as a reflection of discrimination or wage differentials.

3.3 Estimation Of Wage Equation And Decomposition Analysis

After deriving the wage equation, we now estimate this equation using econometric software techniques. The results of our estimation and decomposition analysis have been summarised in Table 2. Firstly, we make the following remarks on the basis of our estimation-

i. *Age* is found to be a significant determinant in the case of migrants but not for locals. In fact, local workers as

---

[4]*Major- if it's a new site or large-scale renovation; Minor- if it's only repairs or small-scale renovation.*

old as 55 years of age were found in our local sample. We learned from the contractors that older workers are hired only if they bring in appropriate skills like carpentry/knowledge of electric works.

ii. *Marital status* significantly determines the wages of migrants but not of locals. There exists economic literature backing this point (der Loop, 1994). The majority of migrant labour are married and seek higher wages for their families. This was confirmed by all the contractors that we interviewed. We show later in this paper from the results of our decomposition analysis that marital status is a dominant factor in positively affecting the wage differential between migrants and locals.

iii. *Education* is found to be a significant component in determining the wages of migrants, but not those of locals. It is evident from our study that the share of illiterate workforce in both local and migrant workers is the same. This paradox remains unexplained because in our interviews with contractors, it was revealed that the literacy or educational qualifications of labourers are not a criteria when construction labour are hired. This hints that an unrevealed selection process is carried out by the agents who bring these migrants into cities for work.

iv. *Caste* significantly determines the wages that migrants get. However, it is not an important determinant in the wages of locals. Another interesting thing to note here is that this could probably be because of the make-up of our sample. The migrant sample had much large number of SC/ST workers than the local one. Existing literature (Srivastava and Sutradhar, 2006) shows that there has been a disproportionate rise in the number of migrant SC/ST labourers in Delhi NCR's construction sector- whereas the caste-wise demography of local construction labourers has remained the same.

v. The *type of work* that labourers have been employed to do reflects directly in their wages. This is only obvious because different jobs require different levels of skills which is reflected in their pay. For example, in our sample (and interviews) we found that carpenters, plumbers and electricians are paid higher than painters and masons (who are in turn paid relatively higher than helpers or unskilled labourers). This difference between skilled and unskilled workers makes sense since it is in accordance with the minimum wage laws- however the difference in wages between distinct pools of skilled labourers asks for a skill-based decomposition analysis (we don't do that here).

vi. *Gender*, unsurprisingly, is also a significant determinant of wages in both the groups. Male participation is higher in physically hazardous work. Contractors informed us that they prefer not hiring female labourers. The only role female workers are hired as is that of helpers/unskilled labourers.

vii. The *channel of recruitment* for migrants affects their wages significantly, unlike the locals. Migrant workers told us that they receive their wages after a significant amount has been deducted in the form of "commissions". Not only this, but they're forced to take part in extremely hazardous jobs. This has a negative impact on their wages.

viii. Work experience and skill at handling equipment, like gender, is unsurprisingly an equally responsible factor in determining the wages of both local and migrant labourers. Human capital that is more proficient and trained in a job is of more value as labour than those who are inexperienced and unskilled.

Hence, the factors which significantly determine wages for both migrants and locals are- work experience, skill at handling equipment, channel of recruitment, gender and type of work. The factors that significantly determine the wages of only migrants are- caste, education, marital status and age. This is complemented by the high R^2 values of our regression.

We now get to the decomposition analysis. Column 6 in Table 1 tells us about the magnitude with which every factor contributes to the wage differential between migrant and local labourers. Column 7 helps us identify which variables have a positive or negative effect on determining the wage differential (it shows the difference in contributions of factors). From the decomposition analysis, we make the following remarks:

i. Variables that reveal to have a dominant impact on the migrants for the wage differential are- marital status, type of work, gender, education and channel of recruitment. Of these, gender and marital status appear to be the most dominant ones.

ii. Variables that are found to have a dominant impact on the local workers for higher wages are- caste, work experience, size of the site and skill at using equipment. Of these, work experience remains to be the most dominant factor, followed by caste. A higher average age of locals also hints at local workers having more work experience than migrants.

iii. When we estimated the role of age as a variable, we did not take into consideration any dummies for the same. This prevents us from assessing its dominance in the wage differential for migrants. However, what can be commented with certainty is that this variable is respon-

sible for lower wages of migrants when compared with locals.

iv. There appeared to be a need for investigating why these migrant workers continued to work for relatively lower wages. Comparing the MGNREGS wages in their

Table 1: OLS estimates of wage equation and decomposition analysis (p-values in parentheses, tested for significance at 5% LOS)

Observed Variables	Dependent Variable is Wage Rate in INR					
	Migrant Coefficient $(\hat{\alpha}_M)$ for N_M =76 (in equation 2)	Local Coefficient $(\hat{\alpha}_L)$ for N_L =27 (in equation 1)	$\bar{X}_M$	$\bar{X}_L$	$\hat{\alpha}_L(\bar{X}_L - \bar{X}_M)$	$\bar{X}_M(\hat{\alpha}_L - \hat{\alpha}_M)$
Age	0.49 (0.00)*	0.018 (0.700)	26.72	35.38	0.1559	-12.61184
Marital status Married = *1* Unmarried = *0*	0.351 (0.001)*	0.004 (0.998)	0.86	0.85	0.0	-0.29842
Education Literate = *1* Illiterate = *0*	0.112 (0.021)*	-0.09 (0.833)	0.79	0.714	0.0068	-0.15
Caste SC/ST = *1* OBC/Others = *0*	0.19 (0.04)*	0.00071 (0.6199)	0.841	0.55	0.0	0.15
Type of work Masonry, Plumbing, etc = *1* Helper = *0*	0.495 (0.00)*	0.37 (0.01)*	0.38	0.659	0.1	-0.04
Gender Male = *1* Female = 0	0.247 (0.001)*	0.691 (0.00)*	0.863	0.809	-0.03	-0.38
Recruitment Agent = *1* Other = *0*	-0.003 (0.0494)*	-0.00074 (0.881)	0.660	0.74	0.0	-0.01
Work Experience Yes = *1* No = *0*	0.551 (0.0002)*	0.032 (0.001)*	0.704	0.66	0.002	0.34
Skill at using equipment Skilled = *1* Unskilled = *0*	0.5 (0.0013)*	0.36 (0.0227)*	0.159	0.33	0.06	0.02
Size of construction site Major = *1* Minor = *0*	-0.00331 (0.0501)	-0.07 (0.61)	0.818	0.571	0.01	0.05
Intercepts	0.0	0.0031				
F value	2.88	13.041				
R^2 value	0.57	0.491				
Diff due to all endowments $\hat{\alpha}_L\Sigma(\bar{X}_L - \bar{X}_M)$					0.3047 or 30.47%	
Difference due to coefficients $\bar{X}_M\Sigma(\hat{\alpha}_L - \hat{\alpha}_M)$						0.07

Source: Author's calculations

Table 2: *Results of decomposition analysis*

1. Wage differential due to different endowments $\hat{\alpha}_L \Sigma(\overline{X}_L - \overline{X}_M)$	0.3047
2. Wage differential due to differences in coefficients $\overline{X}_M \Sigma(\hat{\alpha}_L - \hat{\alpha}_M)$	0.07
3. Intercept differentials (0.00-0.0031)	-0.0031
4. Wage differential given as (2 + 3)	0.0669
5. Overall wage differential (1 + 4)	**0.3716**
The % of wages that migrants lose because of structural causes	37%

Source: Author's calculations

home states with their site wages, it is found that although the wages on-site are lower than their fellow workers, but these wages are much higher than the MGNREGS wages they would have earned back in their villages.

Keeping aside these remarks, the results of our decomposition analysis are further illustrated in Table 2.

4. CONCLUSION

The last section makes it evident that migrant construction workers in NOIDA could be earning more than 37% of their daily wages if not for the structural changes. We also find that different variables are responsible with varying intensity for determining the wage differential between migrant and local construction workers in NOIDA and Greater NOIDA. A number of factors influence the employment status of migrant workers vis-à-vis their local counterparts in the construction sector. This, in turn, has a direct impact on their wages, social security and quality of life at large. (Baiju and Shamna, 2019).

In this paper, we have identified how variables such as age, gender, marital status, education, caste, state of nativity, work experience, source of recruitment, skill at handling equipment and nature of work have an immense influence on wage rates. All of this is with reference to the construction sector in NOIDA and Greater NOIDA, Uttar Pradesh.

Drawing from Srivastava & Sutradhar (2016), it is evident that poverty is anchored in the labour process, and the other-ness of migrant workers disenfranchises them, systematically stripping them of their bargaining power. Other factors, mentioned above, further serve to exacerbate inequalities.

A vast chunk of the Indian economy functions in 'disparate, irregular and fluid' ways. Policy literature on the subject, more often than not, assumes that self-employment is the principal mode of employment in the sector. There is also a lack of clarity as to the size of the sector (Breman, 1996). This, in turn, serves as an impediment to effective legislation, and laws made to bring about transformative change in the sector, prove to be toothless. The construction sector may have a higher degree of formalisation when compared to, say, agriculture, but it still remains largely informal. This imposes costs on both workers and the economy at large. Workers are deprived of the benefits that legislation in the formal sector offers them and the State is deprived of tax revenues, leading to less than desirable effects on the economy. Our research further goes on to show that in spite of the presence of minimum wage laws, employment protection legislation and right to equal pay, migrant construction workers are not paid on par with local labourers and recruiters continue to exploit this differential. This has necessitated an imminent revision of labour laws and wage policies of the state to ensure that migrants do not continue to suffer the loss of their welfare.

REFERENCES

1. Baiju, KC and Shamna TC. "Determinants of Wage Differences between the Inmigrants and Local Labourers in the Construction Sector of Kerala." Economic and Political Weekly 54, No 31 (2019): 35-43.

2. Behera, Deepak Kumar. "Economic Growth and Employment Trends in India." Indian Journal of Labour Economics 55, No 2 (2012): 265–279.

3. Blinder, Alan S. "Wage Discrimination: Reduced Form and Structural Estimates." The Journal of Human Resources 8, No 4 (1973): 436–455.

4. Breman, Jan. "Footloose Labour: Working in India's Informal Economy." Cambridge (1996): Cambridge University Press.

5. Census of India. "Population Enumeration Data (Final Population)." Office of the Registrar General and Census Commissioner, Ministry of Home Affairs, Government of India (2011). http://www.censusindia.gov.in/2011census/population_enumeration.html

6. Duraisamy, P and Malathy Duraisamy. "Social Identity and Wage Discrimination in the Indian Labour Market." Economic & Political Weekly 52, No 4 (2017): 51–60.

7. Guha, Ramachandra. "India after Gandhi: the history of the world's largest democracy." London (2007): Macmillan.

8. Loop, Theo Van Der. "Structure and Dynamics of Labour Market Fragmentation: Divisions among Construction Labourers in South India." Indian Journal of Labour Economics 37, No 3 (1994): 423–436.

9. Marx, Karl. "Wage, Labour and Capital." Moscow (1950): Foreign Languages Publishing House.

10. Mitra, Arup. "Wages and Employment Issues and Facts." Indian Journal of Labour Economics 49, No 4 (2006): 587–602.

11. Oaxaca, R. (1973). "Male-Female Wage Differentials in Urban Labor Markets". International Economic Review. 14 (3): 693–709.

12. Sharma, Varinder. "Wage Differentials between Local and Migrant Permanent Farm Servants in Punjab." Indian Journal of Labour Economics 57, No 1(2014): 158–167.

13. Srivastava, Ravi. "Internal Migration in India: An Overview of its Features, trends, and Policy Challenges." New Delhi: UNESCO, Social and Human Sciences Sector & UNICEF, 2011.

14. Srivastava, Ravi and Sutradhar, Rajib. "Migrating out of poverty? A study of migrant construction sector workers in India." New Delhi: Institute for Human Development, 2016.

A BRIEF STUDY ON INDIAN MUNICIPAL WATER TARIFF SYSTEMS

TANVI VIPRA* and SAMVID UDAY

Ramjas College, University of Delhi

Abstract

A regular and clean supply of water is one of the most important requirements of a household. Following this, its pricing has a significant impact on how and where households get their water from. This paper aims to analyse the water tariff schemes of major urban areas like Delhi, Jaipur and Kolkata. These cities follow different pricing mechanisms which seek to achieve various objectives such as efficiency, affordability, equity etc. The paper tries to provide an idea on how pricing structures are determined and what objectives are fulfilled with each modification to the structure. The differences and similarities in pricing structures of the three cities are discussed, while international case studies are provided as examples.

1. INTRODUCTION

1.1. Water As An Economic Good

The importance of water is becoming increasingly apparent over time and across the world. In most developing and developed countries, a sufficient and safe supply of water is considered every citizen's right (Shah, 2016). Its importance in and of itself is not lost upon anyone and hardly needs to be emphasized further. However, the importance of making this water adequately available to people requires due address. Before the emergence of the climate crisis, resulting from mass environmental destruction and the rapid depletion of natural resources, people's attitudes towards water usage were fairly lax. However, as elementary economics suggests, an increase in scarcity leads to an increase in price. This is precisely what would have happened to water supply in the absence of appropriate regulation. At the International Conference on Water and Environment in 1992, it was decided that water has an economic value and thus, should be treated as an economic good (GWP, 2017). This made it possible to put a price tag on water supply. In order to ensure that these prices are not exploitative, it was noted in the conference that water must first be seen as a human right and that access to it must be affordable. This responsibility of creating a fair, equitable and somewhat efficient pricing system falls upon government bodies. As per welfare economics, the traditional pricing mechanism which equates demand to supply would not be applicable in this situation because of water's status as a human right. In such a scenario, where a tradeoff must be made between equity and efficiency, a pricing system which aims to bring a balance between the two is the most desirable one. Various pricing systems are followed all over the world and each system deals with the equity-efficiency tradeoff differently. The aim of this study is to observe the pricing systems adopted by major urban government bodies in the country and analyse their effects on the end-users and/or the suppliers.

1.2. The Demand For Water

The demand for water comes from a very heterogeneous population for multiple uses. For example, farmers demand it for irrigation, industries for production or households and service providers for domestic use, and so on. The quality and quantity demanded by these people have significant differences. To make the analysis easier, we focus only on urban water pricing. This includes the water supply prices faced by households in urban dwellings. The rationale behind focusing on urban water pricing is pretty straightforward. A large part of the Indian population has migrated to urban areas in search of a livelihood which has not only led to an increase in urban population but has also led to the rapid development of towns into urban dwellings. Since most people live in these areas, it becomes very important to focus upon the fundamental requirement of these people, that is, a reliable water supply priced at an affordable rate.

* Corresponding author's email address: vipratanvi@gmail.com

1.3. Pricing Structure

A pricing system typically has a tariff structure which is a set of procedural rules used to determine the conditions of service and monthly bills for water users in various categories or classes (Singh et al, 2005). A tariff structure is expected to fulfill certain objectives to ensure appropriate pricing. Before we discuss the objectives, it is important to understand the general functioning of a water distribution mechanism and the stakeholders involved in it. In India, the responsibility of providing water rests with the states. The state governments are responsible for setting up and maintaining a water procurement, treatment and distribution framework. Today, many urban households have a metered connection to water, although this is not always true for the poor population. At times, the pipeline network does not reach poor or slum localities. The poor are then forced to source water through alternate means such as buying it from private sellers or pumping groundwater with personal pumps, which is illegal in most regions. We refer to the process of providing water to households through a government framework as the water distribution framework. The primary stakeholders that we identify in this framework are categorised into two groups: one, the general public, who are henceforth referred to as consumers and two, the government which acts as the supplier.

2. LITERATURE REVIEW

As a policymaker grapples with the issue of creating a water tariff, it must fulfill at least a few of the following objectives. These objectives are discussed in detail by Singh et al. (2005):

i. Cost Recovery: This requires that tariffs charged from the consumers should produce revenue equal to the financial cost of supply.

ii. Economic Efficiency: It requires that prices signal to the consumers the financial, environmental and other costs that their decisions to use water impose on the rest of the system and the economy.

iii. Equity: The water tariff treats similar consumers equally while those consumers in different situations are not treated the same. Users shall pay monthly water bills that are proportionate to the costs they impose on the utility by their water use.

iv. Affordability: Water, being basic a necessity for the maintenance of minimum health and hygiene standards, shall be provided to the poor at a price that they can afford through the system of subsidies.

v. Simplicity: A tariff design should be simple and easy to understand and implement. It should be acceptable to the public and politicians.

One would immediately notice that all five objectives cannot be fulfilled simultaneously mainly because they are conflicting in nature. For example, the objective of cost recovery would expect water to be priced at its marginal cost. However, the affordability objective indicates that water must be priced below its marginal cost for the poor. Achieving both of these objectives simultaneously hardly seems possible and opens up the idea of a tradeoff in achieving objectives. Most water pricing structures achieve one or two of these objectives and adjust prices in such a way that other objectives are partially achieved. The idea of water prices being below the marginal cost can be illustrated through an example of certain towns in Maharashtra. There, revenue per connection is ₹120 per year as opposed to expenditure per connection which is ₹1300 per year (Patwardhan, 1993). Thus, while there is a relief to the poorer sections of society and a certain degree of affordability, the prices fail to achieve cost recovery and economic efficiency for the state. The problem with such a pricing structure is that in the long run, as the government becomes unable to sustain the infrastructure, the quality and dissemination of water falls. This reduced quality and quantity of water will directly affect the consumers, who will face the brunt of a poorly designed price structure. As a result, it becomes imperative to analyse the water tariff structures that are currently operational.

3. TYPES OF TARIFF STRUCTURES

Two popular tariff structures are widely used around the world: the uniform pricing system and the volumetric pricing system. In the uniform pricing system, consumers pay a fixed charge to the supplier regardless of the amount of water consumed, and usually this fixed charge depends on factors such as the size of the property and acts as a form of water tax. In the volumetric pricing system, water is charged on the basis of the amount of water consumed per unit of consumption. Cities such as Kanpur, Indore, Surat and Madurai follow the uniform pricing system (Mathur et al, 2006). This kind of system is generally lauded for its simplicity but provides no incentive for the consumer to conserve water.

Within the volumetric pricing system, a fairly popular system of pricing is the Increasing Block Tariff (IBT) system. In this system, the rate per unit of water increases as the volume of consumption increases. Consumers face a low rate up to the first block of consumption and pay a higher price up to the limit of the second block, and so on until the highest block of consumption (Ricato, SSWMT). International financial and engineering consultants and water sector professionals working in developing

countries commonly presume that IBT structures are the most appropriate way to determine water users' monthly bills (Boland and Whittington, 1997) but this claim is contended in their paper.

After doing a review of the existing literature with regards to IBTs, and as argued by Whittington (1992), we agree that IBTs have several shortcomings, but they can be overcome. One of the main issues raised against IBTs is that of the construction of the first block and its pricing. If the initial block is too large and it is priced too low, the supplier may not be able to recover any of its costs. In fact, one of the prime features of an IBT is that it also has a concept of a lifeline block. The first block in an IBT system is referred to as the lifeline block. With the assumption that poor people consume less water than rich people, the lifeline block is priced at an extremely low rate or, at times, is made free of cost (Ricato, SSWMT). Since the rich pay more for water, they are expected to subsidise the usage of the poor. This cross-subsidy ensures that the poor are able to afford water at lower rates and the rich subsidise the water for them while ensuring cost recovery takes place. While this sounds viable in theory, a major problem with this stands in places where either the poor share meters or live in large families whose consumption is greater than the average household consumption. In such a scenario, the poor end up paying much more than the affluent simply because they fall in a higher block, despite their personal consumption being less than average (Singh et al, 2005).

However, these shortcomings can be overcome and the benefits that it provides can supersede the shortcomings. If meticulous surveys on people's demand, ability to pay and willingness to pay are done and the data is analysed appropriately, then the construction of this initial block should not be very difficult.

4. TARIFF STRUCTURES IN DIFFERENT CITIES OF INDIA

Most urban bodies use a combination of a uniform price and an IBT system, which is referred to as a two-part tariff system. The fixed part is usually levied in the form of connection fee, water cess or sewerage charge. The general trend in most cities has been a shift from a uniform price to a volumetric charge with some fixed part. Take the case of Chennai as an illustration. We see that until very recently, the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), the water authority of the city, used to levy a fixed tariff irrespective of the quantum of water used (Vishwanath, 2019). However, now the city has moved towards an IBT system with a

fixed portion which includes the sewerage charge ("Tariff", CMWSSB). Cities like Jaipur, Bangalore, Delhi, Hyderabad, Agra, Prayagraj, Pune and Mumbai also follow some form of the IBT system.

The authors would like to discuss the tariff structures of Delhi, Jaipur and Kolkata in detail primarily because of the innovations that the policymakers have brought into the pricing mechanisms and whether these innovations are better than traditional pricing structures.

4.1. Delhi

In Delhi, most of the water supply and pricing activities fall under the jurisdiction of the Delhi Jal Board (DJB). Up until 2014, the city had a basic two-part tariff system which had a fixed rate and a volumetric charge. The volumetric charge in this structure followed an IBT system. However, a large part of the population did not have meters and thus had to get water from illegitimate sources. This was because of the inability of the government to supply water to these regions and the subsequent birth of the 'water mafia'. These were private suppliers who held a regional monopoly on water supply. As a result of this, the people without meters, who were mostly the poor, ended up paying more for water. To address this problem, the Delhi Jal Board altered their pricing mechanism and marketed it as a 'free water scheme'. The alterations were:

1) A subsidy was provided on the initial block (lifeline block) such that any domestic consumption within the 20,000 litre limit would get a 'zero-bill'.

2) The tariffs of the higher blocks were increased by 20%. If consumption exceeds the 20,000 litre limit, then the appropriate rate would be applicable to the entire amount of water consumed, and not the differential.

3) For example, if your water consumption is 25,000 litres per month, the bill will be calculated as: 25 x ₹21.97[1] = ₹549.25

A key requirement of availing the benefit of this subsidy was to have a government-approved water meter. This led to a considerable increase in the number of water connections and significantly reduced the presence of the 'water mafia' in the city. Now most of the households who shifted from an unmetered water supply to a metered water supply are likely to have benefitted as they faced lower prices and could avail the subsidy if their consumption was sufficiently low. This indicates the fulfilment of both objectives of affordability and equity because the poor, who are assumed to consume less water, now get water at an affordable rate through the means of subsidy. More-

---

[1]*The water charges are per kilo liter (1kl = 1,000l). "Water", Delhi Jal Board http://delhijalboard.nic.in/content/water-0*

over, the existence of different prices for different consumers ensures that equity is maintained.

We will analyse the cost recovery of the new (introduced in 2015) and old (introduced prior to 2015) pricing structures. The calculation of expenditure includes the cost of water supplied and the sewerage charges as both of those constitute the production costs. Sewerage costs have not seen a significant change and have been progressively increasing in each year by a marginal amount. Using data from Table A and Table B in the appendix, the revenue and expenditure data for both time periods are compiled to track their efficiency. The years 2013-2014 and 2014-2015 are omitted due to ambiguity over the government's resignation and the subsequent modification of their water scheme from the next term when they were re-elected in 2015.

Table 1: Before modification (₹ lakhs)

Year	Revenue Collected	Total Expenditure	Revenue - Expenditure
2010-2011	92531.62	160807	-68275.38
2011-2012	120247.97	156104	-35856.03
2012-2013	151926.49	171737	-191810.51
Total	364706.08	488648	-295341.92

Source: Compiled by authors from official Delhi Jal Board figures.

Table 2: After modifications to the price structures (₹ lakhs)

Year	Revenue Collected	Total Expenditure	Revenue - Expenditure
2015-2016	161583.50	172393	-10809.5
2016-2017	178220.00	138465	+39755
2017-2018	171981.00	173000	-1019
Total	511784.5	483858	+27926.5

Source: Compiled by authors from official Delhi Jal Board figures.

From the two tables, it is clear that the Delhi government water tariff scheme has somewhat been able to reduce the difference between its revenue and expenditure and hence sustain the water subsidy. The price hike in higher blocks has led to the recovery of costs to an extent greater than ever before.

In reference to the scheme's funding, as per the budget documents of the Delhi government, it has spent approximately ₹1400 crores to actualise the price structure (Budget NCT, 2015-16). Subtracting that from the total balance at the end of 2018, we get a deficit of ₹1120.755 crores, which is roughly 40% of the revenue deficit in the previous term with no subsidy. This decrease in the reve-

nue deficit is significant primarily because a section of the population pays virtually no money for their water consumption but the DJB is still able to recover costs better than the previous pricing structure.

4.2 Jaipur

If we take the case of Jaipur, we find similarities in its tariff structure with that of Delhi, with some minor differences. Although the effect of the scheme in terms of cost recovery and consumer benefit has been significantly different, mostly because of the finer details of the scheme. The water supply authority of Jaipur, the Public Health Engineering Department (PHED) made interesting changes to their tariff systems.

In 2017, the PHED decided that the water tariff would be revised upward each year by 10%. Due to this, the average water bill for each household went up from ₹ 435 to ₹ 550. The PHED claimed that the increase was necessary to secure loans from the bank for water projects (Pink City Post, 2017). This made an existing problem of defaulting even worse. The PHED had been seeing an increase in the number of defaulters for the past six years and the amount of unpaid bills had reached ₹68,56,503. The only measure that was taken against the defaulters was to cut their connection but that proved to be futile as it did not ensure cost recovery (Sharma, 2018).

Till 2019, the tariff system in the city was two-part, i.e. it had a fixed rate and a volumetric charge. The fixed rate was calculated on the basis of the average consumption of each household for the past six months. The system was incredibly complex with charges varying according to service lines and the level of consumption. There also existed a flat charge for unmetered households (Water Tariff, PHED).

In 2019, the city introduced a 'free water' scheme similar to the scheme we assessed in Delhi. The differences being:

1. The lifeline block included consumption upto 15,000 litres, which meant that urban households consuming under 15,000 litres do not have to pay any volumetric charge.

2. Households in rural areas would be supplied up to 40 litres of water per capita per day free of charge.

Similar to the requirement in Delhi, this tariff would be applicable to only those households that have a metered connection of water. However, unlike Delhi, this requirement did not lead to an increase in the number of metered households, primarily because of the exemptions made for non-metered households. The water charge for

non-metered areas, which was earlier fixed at ₹ 240, was now made free of cost. As per data from the PHED (up to August 2019) there are about 1,91,689 consumers in Jaipur who don't have a metered connection. There are about 21,866 flat rate connections in the city. If the average water bill for a metered household in 2019 was ₹127 inclusive of all charges, then that bill amount changes to ₹ 25.96 after the change in the price structure, which is a dramatic reduction, to say the least (Jain, 2019).

The PHED already has a disappointing track record with respect to cost recovery up till 2018. By introducing a lifeline block, reducing fixed charges and exempting flat rate charges, the PHED has blocked a significant source of its income which is more than likely to affect cost recovery. The IBT system, along with the introduction of a free lifeline block, has the potential to change water pricing and delivery. However, different circumstances in each region and the effect of parallel price structures must be accounted for in order to get the desired results, something Jaipur may not have done properly. There are 45,257 consumers but only 27,859 functional meters. This indicates that the government has no means to track water consumption of roughly 38.4% of the consumers. This is worrying because without the means to track the water consumption of these consumers, the PHED has no means to prepare itself for capacity, leakages and unlawful use. Moreover, this price structure does not achieve economic efficiency as the consumers are not made aware of the costs incurred in supplying water via the prices.

As per the progress report released by the PHED, huge gaps have been observed between the revenue and expenditure of the department over the years. In the financial year 2018-19, the expenditure was as high as ₹2,412.98

while the department generated a revenue of only ₹390.07 crores which is only 16.1654% of the expenditure. A similar trend was seen in the past few financial years. The only source of revenue generation for the department has been billing (ibid). The revenue and expenditure trend can be summarised in Figure 1.

4.3. Kolkata

The case of Kolkata is interesting for many reasons. Firstly, the city has a rich source of water from the river Hooghly and has liberal access to groundwater as well. Despite an abundance of water, the supply and pricing system of water in Kolkata is in shambles. The municipal authority, Kolkata Municipal Corporation (KMC), has been unable to recover costs and monitor supply across its command area. Due to bad planning and rampant criminal activities, the water-rich city is now becoming water-stressed. Prior to 2003, a 'nominal water fee' was charged for domestic use along with the property tax paid quarterly by the residents. This form of flat rate was discontinued by the government and at present, domestic water supply is not billed in the city. For any new connection, a household has to pay a fixed charge which includes a meter charge and road restoration fees. This can cost a consumer somewhere between ₹1500 and ₹6000 based on the size of the meter. A household is also liable to pay rent for the meter which varies between ₹100 to ₹1100 per month, depending on the size of the meter. Clearly, these prices are much higher than those found in any other city. These prices are close to indicating the actual value of water. So, one can conclude that having such prices may indicate economic efficiency. However, due to high prices, most households pump their own groundwater despite having a piped connection (Basu, 2015). This has led to a sharp decline in the groundwater tables and a

Figure 1: Revenue versus Expenditure of the PHED Department, Rajasthan
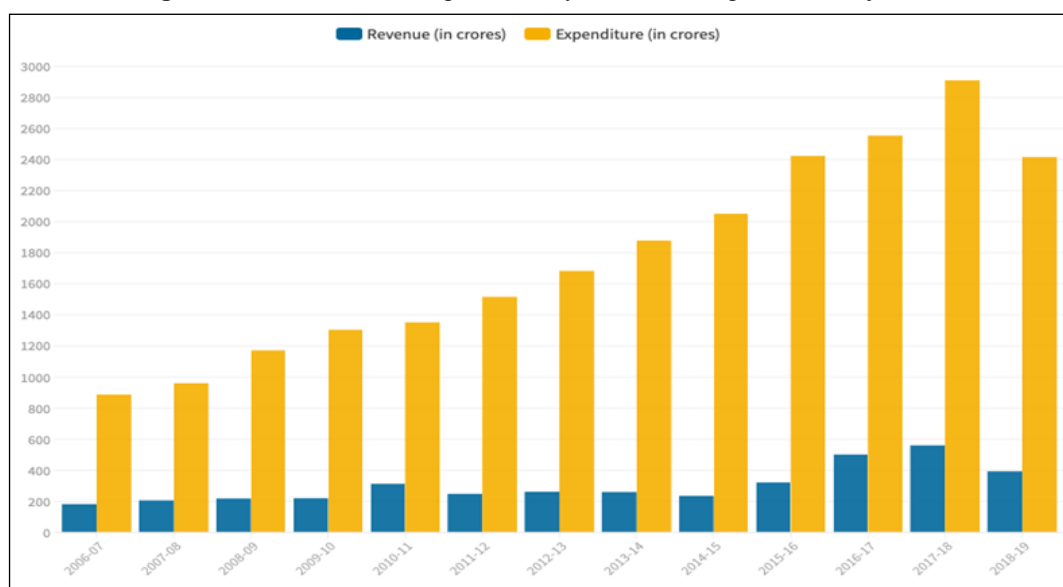
Source: The Wire, "Rajasthan: Gehlot's Free Water Scheme Benefits Neither Consumers Nor The Exchequer", 2019

steep rise in arsenic levels in the water.

Public taps in Kolkata are not billed and hence are responsible for a significant portion of water wastage and revenue loss for the KMC. The pricing structure in Kolkata fails to fulfil the objective of not just cost recovery, but also that of simplicity. Users in the city have been divided into 49 categories for levying in connection fees and these include stables, cooling plants, flushing purposes in the market areas, firefighting, medical practitioners, film actors and painters, owners of newspapers, estate agents, racehorse jockey, persons engaged in the profession of loading and unloading and others (Mathur, 2006). Efforts have been made by the authorities to simplify this system and increase the coverage of piped connections. For example in 2002, 85% of the population was served by a piped connection but by 2015, this figure jumped to 94%. Although it is an increase, the increase is not significant enough. The provision of free water through public taps ensures that water is available even to the poorest in the city, but studies have shown that most people are ready to pay money and even higher prices for water (Majmudar et al, 2009). In such a situation, the water authority of Kolkata must adequately charge at least a nominal fee for water and ensure a steady revenue flow.

5. INTERNATIONAL PRACTICES

Most developed and developing countries have experimented with different forms of pricing structures to suitably price water to ensure availability while also indicating the true economic cost of providing water to households. We will briefly look at the tariff structures of Australia and Guinea.

In a case study published by the World Bank Oxford University Press, we observe the case of the Hunter District Water Board. The Hunter District Water Board supplies water to Newcastle, the second-largest city in New South Wales. In the 1970s, the board had proposed the construction of a new dam to ensure capacity for rising demand but was short on finances. In 1982, the board reformed its tariff structure and ensured a reduction in demand and a simultaneous increase in revenue.

Prior to this reform, users had to pay a flat charge on the basis of the value of their property, for a base or free allowance of water. The free allowance was generous, with the result that the cost to most consumers at the marginal unit of water consumed was zero. Consumers who exceeded the base allowance paid a volumetric charge. The reform introduced a two-part tariff structure, similar to the ones observed in Delhi and Jaipur but without the

lifeline block. This reform modified the base charge such that it was still based on land value but simultaneously reflected that it only existed to cover the fixed costs of the board. There was a phased change to the tariff structure and it led to dramatic impacts. This pricing reform based on the principles of consumption-based pricing, full cost recovery and the removal of cross-subsidies was successful as it led to many similar reforms by urban authorities in the country (Ariel, 2000).

In a move similar to Delhi and Jaipur, Guinea has adopted a lifeline block within its IBT system and has made the consumers falling under this block free of payment. The water authority is a private commercial operator. Subsequent block rates were increased in a phased manner so that the higher paying consumers could subsidize the consumption of those falling in the lifeline block. This has ensured the fulfilment of affordability and equity. External credit was sought to sustain the phased increase of tariffs to ensure cost recovery at a future date which has worked out well for Guinea (Mathur et al, 2006). The pricing structure also seems to be fairly simple to understand and hence, fulfils the objective of simplicity as well.

6. CONCLUSION

As we get closer to a climate crisis, it is expected that a large part of the population will lose its access to clean water very soon. In this context of scarcity and urgency, it becomes very important for municipal bodies to get water tariffs right which will not only ensure availability of water but also make sure that the prices encourage conservation of water. From the brief analysis we have conducted above, we are of the belief that the water tariff system of Delhi has by far been able to produce desirable results. However, no empirical study has been conducted to substantiate these claims. The authors are currently working on this issue to gather evidence via a primary survey to evaluate the benefits of the water tariff structure of Delhi. The primary research aims to look into the various aspects of consumer behaviour and public reaction to pricing policies of essential commodities.

Such innovations in tariff structures are essential especially for cities like Kolkata which have an abundance of water, but poor management systems. These innovations encourage households to install a water meter in order to benefit from a subsidy. This decreases the households' dependence on illegitimate sources of water and helps the authorities to keep track of the water consumption patterns. This can ensure that there is no reckless use of water and can help in ensuring that groundwater tables do not get depleted.

APPENDIX

Table A: Expenditure incurred on water supply and sewerage programmes in Delhi during 2007-2018

				(₹ Crore)
S. No.	Details	Water Supply	Sewerage	Total
1.	Approved Outlay (2007-2012)	4361.50	3132.50	7494.00
2.	Fund Released			
	a. 2007-08	962.01	383.96	1345.97
	b. 2008-09	1015.17	441.73	1456.90
	c. 2009-10	1080.35	568.55	1648.90
	d. 2010-11	1080.14	527.93	1608.07
	e. 2011-12	1033.02	528.02	1561.04
	Total (a+b+c+d+e)	5179.69	2450.19	7620.88
3.	Approved Outlay (2012-17)	6087	4913	11000
4.	Fund Released			
	a. 2012-13	964.97	752.40	1717.37
	b. 2013-14	796.77	753.23	1550.00
	c. 2014-15	854.50	934.50	1789.00
	d. 2015-16	646.50	1077.43	1723.93
	e. 2016-17	850.15	534.50	1384.65
	Total (a+b+c+d+e)	4112.89	4052.06	8164.95
5	Revised Outlay 2017-18	1023.00	813.50	1890.00
6	Fund Released 2017-18	999.50	730.50	1730.00

Source: Economic Survey of Delhi 2018-19 | Planning Department |

Table B: Revenue Collection of Delhi Jal Board

Year	Revenue Collection(rupees in lakh)
2009-2010	64936.05
2010-2011	92531.62
2011-2012	120247.97
2012-2013	151926.49
2013-2014	143715.33
2014-2015	121993.29
2015-2016	161583.50
2016-2017	178220.00
2017-18	171981.00

Source: Delhi Jal Board Website, Revenue Department

REFERENCES

1. Basu, Jayanat (2015) "Kolkata, a water-rich city turning water-poor" *The Third Pole*, November 11, 2015. https://www.thethirdpole.net/en/2015/11/11/kolkata-a-water-rich-city-turning-water-poor/

2. Delhi Jal Board Website, Revenue Department

3. Dinar, Ariel (2000), "The Political Economy of Water Pricing Reform", *Published for the World Bank Oxford University Press*, April 2000.

4. Economic Survey of Delhi 2018-19 | Planning Department |

5. Global Water Partnership, 2017. "Vision and Mission". Last modified March 20, 2017. https://www.gwp.org/en/GWP-CEE/about/how/Vision-and-Mission/. Accessed on April 19, 2020.

6. Government of NCT Delhi, Planning Department, "Budget 2015-16 (Regular)", pp 30, Last modified 21 May, 2019.
http://delhiplanning.nic.in/sites/default/files/For%2BWeb-%2BBS%2BEnglish.pdf

7. https://www.patrika.com/bassi-news/losses-in-revenue-collection-phedकार्मिक-वसूली-के-प्रति-नहीं-दिखा-रहे-दिलचस्पी-2507453/

8. https://www.pinkcitypost.com/water-bill-tariff-increased-consumer-categories-10-percent-jaipur/

9. https://www.researchgate.net/publication/ 228541240_Water_tariff_design_in_developing_countries_ disadvantages_of_increasing_block_tariffs_IBTs_and_advantages_of_uniform_price_with_rebate_UPR_designs

10. Jain, Shruti (2019). "Rajasthan: Gehlot's Free Water Scheme Benefits Neither Consumers nor the Exchequer". October 12, 2019

11. Majumdar, Chirodip, and Gautam Gupta, "Willingness to pay and municipal water pricing in transition: a case study", *Journal of Integrative Environmental Sciences,* 247-260, https://doi.org/10.1080/19438150903068224

12. Mathur, O.P, and Thakur, S (2000), "Urban Water Pricing: Setting the Stage for Reforms", 2006.

13. Patwardhan, S.S (1993)."Financing Urban Water Supply Scheme" *Journal of IWWA, Oct-Dec, 1993*

14. Ricato, Martina "Water Pricing - Increasing Block Tariffs", Sustainable Sanitation and Water Management Toolbox,
https://sswm.info/water-nutrient-cycle/water-use/softwares/economic-tools/water-pricing---increasing-block-tariffs

15. Shah, M. (2016), "Report submitted by the Committee on Restructuring the CWC and CGWB", (July, 2016)

16. Sharma, Vinod. "Losses In Revenue Collection, PHED", *Patrika* March 17, 2018

17. Singh, M.R. V. Upadhyay and A.K. Mittal, (2005) "Urban water tariff structure and cost recovery opportunities in India", *Water Science & Technology,* Vol 52 No 12 (2005), 43–5.

18. Staff Writer. "Water bill tariff increased in all consumer categories by 10 percent in Jaipur". April 2, 2017

19. "Tariff", Chennai Metropolitan Water Supply and Sewerage Board, https://chennaimetrowater.tn.gov.in/tariff.html

20. Viswanath, Madhumita "In a few months, Chennai residents will pay water bill based on usage.", *The New Indian Express,* September 08, 2019.
https://www.newindianexpress.com/cities/chennai/2019/sep/08/in-a-few-months-chennai-residents-will-pay-water-bill-based-on-usage-2030829.html

21. "Water Tariff", Public Health Engineering Department, Government of Rajasthan. https://phedwater.rajasthan.gov.in/content/raj/water/public-health-engineering-department/en/citizencorner/watertariff.html.

22. Whttington, Dale, John Boland (1997) "Water Tariff Designing in Developing Countries: Disadvantages of Increasing Block Tariffs (IBTs) and Advantages of Uniform Price With Rebate (UPR) Designs" January 1997

INSTITUTIONAL QUALITY AND ECONOMIC GROWTH IN SOUTH ASIA

ANINDYA TOMAR

Ramjas College, University of Delhi

Abstract

This paper empirically investigates the relationship between institutional quality and economic growth in South Asia. It further aims to pinpoint specific aspects of institutional quality which are more important in determining economic growth in South Asia. To an extent, this study also empirically tests the mechanism through which institutions affect economic performance, which was propounded by Daron Acemoglu, Simon Johnson, and James Robinson in 2005. Panel data regression analysis has been used to undertake this study. The dataset used for this study has been compiled from larger datasets provided by the United Nations, World Development Indicators and World Governance Indicators. It is observed that institutional quality has a positive impact on economic growth in South Asia. More specifically government efficiency, regulatory quality, control of corruption, rule of law, voice and accountability, and political stability and absence of violence/terrorism have a positive effect (in descending order of magnitude) on economic growth in South Asia. Despite emphasising the role of institutional quality as an important determinant of economic growth, this study reaffirms the critical importance of factors such as capital stock, labor force, and international trade in determining economic growth. The results also show that economic institutions are fundamental determinants of economic growth in South Asia; and further indicate that political institutions also have a positive effect on economic growth in South Asia indirectly via economic institutions, though the evidence on the latter proposition is not very conclusive.

1. INTRODUCTION

One of the most pressing questions in the literature of economics of growth and development is: *Why some countries are poorer than others*? The evolution of the answer(s) to this question corresponds to the historical trajectory of the evolution of the theories of economic growth. Classical economists like Adam Smith, Karl Marx, Thorstein Veblen, Joseph Schumpeter were much concerned with economic growth. But the modern revival of the topic of economic growth started in the mid-twentieth century with a remarkable paper by Roy Harrod in 1939. This also marked the beginning for much of the theoretical and empirical research aiming to explain the international differences in income levels and their growth rates.

The so-called Harrod-Domar model of economic growth, which is based on the Keynesian saving-investment analysis predicts that the cross-country differences in economic growth are primarily due to the differences in aggregate economic parameters such as savings rate, capital-output ratio, population growth rate and rate of depreciation. Neoclassical growth models, explains the differences in income per-capita in terms of the different paths of factor accumulation across countries. New growth theories have taken two major paths to explain the international differ-

ences in income levels and their growth rates. First, they have emphasised the role of human capital and its deliberate accumulation over time. Second, they have emphasized the linkages between economic growth, technological growth, factor productivity, and innovation.

Despite such a rigorous and vibrant theoretical and empirical tradition 'it [economic growth theories] has for a long time seemed unable to provide a *fundamental* explanation for economic growth' (Acemoglu, Johnson, and Robinson, 2005). Scholars belonging to the institutional school of economic thought believe that physical capital, human capital, and technological growth are only *proximate* causes of growth. In the sense that they raise additional questions regarding the reasons for the cross-country differences in physical capital, human capital and technological growth. 'The factors we have listed (innovation, economies of scale, education, capital accumulation etc.) are not causes of growth; they *are* growth' (North and Thomas, 1973)). In North and Thomas's view, the fundamental explanation of comparative economic growth is the difference in *institutions.*

The broader emphasis on the role of institutions in determining economic behavior, in general, started with the works of Thorstein Veblen (see for example Veblen (1899)). The modern revival of this approach started with works of scholars like John Kenneth Galbraith, Gunnar Myrdal, Robert Fogel, Douglas North, and others (see for example Galbraith (1958), Myrdal (1968), North (1990)). They undertook cross-discipline analysis to establish the relevance of formal and informal institutions for the economy, and the society in general.

A more focused inquiry into the relationship between institutional quality and economic growth also has rich theoretical and empirical literature (see for example Easterly and Levin (2000), Acemoglu, Johnson, and Robinson (2002,2005), Rodrik (2008)). Many other studies have inquired into the relationship between economic growth and specific aspects of institutional quality such as corruption, form of government, property right enforcement, rule of law and others (see for example Barro (1991), Knack and Keefer (1995), Mauro (1995), Vijayaraghavan and Ward (2001), Ulubasoglu and Doucouliagos (2004), Asgar, Qureshi, and Nadeem (2015), Iheonu, Ihedimma, and Onwuanaku (2017)). There is also evidence of a bilateral causality between institutional quality and economic growth (see for example Chong and Calderon (2000)). One common conclusion of all these studies is that an improvement in institutional quality does not lead to a fall in economic growth (rather in most cases it leads to a rise in economic growth).

In this context, there are three main objectives of this study. First, to investigate the relationship between institutional quality and economic growth in South Asia. Second, to pinpoint *specific* aspects of institutional quality which are more important in determining economic growth in South Asia. Third, to an extent, empirically test the mechanism through which institutions affect economic performance, which was propounded by Daron Acemoglu, Simon Johnson, and James Robinson in 2005.

It is observed that institutional quality has a positive impact on economic growth in South Asia. More specifically government efficiency, regulatory quality, control of corruption, rule of law, voice and accountability, and political stability and absence of violence/terrorism have a positive effect (in descending order of magnitude) on economic growth in South Asia. Despite emphasising the role of institutional quality as an important determinant of economic growth, this study reaffirms the critical importance of factors such as capital stock, labor force, and international trade in determining economic growth. The results also show that economic institutions are fundamental determinants of economic growth in South Asia; and further indicate that political institutions also have a positive effect on economic growth in South Asia indirectly via economic institutions, though the evidence on the latter proposition is not very conclusive.

This study contributes to the existing literature in the following ways. First, it uses a more reliable, more transparent and all-encompassing dataset on different aspects of institutional quality provided by World Governance Indicators[1]. Second, there has been limited empirical research to identify specific aspects of institutional quality which are more important in determining economic growth, especially in the context of South Asia; this study attempts to identify such specific aspects of institutional quality. Third, it reaffirms the importance of factors such as capital stock, labor force, and international trade as fundamental determinants of economic growth. Fourth, to an extent, this study presents empirical evidence in favor of the mechanism through which institutions affect economic performance, which was propounded by Daron Acemoglu, Simon Johnson, and James Robinson in 2005.

The next section discusses the underlying theoretical framework for this study. Section 3 outlines the econometric model and estimation methods used in this study. Section 4 presents a detailed description of the dataset which has been compiled from various data sources for

---

[1]*The methodology through which World Governance Indicators are constructed can be viewed at https://info.worldbank.org/ governance/wgi/Home/Documents (last viewed on 22nd December 2019).*

econometric estimation. Section 5 presents estimation results based on various estimation methods and their relevant interpretations. Section 6 concludes the study and links some of the findings to the theoretical issues discussed in Section 2. Appendix and Notes can be found at the end of the paper.

2. THEORETICAL FRAMEWORK

What are institutions? This study uses the following definition, propounded by Douglass North: 'Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence, they structure incentives in human exchange, whether political, social, or economic' (North, 1990). This definition brings out three important characteristics of institutions. First, they are humanly devised constraints. Second, they shape human interaction. Third, they *structure incentives* in human exchange.

To understand the relevance of institutional quality as an important determinant for economic growth, it is important first, to understand the distinction between economic institutions and political institutions. Both economic institutions and political institutions influence the structure of incentives in society, but in different aspects. *Economic institutions* are concerned with aspects like - credibility of government's economic policies, judicial and civil services efficiency, property rights, quality of contract enforcement, and others. *Political institutions* are concerned with aspects like the extent of elite control of the state, people's participation in government selection, freedom of expression, free media, political stability, and others.

Figure 1: *Mechanism through which institutions affect economic performance.*
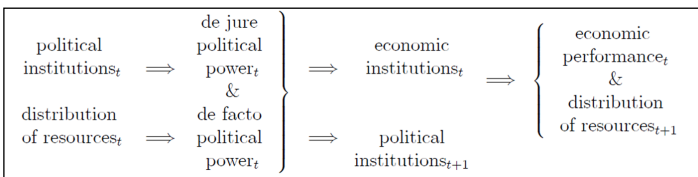
Source: Acemoglu, Johnson and Robinson (2005).

Now, it is useful to consider the mechanism through which institutions affect economic performance as described in Acemoglu, Johnson, and Robinson (2005) and presented by the schematic diagram in Figure 1. Political institutions and the distribution of resources amongst different social groups in period t determine *de jure* and *de facto* political power in period t. The *de jure* and *de facto* political power in period t determines the state of economic

institutions in period t and political institutions in period $t+1$. Economic institutions in period t determine economic performance[2] in period t and the distribution of resources amongst different social groups in period $t+1$. Thus, economic institutions have a direct impact on economic performance, while political institutions affect economic performance indirectly via economic institutions.

This study adopts the following theoretical strategy to address its objectives. The neoclassical production function (see for example Solow (1956)), postulates that total output is equal to technical change factor times a function of capital stock and labor force. This production function has been expressed in Equation 1.

$$Y = A\varphi(K, L) \tag{1}$$

Here Y stands for total output/total income, A stands for the technical change factor, K stands for capital stock and L stands for the labor force. There are strong theoretical and empirical justifications of the hypothesis that the economic interaction of an economy with the rest of the world, i.e. international trade has a significant effect on income (total output). This can be justified based on almost every theory of international trade either based on comparative advantages (Ricardian Model, Specific Factors Model, Heckscher-Ohlin Model, and Standard Trade Model) or economies of scale. Many empirical studies have shown that international trade has a quantitively large and robust positive effect on income (see for example Frankel and Romer (1999)). Thus, the extended functional relationship has been expressed in Equation 2.

$$Y = A\varphi(K, L, T) \tag{2}$$

Here T stands for international trade. Every independent variable in Equation 2 is directly observable except the technical change factor. The technical change factor represents the composite effect of all factors which effect total output for a given amount of capital stock and labor force. The popular components of technical change factor are technological growth, innovation, human capital, institutional quality, and others. Based on the discussion in this paper so far, it is reasonable to postulate that technological growth, innovation, human capital and other such factors are *proximate* determinants of technical change factor while institutional quality is the *fundamental* determinant of technical change factor. Hence, the technical change factor can be exhaustively measured through the data on institutional quality. Finally, the functional relationship which act as the basis of the econometric model, specified in the next section has been expressed in Equation 3.

$$Y = \varphi(K, L, T, IQ) \tag{3}$$

---

[2]*Economic performance can mean many things. This study concentrates solely on economic growth as an exhaustive measure of economic performance.*

Here IQ stands for institutional quality. It is reasonable to expect that all the independent variables, i.e. capital stock, labor force, international trade, and institutional quality, in Equation 3 have a positive effect on total output/total income. The functional relationship in Equation 3 suggests that in addition of institutional quality, factors such as capital stock, labor force, and international trade are also fundamental determinants of total output/total income. This view is divergent from the arguments put forth by *pure institutionalists*, according to whom institutions and institutional quality is the only fundamental determinant of income level and its growth rate.

3. ECONOMETRIC MODEL AND ESTIMATION METHODS

Based on the discussion in this paper so far, the econometric model used in this study has been expressed in Equation 4. Here, i refers to the number of cross-sectional

$$lnY_{it} = \beta_0 + \beta_1 lnK_{it} + \beta_2 lnL_{it} + \beta_3 lnT_{it} + \beta_4 IQ_{jit} + u_{it} \quad (4)$$

$$i = 1, 2, \ldots \ldots, 8$$
$$t = 1, 2, \ldots \ldots, 19$$
$$j = 1, 2, \ldots \ldots, 6$$

subjects in the panel dataset, t refers to the time dimension of the panel dataset and j refers to the different aspects of institutional quality which have been considered in this study.

It is observed based on the analysis of the compiled dataset, that the natural log of the observable variables for the explanatory variables, i.e. capital stock, labor force, and international trade, have a strong uncontrolled positive correlation with the natural log of the observable variable for total output/ total income (see Appendix A.1.). This observation is as per the priori expectation.

It is also observed that there is a weak uncontrolled negative correlation between different aspects of institutional quality which have been considered in this study and the natural log of the observable variable for total output/ total income (see Appendix A.1.). This observation is not as per the priori expectation because it is unreasonable to expect that an improvement in institutional quality would lead to a decrease in the natural log of total output/total income. This suggests that in order to understand the relationship between institutional quality and the natural log of total output/total income there is a need to control for other variable(s). As discussed in the previous section,

theory suggests that capital stock, labor force and volume of international trade needs to be controlled. This is the justification of the model specified in Equation 4.

As described in the next section, six aspects of institutional quality have been considered in this study. Data on different aspects of institutional quality has been used *turn by turn*, to estimate the econometric model given in Equation 4. This ensures two things. First, the problems related to imperfect multicollinearity are avoided, since it is only reasonable to expect that the data on different aspects of institutional quality are correlated amongst themselves. This expectation is borne out in reality (see Appendix A.2.). Second, *specific* aspects of institutional quality that are more important in determining economic growth in South Asia can be identified conveniently and accurately.

The econometric model given in Equation 4 ensures that the estimates of β_1, β_2, and β_3 are the partial elasticities of total output/total income with respect to the capital stock, labor force, and international trade respectively. The estimates of β_4 are the semi-elasticities of total output/total income with respect to the different aspects of institutional quality.

The estimation methods which have been used in this study are pooled OLS estimation, fixed effects estimation and random effects (Swamy-Arora)[3] estimation. Intuitively speaking, it does *not* appear that the pooled OLS estimation method will be the appropriate estimation method since it is reasonable to expect heterogeneity amongst different countries of South Asia. Similarly, it does *not* appear that the random effects estimation method is the appropriate estimation method since it assumes that the sample of countries is drawn from a much larger universe of such countries, which is not the case here as all the countries of South Asia[4] are part of the sample.

Moreover, "even if it is assumed that the underlying model is pooled or random, the fixed effects estimators are always consistent" (Gujarati, Porter, Gunasekar (2017)). Hence, in the context of the objectives of this study, it appears that the fixed effects estimation method is the most appropriate estimation method for this study.

For the sake of *completeness*, the econometric model given in Equation 4 has been estimated by all three estimation methods. The decision regarding the most appropriate

---

[3]*Swamy-Arora estimation method is the most widely used random-effects estimation methods in situations concerning balanced panel data.*

[4]*South Asia for this study has been defined as a group of countries that are members of the South Asian Association for Regional Cooperation (SAARC).*

estimation method(s) has been made based on F-test, Hausman test, and Breusch-Pagan Lagrange Multiplier test. Robust standard errors have been used for the purpose of statistical inference[5].

4. THE DATA

This study uses a panel dataset which has been compiled from larger datasets provided by the United Nations, World Development Indicators, and World Governance Indicators. The compiled dataset includes data on eight countries that are members of the South Asian Association for Regional Cooperation (SAARC), i.e. Afghanistan, Bangladesh, Bhutan, Nepal, Maldives, India, Pakistan, and Sri Lanka, for the period 1996-2017[6].

The description of data on the dependent variable and controlled variables, i.e. total output/total income, capital stock, labor force, and international trade is given in Table 1.

Table 1: Description of data on dependent variable and controlled variables.

Conceptual Variables	Observable Variable (unit)	Source
Total Output/Total Income (Y) [Dependent Variable]	GDP at constant 2010 prices (US Dollar)	United Nations
Capital Stock (K)	Gross Capital Formation at constant 2010 prices (US Dollar)[7]	United Nations
Labor Force (L)	Labor Force (Absolute Number)	World Development Indicators
International Trade (T)	Exports of Goods and Services at constant 2010 prices + Import of Goods and Services at constant 2010 prices (US Dollar)	United Nations

Source: Author's compilation based on data provided by the United Nations and World Development Indicators.

In this study, data on all the six aspects of institutional quality provided by World Governance Indicators has been considered. The data on different aspects of institutional quality provided by World Governance Indicators has certain characteristics, which makes it superior to any other dataset on institutional quality. These character-

istics have already been discussed in Section 1. The description of data on different aspects of institutional quality provided by World Governance Indicators is given in Table 2.

Table 2: Description of data on different aspects of institutional quality.

Aspects of Institutional Quality	Description
Control of Corruption (CC)	Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
Government Effectiveness (GE)	Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Political Stability and Absence of Violence/Terrorism (PV)	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.
Regulatory Quality (RQ)	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
Rule of Law (RL)	Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Voice and Accountability (VA)	Voice and accountability capture perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Source: Author's compilation based on information provided by World Governance Indicators.

---

[5]*Since the number of cross-sectional subjects is less than the time dimension, Panel Consistent Standard Errors (PCSE) suggested by Beck and Katz have been used.*
[6]*The sample size is 152. This is because the data on different aspects of institutional quality for the years 1997, 1999 and 2001 is not available.*
[7]*Gross Capital Formation at constant 2010 prices, has been used as a proxy variable for capital stock.*

It should be noted, that the "estimate" of different aspects of institutional quality used in the analyses are not in absolute units but standardised units. "Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5" (World Governance Indicators).

5. ESTIMATION RESULTS AND INTERPRETATION

In this section, the estimation results based on pooled OLS, fixed effects and random effects (Swamy-Arora) estimation methods have been presented. Based on the results of the F-test, Hausman test, and Breusch-Pagan Lagrange Multiplier test the correct estimation method(s) has been determined. This section ends, with the interpretation of the main results, based on the appropriate estimation method(s).

The descriptive statistics of the compiled dataset and the results of the F-test, Hausman test, and Breusch-Pagan Lagrange Multiplier test can be found in the Appendix (see Appendix A.3. and Appendix A.4.). The estimation results of Equation 4, based on the different estimation methods are given in Tables 3 to Table 5 [8].

Table 3: Pooled OLS estimation results

Regressor/Statistic	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.891167	0.877832	0.823041	1.44627	0.766667	−0.121041
	(0.0159)**	(0.0272)**	(0.0287)**	(0.0026)***	(0.0518)*	(0.7768)
lnK	0.152413	0.0181655	0.156514	0.0255251	0.0633594	0.159862
	(0.0132)**	(0.6775)	(0.0401)**	(0.5820)	(0.2042)	(0.0141)**
lnL	0.255545	0.310928	0.232743	0.339389	0.285848	0.246587
	(0.0000)***	(0.0000)***	(0.0001)***	(0.000)***	(0.000)***	(0.000)***
lnT	0.665068	0.760779	0.678479	0.713339	0.737782	0.704840
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
CC	−0.0707309	-	-	-	-	-
	(0.0386)**					
GE	-	0.0604824	-	-	-	-
		(0.1108)				
PV	-	-	−0.0643744	-	-	-
			(0.0929)*			
RQ	-	-	-	0.173382	-	-
				(0.0002)***		
RL	-	-	-	-	0.00319239	-
					(0.9205)	
VA	-	-	-	-	-	−0.168439
						(0.0127)**
Adjusted R^2	0.992028	0.991944	0.992138	0.992993	0.991825	0.992588

Source: Author's calculation based on the compiled dataset

[8] *Values in the parentheses in Tables 3 to Table 5 represents p-value; *** represents significance at 1 percent level of significance, ** represents significance at 5 percent level of significance and * represents significance at 10 percent level of significance.*

Based on the results of statistical tests (see Appendix A.4.), it can be inferred that the fixed effects estimation method is the most appropriate estimation method for this study. This finding supports the intuitive discussion of these matters presented in Section 3. Thus, the estimation results presented in Table 4 is all that is required for the purpose of statistical inference and interpretation.

As per the results shown in Table 4, in South Asia, a 1 percent increase in capital stock leads to an increase ranging from 0.18-0.30 percent in total output/total income on an average. Similarly, in South Asia, a 1 percent increase in the labor force and international trade leads to an increase ranging from 0.23-0.44 percent and 0.33-0.44

percent respectively, in total output/total income on an average. The partial slope coefficients associated with the natural log of capital stock, labor force, and international trade are highly statistically significant in all six regression equations.

Partial slope coefficients associated with the different aspects of institutional quality has a different interpretation. A one standard deviation unit increase in government efficiency, regulatory quality, control of corruption, rule of law, voice and accountability and political stability and absence of violence/terrorism leads to a 22, 20, 18, 18, 3.5 and 3 percent increase in total output/total income on an average respectively, in South Asia. All aspects of institu-

Table 4: Fixed effects estimation results.

Regressor/Statistic	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.03056	3.39087	4.83356	3.60863	4.86633	5.62652
	(0.0000)***	(0.0035)***	(0.0001)***	(0.0011)***	(0.0000)***	(0.0000)***
lnK	0.205438	0.244203	0.184654	0.290403	0.240132	0.201821
	(0.0011)***	(0.0015)***	(0.0045)***	(0.0009)***	(0.0008)***	(0.0020)***
lnL	0.271265	0.438814	0.305596	0.380118	0.274460	0.238855
	(0.0022)***	(0.0005)***	(0.0027)***	(0.0005)***	(0.0022)***	(0.0070)***
lnT	0.432408	0.349864	0.434543	0.337005	0.403014	0.429329
	(0.0001)***	(0.0007)***	(0.0003)***	(0.0011)***	(0.0002)***	(0.0002)***
CC	0.181944	-	-	-	-	-
	(0.0060)***					
GE	-	0.223544	-	-	-	-
		(0.0048)***				
PV	-	-	0.0292172	-	-	-
			(0.1491)			
RQ	-	-	-	0.199504	-	-
				(0.0016)***		
RL	-	-	-	-	0.177589	-
					(0.0279)**	
VA	-	-	-	-	-	0.0361702
						(0.3587)
LSDV R^2	0.997514	0.997746	0.997368	0.997776	0.997509	0.997360
Within R^2	0.905189	0.914043	0.899617	0.915163	0.904990	0.899315

Source: Author's calculation based on the compiled dataset

tional quality except voice and accountability, and political stability and absence of violence/terrorism are highly statistically significant.

It should be noted, that achieving a one standard deviation unit increase in any and every aspect of institutional quality considered in this study is not at all trivial; it might take a couple of decades altogether. This explains why a unit change in any aspect of institutional quality has a larger effect on total output/total income than a unit change in any of the controlled variables, i.e. capital stock, labor force, and international trade.

6. CONCLUSION

In conclusion, there are four major findings of this study. First, there exists a positive relationship between institutional quality and economic growth in South Asia, i.e. an improvement in institutional quality leads an increase in economic growth in South Asia. This conclusion follows straight from the estimation results presented in Table 4, where the estimated coefficients associated with all aspects of institutional quality are positive.

Second, it is observed that all the different aspects of institutional quality considered in this study, i.e. government

Table 5 [9]: Random effects estimation results.

Regressor	(1)	(2)	(3)	(4)	(5)	(6)
Constant	3.64111	3.47532	3.32608	3.47112	3.64141	2.96065
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
lnK	0.190992	0.227017	0.167764	0.280930	0.217600	0.179418
	(0.0000)***	(0.0000)***	(0.0005)***	(0.0000)***	(0.0000)***	(0.0000)***
lnL	0.387323	0.408249	0.389098	0.375537	0.376527	0.352805
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
lnT	0.425149	0.383578	0.458378	0.355273	0.406873	0.485848
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
CC	0.133831	-	-	-	-	-
	(0.0031)***					
GE	-	0.208716	-	-	-	-
		(0.0000)***				
PV	-	-	0.0370092	-	-	-
			(0.0545)*			
RQ	-	-	-	0.202916	-	-
				(0.0000)***		
RL	-	-	-	-	0.158353	-
					(0.0013)***	
VA	-	-	-	-	-	−0.000967117
						(0.9804)

Source: Author's calculation based on the compiled dataset

---

[9]*Gretl, the econometric software used for this study, does not report R^2 statistics associated with random effects estimation methods.*

efficiency, regulatory quality, control of corruption, rule of law, voice and accountability, and political stability and absence of violence/terrorism have a positive effect (in descending order of magnitude) on economic growth in South Asia. Thus, government efficiency is the most important aspect of institutional quality, and political stability and absence of violence/terrorism is the least important aspect of institutional quality in determining economic growth in South Asia. This conclusion follows straight from the estimation results presented in Table 4.

Third, despite emphasising the role of institutional quality in determining economic growth; this study reaffirms the critical importance of factors such as capital stock, labor force, and international trade in determining economic growth. It is observed that different aspects of institutional quality positively affect economic growth in South Asia, only when the differences in capital stock, labor force, and international trade are controlled for. Thus, capital stock, labor force, international trade, and institutions are *fundamental* determinants of economic growth. This conclusion follows straight from the analysis presented in Figure A.1. and Table 4.

Fourth, there is strong evidence that economic institutions are *fundamental* in determining economic growth in South Asia. Political institutions also have a positive effect on economic growth in South Asia indirectly *via* economic institutions; though the evidence in this regard is not very conclusive. This becomes evident when the theoretical and conceptual issues discussed in Section 2 and the estimation results presented in the previous section are viewed together.

The distinction between economic institutions and political institutions discussed in Section 2, and the description of the different aspect of institutional quality presented in Table 2, ensures that the different aspects of institutional quality considered in this study can be categorised into indicators of economic institutions and political institu-tions. Government efficiency, regulatory quality, control of corruption and rule of law can be thought of as indicators of economic institutions. Whereas voice and account-ability, and political stability and absence of violence/ terrorism can be thought of as indicators of political insti-tutions.

Based on the estimation results presented in Table 4, it can be observed that the estimated coefficients associated with indicators of economic institutions are much larger in magnitude and are also statistically significant even at 1 percent level of significance. On the other hand, esti-mated coefficients associated with indicators of political institutions are much smaller in magnitude and are statisti-cally significant only at 15 and 36 percent[10] level of signifi-cance respectively.

This finding corresponds to a large extent with the mechanism through which institutions affect economic performance, which has been presented by a schematic diagram in Figure 1. This study presents strong evidence to establish at least one of the many relationships of that mechanism in the context of South Asia, which has been expressed in Equation 5.

$$economic\ institutions \longrightarrow economic\ performance \quad (5)$$

Another relationship of that mechanism, for which this study provides non-conclusive evidence in the context of South Asia has been expressed in Equation 6.

$$political\ institutions \xrightarrow{economic\ institutions} economic\ performance \quad (6)$$

The fact that political institutions have a positive but sta-tistically insignificant effect on economic growth in South Asia indicates that *maybe* political institutions affect eco-nomic growth indirectly, through a catalyst. Based on the mechanism presented in Figure 1, it can be concluded that maybe the catalyst is economic institutions.

APPENDIX

A.1. Scatter plot of lnGDP and the different explanatory variables given in Equation 4.

---

[10]*It implies by definition that the indicators of political institutions are statistically insignificant with respect to conventional level of significance, i.e. 1,5 and 10 percent.*
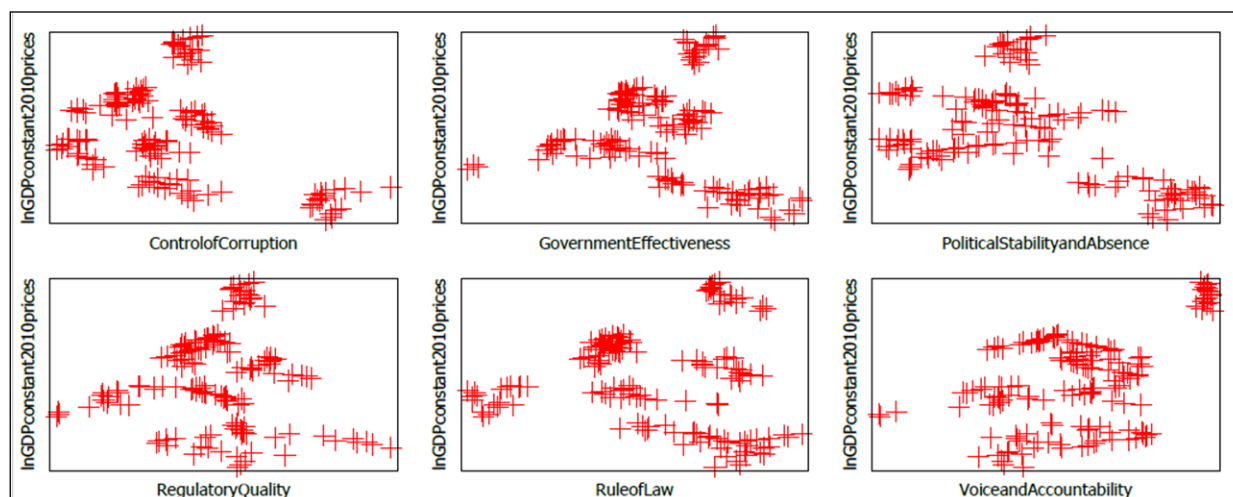
Source: Author's calculation based on the compiled dataset

A.2. Correlation matrix for different aspects of institutional quality.

	CC	GE	PV	RQ	RL	VA
CC	1					
GE	0.8235	1				
PV	0.7604	0.7895	1			
RQ	0.4018	0.7075	0.4979	1		
RL	0.8258	0.8844	0.6990	0.7095	1	
VA	0.2746	0.4474	0.2231	0.3984	0.6121	1

Source: Author's calculation based on the compiled dataset

A.3. Descriptive statistics of the compiled dataset

	Mean	Minimum	Maximum	Std. Dev.	5% Perc.	95% Perc.
lnY	24.052	20.074	28.593	2.2008	20.654	28.074
lnK	22.697	18.992	27.509	2.1595	19.323	27.066
lnL	16.019	11.193	20.041	2.5333	11.676	19.947
lnT	23.391	19.870	27.738	1.8774	20.587	27.327
CC	-0.54156	-1.6383	1.5683	0.70005	-1.5038	0.99208
GE	0.41907	-2.2317	0.90129	0.60717	-1.4507	0.59267
PV	-0.99564	-2.8100	1.2834	1.1549	-2.6540	1.0888
RQ	-0.60222	-2.1096	1.0267	0.54307	-1.6481	0.31806
RL	-0.48450	-1.8966	0.62753	0.63250	-1.7818	0.33952
VA	-0.53805	-2.0393	0.47656	0.54061	-1.3063	0.43824

Source: Author's calculation based on the compiled dataset

A.4. Statistical tests to determine the appropriate estimation method(s)

F-Test (Pooled OLS v/s Fixed Effects (LSDV))

H_o: Both Pooled OLS method and Fixed Effects method give consistent estimators.
H_1: Fixed Effects method give consistent estimators.

Hausman Test (Fixed Effects v/s Random Effects)

H_0: Both Fixed Effects method and Random Effects method give consistent estimators.
H_1: Fixed Effects method give consistent estimators

Breusch- Pagan Lagrange Multiplier test (Pooled OLS v/s Random Effects)

H_0: Both the Pooled OLS method and Random Effects method give consistent estimators.
H_1: Random Effects method give consistent estimators.

Table A.4. Results of F-tests, Hausman tests, and Breusch-Pagan Lagrange Multiplier tests.

Aspect of Institutional Quality in the Regression Equation	Welch F-Tests Statistics	Hausman Test Statistics	Breusch-Pagan (LM) Test Statistics	Appropriate Estimation Method
CC	33.7388 (0.0000)***	27.8143 (0.0018)***	210.789 (0.0000)***	Fixed Effects
GE	33.2382 (0.0000)***	9.61443 (0.0474)**	284.597 (0.0000)***	Fixed Effects
PV	30.2424 (0.0000)***	108.194 (0.0000)***	153.973 (0.0000)***	Fixed Effects
RQ	33.0102 (0.000)***	3.62995 (0.45839)	311.995 (0.0000)***	Fixed Effects and Random Effects
RL	34.5953 (0.0000)***	38.5852 (0.0000)***	247.416 (0.0000)***	Fixed Effects
VA	24.3293 (0.0000)***	101.536 (0.0000)***	110.632 (0.0000)***	Fixed Effects

Source: Author's calculation based on the compiled dataset

REFERENCES

1. Acemoglu, Daron, Simon Johnson and James A. Robinson (2002): "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, Vol. 91, No. 5, pp. 1369-1401.

2. Acemoglu, Daron, Simon Johnson and James A. Robinson (2005): "Institutions as the Fundamental Cause of Long-Run Growth," *Handbook of Economic Growth*, Vol. 1, No. 1, pp. 385-472.

3. Acemoglu, Daron (2017), Introduction to Modern Economic Growth, Princeton: Princeton University Press.

4. Asgar, Nabila, Shazia Qureshi and Muhammad Nadeem (2015): "Institutional Quality and Economic Growth: Panel ARDL Analysis for Selected Development Economies of Asia," *South Asia Studies*, Vol. 30, No. 2, pp. 381-404.

5. Barro, Robert J. (1991): "Economic Growth in a Cross-Section of Countries," *The Quarterly Journal of Economics*, Vol. 106, No. 106, pp. 407-443.

6. Calderon, C. and A. Chong (2000), "Causality and Feedback between Institutional Measures and Economic Growth," *Economics and Politics*, Vol. 12, No. 1, pp. 69-81.

7. Cottrell, Allin and Riccardo "Jack" Lucchetti (2019), Gretl User's Guide, retrieved from http://gretl.sourceforge.net/gretl-help/gretl-guide.pdf (last viewed on 13th December 2019).

8. Easterly, William and Ross Levine (2000): "What have we learned from a decade of empirical research on growth? It's Not Factor Accumulation: Stylized Facts and Growth Models," *The World Bank Economic Review*, Vol. 15, No. 2, pp. 177–219.

9. Frankel, Jeffrey A. and David E. Romer (1999): "Does Trade Cause Growth," *American Economic Review*, Vol. 89, No. 3, pp. 379-399.

10. Galbraith, John K. (1958): The Affluent Society, New York: Houghton Mifflin.

11. Gujarati, D.N., D.C. Porter and Sangeeta Gunasekar (2012): Basic Econometrics, Chennai: McGraw Hill.

12. Iheonu, Chimere, Godfrey Ihedimma and, Chigozie Onwuanaku (2017): "Institutional Quality and Economic Performance in West Africa," MRPA Paper No. 82218.

13. Knack, Steven and Philip Keefer (1997) "Does Social Capital Have an Economic Impact? A Cross-Country Investigation," *The Quarterly Journal of Economics*, Vol. 112, No. 4, pp. 1251-1228.

14. Mankiw, Gregory N., David Romer and David N. Weil (1992): "A Contribution to the Empirics of Economic Growth," *The Quarterly Journal of Economics*, Vol. 107, No. 2, pp. 407-437.

15. Mauro, Paulo (1995): "Corruption and Growth," *The* Quarterly Journal of Economics, Vol. 110, No. 3, pp. 681–712.

16. Myrdal, Gunnar (1968): Asian Drama: An Inquiry into the Poverty of Nations, New York: Twentieth Century Fund,

17. National Accounts – Analysis of Main Aggregates (AMA), United Nations Statistics Division, retrieved from https://unstats.un.org/unsd/snaama/downloads (last viewed on 11th December 2019).

18. North, D. C. (1990): Institutions, Institutional Change, and Economic Performance, New York: Cambridge University Press.

19. North, D.C. and R.P. Thomas (1973): The Rise of the Western World: A New Economic History, Cambridge: Cambridge University Press.

20. Rodrik, Dani (2008): One Economics, Many Recipes: Globalization, Institutions, and Economic Growth, Princeton: Princeton University Press.

21. Sen, Amartya (ed.) (1970): Growth Economics, New York: Penguin.

22. Solow, Robert M. (1956): "A Contribution to the Theory of Economic Growth," *The Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94.

23. Ulubasoglu, M. A., & Doucouliagos, C. (2004): "Institutions and Economic Growth: A Systems Approach," in *Econometric Society 2004, Australasian Meetings Paper,* Vol. 63.

24. Veblen, Thorstein (1899): A Theory of the Leisure Class, New York: Penguin.

25. Vijayraghavan, Maya and William A. Ward (2001): "Institutions and Economic Growth: Empirical Evidence for a Cross-National Analysis," Clemson University.

26. Wooldridge, J.M. (2013): Introductory Econometrics: A Modern Approach, New Delhi: Cengage.

27. World Development Indicators, World Bank, retrieved from https://data.worldbank.org/indicator/SL.TLF.TOTL.IN (last viewed on 11th December 2019).

28. Worldwide Governance Indicators, The World Bank, retrieved from www.govindicators.org (last viewed on 11th December 2019).

EXPONENTIAL GOODS

ADVAITA SINGH

Ashoka University

Exponential Goods [1]
Every entrepreneur's dream Good…

1. INTRODUCTION

For years, entrepreneurs have struggled and striven to attract customers to their products, build a customer base and foster consumer loyalty. They have spent thousands of dollars on branding, loyalty schemes, advertising, and product development to boost the demand for their goods and services. However, imagine a product that (once supplied) would create its own demand; a good or service that, through its initial consumption, triggers further need and fuels future demand. This is a new concept, and I call it the 'exponential good'.

Every good or service seeks to cater to a want or a need. Wants or needs can be expressed as problems faced by the consumer that are solved using a good or service. For instance, food solves the problem of hunger, jewellery provides for enhancing one's appearance, etc. Therefore, it can be said that most products today seek to fill a void or solve a problem faced by the consumers, thereby manifesting in the form of something that they want or need. Exponential goods differ from other goods because, in their use, they simultaneously add to the problem they initially sought to solve; thereby, fuelling future demand for themselves. By logic, if the problem that sparks consumption keeps growing, the need for the solution increases, causing demand for the exponential good to rise. With increased consumption of the exponential good, the problem continues to grow at a higher rate which boosts

demand and the cycle continues; causing the demand growth curve to resemble an exponential curve.

The hallmark characteristic of an exponential good is its ability to generate recurring demand. Previously, we have seen this phenomenon in habit-forming goods like cigarettes and alcohol. These goods are addictive and affect the consumer in such a manner that the good or service becomes a necessity for them. However, habit-forming goods work on an individual level and not on a mass scale. In other words, consumption of alcohol by one will not change the conditions such that others will also feel an increased necessity to consume it. In contrast to habit-forming goods, exponential goods alter the market conditions such that the overall need or want for consuming that good or service felt by everyone increases. (Market conditions here refer to the reasons for consumption or the primary conditions that spark the need or want, forming the reasons for demanding that good.)

2. THE CASE OF AIR CONDITIONERS

To prove this theory, we consider the case of a good that has become ubiquitous in our urban settings i.e. air conditioners. Air conditioners are built to solve the problem of heat and harsh summers and offer relief by cooling down a closed space. However, their use contributes to global warming by releasing excessive amounts of carbon dioxide and other harmful greenhouse gases like hydrofluorocarbons (HFCs). Statistics and data show that global energy consumption for space cooling has tripled over the last 26 years (Figure 1) from 600 terawatt-hours in 1990
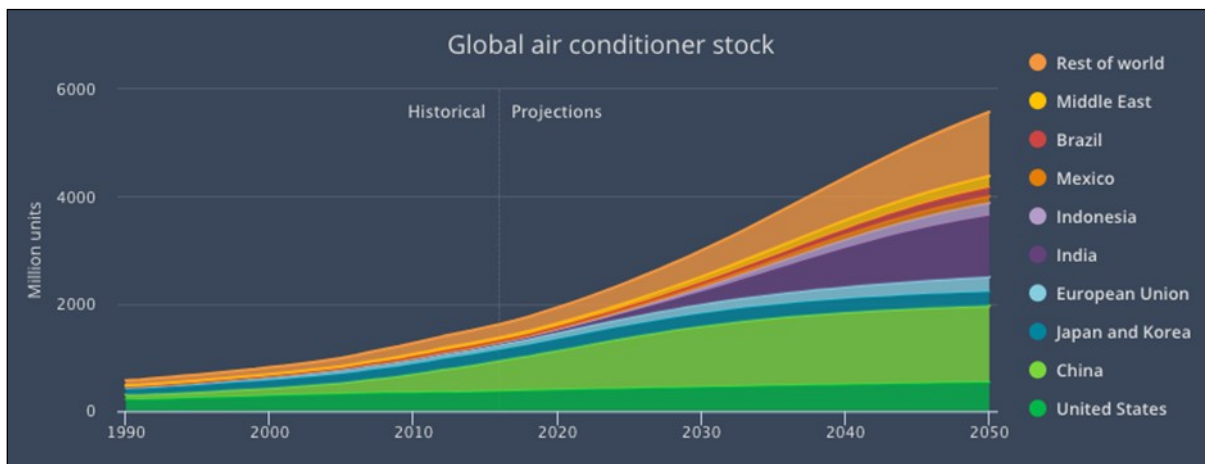
*Figure 1*: *World energy consumption for space cooling in buildings*
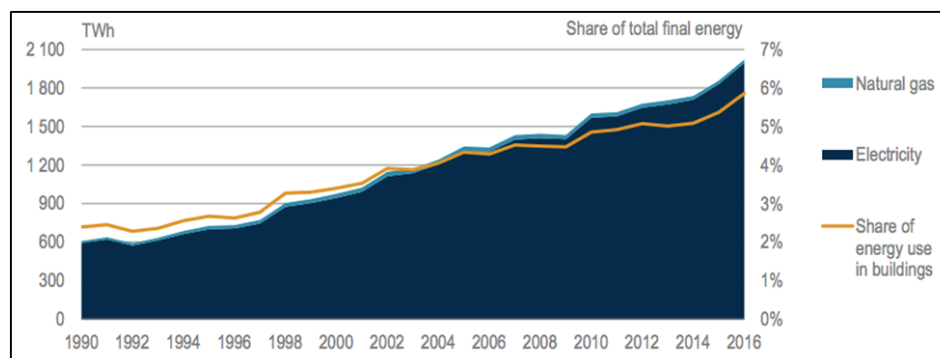
Source: 'The Future of Cooling' report by the IEA

[1] 'Goods' in 'Exponential Goods' here and everywhere in this article refer to both goods and services

Figure 2: Units (in millions) of ACs households have stocked over time

Source: 'The Future of Cooling' report by the IEA

Figure 3: Demand growth graph for current cooling technology and efficient cooling technology
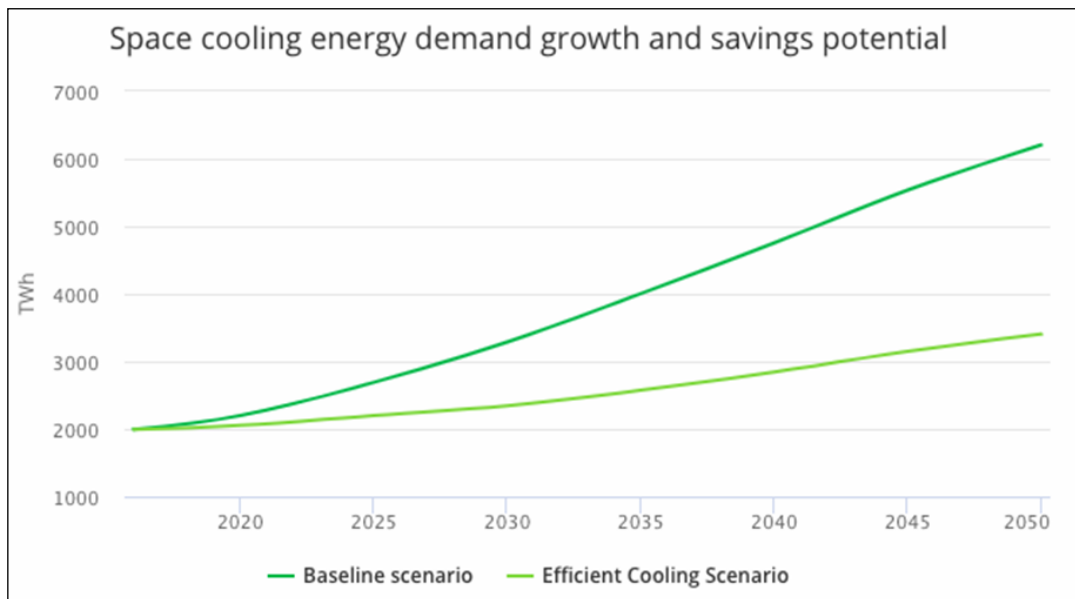
Source: 'The Future of Cooling' report by the IEA

to 2000 terawatt-hours in 2016. Households are buying more air conditioners which is leading to a rapid increase in the stock held globally (Figure 2). Hence, it is no surprise that the demand growth curve for air conditioners (Figure 3) closely resembles that of a shallow exponential curve.

The use of air conditioners becomes a vicious cycle, their consumption leads to rising temperatures causing a need for more air conditioners, which results in further temperature rises. Through the example of air conditioners, we can understand the model of exponential goods and their characteristics.

3. CHARACTERISTICS OF EXPONENTIAL GOODS AND THEIR DEMAND MODEL

Problems faced by customers drive them to demand a solution. Like other goods, exponential goods also solve a problem. However, when consumed, they also exacerbate that very problem on a large scale. Thus, with increased consumption, the intensity of the problem faced by everyone increases, which causes them to demand the good further. More consumption leads to greater addition to the problem and hence, further consumption.

Thus, to characterise any good or service as an exponential good, the following conditions are essential:

i. It must add to the problem it seeks to solve in the process of its consumption.

ii. The increase in the problem must be felt on a scale larger than the individual so as to create a significant increase in demand.

iii. There should be an absence of alternatives, especially cheaper ones for the demand to continue to rise.

Due to the nature of the product and the consequences of its consumption, the exponential good has an unending demand cycle (except for rare cases, such as when all individuals will possess the good). In terms of magnitude, after its introduction to the market, the graph for demand trends is likely to resemble that of an exponential curve. In other words, after the first sale, over time (regardless of the rate), the demand for the good will grow approximately exponentially.

Such consistent growth in demand should eventually attract new firms to set up and join the promising market. The arrival of new firms will increase supply and prevent prices from rising drastically. Although the actual change in price will depend on the relative rates at which supply and demand are growing, it is likely that with an exponential increase in demand, prices will rise in the very long run.

Necessity is an essential factor in determining the price elasticity of demand for exponential goods. Given that it has the prerequisite characteristic of increasing the need for its consumption over time, we can conclude that the price elasticity of demand for exponential goods will fall, making it more inelastic in nature over time, ceteris paribus.

The nature or design of the good are the primary reasons for the continued consumption of an exponential good. Other factors could also drive the consistent and growing demand for it, such as the lack of information about the external costs and benefits of its consumption. If there is an incomplete understanding of the long-term effects of consumption, consumers will become careless and reckless in their purchase and use. Their unawareness of the external costs and benefits propagates their consumption. Another reason for its continued use is when consumers, despite knowing the long-term consequences of consumption, do not regard them as severe enough. In case of external costs, if there is a considerable positive difference between the short-term satisfaction received from the use of the good and the external costs of consumption, then the consumers are again likely to be persistent in their consumption of the exponential good.

Air conditioners are used as an example for understanding exponential goods and their nature. Because of their high external costs on the environment, it is important to explore how to break their increasing demand cycle. Understanding this will shed light on what measures or conditions take away the key properties of exponential goods. We know of information failure as a possible reason for continued consumption, thus the unending demand cycle can be broken by supplying adequate information. Following the nudge theory put forward by Cass Sunstein and Richard Thaler, we know that giving enough information about long-term consequences outweighing short-term satisfaction will nudge consumers to make wiser choices and reduce consumption of the good with external costs. Active government intervention will be required to eliminate this information failure. Disseminating information about CFC (chlorofluorocarbons) and HFC emissions of air conditioners, to some extent, has made consumers more aware about the impact on the environment and more conscious and careful in their consumption thereby disrupting the continued growth in the demand model.

For exponential goods with external benefits, providing more information about the higher social benefits should boost demand further, according to the nudge theory. People will recognise the real higher merits of consuming the good and will increase their consumption. This should aid the exponential nature of the good's demand growth model.

For goods with external costs, innovation and the presence of better substitutes will cause a massive disruption in the market, just like providing information. Launch of more eco-friendly air conditioners has caused the decline of the old air conditioners market. Thus, the development of alternatives can potentially break the exponential demand trend, especially if they are cheaper to buy. In an oligopolistic market, collusion amongst market players can prevent a situation like this from arising. There will be the risk of new players bringing alternatives since the market will possibly be close to a contestable market. Nevertheless, with collusion, the risk diminishes significantly. In other cases, to be safe, a firm should invest in research and development and find a better alternative to stay competitive in the market and launch it as late as it possibly can to extract the maximum profit out of the exponential good's growing demand. Many firms have started to develop eco-friendly air conditioners as consumers become increasingly aware of their carbon footprints. Such a move will disrupt the market of older and harmful air conditioners, causing it to reach stagnation sooner than it would have otherwise.

4. CONCLUSION

The most important part that distinguishes an exponential good from other goods is that it feeds on its own consumption to fuel future demand by altering external conditions on a large scale, not necessarily physically but even in an intangible way like changing perceptions in society. The altering of external conditions is such that new con-

sumers are attracted in a quicker and more certain way. This saves on a firm's marketing costs and causes it to have consistently increasing demand for a very long time, thereby making its demand growth curve resemble an exponential curve. By no means is it implied that an exponential good would never meet stagnation in sales. But it is clear that the product life cycle will certainly be much longer than usual.

The exponential good is an ideal product for entrepreneurs, a long product life cycle and lasting demand. The product will require an initial push in terms of marketing and advertising to drive sales in the introductory stage of the product life cycle. The marketing costs should fall with time as the good works its charm and creates a mar-

ket for itself. The money saved due to lower marketing costs can be used at later stages for research and development that will help a firm sustain its competitive edge.

The exponential good is like the magic harp that played itself in Jack and the Beanstalk. Just get the harp and let it work its magic. It is a treat for the entrepreneur, saving them the headache of marketing and reducing the risk of falling demand. However, the social implications of such goods are uncertain. By harming the environment, air conditioners have done more damage than good. However, other exponential goods can be socially beneficial. This is an uncharted space in economics, one with a lot more to be discovered. Further research can help provide us with more clarity about this magic harp.

REFERENCES

1. Bryant, Chris. 2019 *"Air conditioning is the world's next big threat"*. Economic Times, June 30, 2019 *https://economictimes.indiatimes.com/news/science/air-conditioning-is-the-worlds-next-big-threat/articleshow/69999842.cms?from=mdr*

2. Dean, Brian, et al. 2018. *"The Future of Cooling: Opportunities for energy-efficient air conditioning"*. IEA, International Energy Agency. iea.org/futureofcooling/

3. Ospina, Christina. 2018 *"Cooling your home but warming the planet: How can we stop air conditioning from worsening climate change"*. Climate.org, August 7, 2018 *https://climate.org/cooling-your-home-but-warming-the-planet-how-we-can-stop-air-conditioning-from-worsening-climate-change/*

4. Sunstein, Cass and Richard Thaler. 2008. *Nudge.* Yale University Press, 2008

ANALYSIS OF INNOVATION: A GAME THEORETIC MODEL

SAMIRAN DUTTA* and VARUN BANSAL
Ramjas College, University of Delhi

Abstract

This paper attempts to model the impact of innovation and imitation in a duopoly market on firm profitability. The market is initially taken to be a duopoly because of the relative ease in modelling and it also provides the minimum situation required for any sort of competitive analysis. This paper focuses specifically on product innovation and not process innovation and so innovation has an impact on the demand. First, we model the demand curves and the cost curves of the individual firms in a manner that facilitates our analysis. Second, we find the short run and the long run profits of both firms. Here, the difference between the short run and the long run is defined as the time lag that it takes for the imitating firm to imitate the innovator's product to some degree. The short run analysis is a one-stage game involving price competition. The long run analysis is a two-stage game where stage one is determining the degree of imitation and stage two determines the price in a similar manner to the short-term analysis. A positive spillover of innovation is observed both in the short and in the long run. Third, we also analyse the impact of various parameters such as price elasticity, degree of imitation and the market's affinity to new products on the incentive to innovate, thus, providing important insights into which markets are characterised by more product innovation and why some industries demand more protection. Fourth, we look at how the positive spillover effect may be tackled from a policy-maker's perspective. Finally, the paper attempts to provide an intuitive explanation of how this model can be extended to 'n' firms.

1. INTRODUCTION

Competition among a small number of firms has always attracted much interest from theoretical economists. Price and quantity competition has been much easier to comprehend and model, as done in the Cournot, Bertrand and Stackelberg models. Analysis of competition in other spaces has been much more elusive but equally as important, especially among a small number of firms. The influential paper by Harold Hotelling in the first half of the 20th century was one of the first in an increasingly large number of attempts to model various intricacies of competition involved. We try to model one such impor-

tant element of competition and its impact on the short term and the long-term profitability of the firms involved in such competition. That element is innovation and more specifically product innovation. The inspiration of this paper in its analysis of innovation follows directly from the work done by growth economist Paul Romer in his "Increasing Returns and Long-Run Growth", which makes it clear that technological progress is the engine of long-term growth. The product innovation analysed in this paper is clearly not perfectly synonymous with the macroeconomic concept of technological progress. However, the importance of the growth of ideas or the increase in the output of the 'research sector' as emphasised

---

* Corresponding author's email address: samduttaf7@gmail.com

by Romer has clear parallels with the analysis carried out in this paper.

There are essentially two types of innovation, product and process innovation. Product innovation involves a change in the attribute of the product while process innovation involves improvement in the process of producing a given product. Process innovation usually has implications for the cost of production and is easier to model as a result. Product innovation, on the other hand, has implications for demand, market share as well as the mark-up of price over cost and hence the profitability. An important insight into process innovation as well as the treatment of cost of imitation comes from Rosenberg and Landau in their influential book, "The Positive Sum Strategy: Harnessing Technology for Economic Growth" which talks about lower imitation costs and process innovation's impact on the supply curve.

The firms competing over the same market often gain on other firms' loss, so innovation has implications not only for the firm engaging in innovation but also for the competitors, which might induce imitation. In fact, the fear of imitation has been the primary reason for patent and protection policies around the world, to prevent the spillover of benefits (positive externalities) of innovation to other firms in order to promote innovation in the first place.

The model examined in this paper focuses on a two-firm situation. The model is deliberately kept simplistic, where one firm gains market only to the detriment of the other firm with total market demand remaining the same. The demand curves utilised in this paper are inspired by the work done by P. Krugman in his analysis of monopolistically competitive firms in his book on international economics, with the equation adjusted to meet the specific needs of our model. The implications of innovation are derived in both the short term (when the other firm does not act) and the long-term (when the other firm has the opportunity to imitate). The focus is on the degree of imitation i.e. how closely the second firm copies the first firm's product. The cost of innovation is modelled through a basic linear cost function, where the degree of imitation correspondingly affects the cost of the imitating firm. The competition in terms of price is similar to the traditional Bertrand competition. Finally, policy suggestions are presented based on the policymaker's objective for promoting more innovation and competition, given the situation of an existence of a positive spillover effect of innovation which cannot be effectively internalised by the innovating firm without State intervention in the market. This paper attempts to arrive at a conclusion regarding which policy will work effectively within the framework of the model.

2. MODEL

2.1. Assumptions

The model analysed in this paper consists of only 2 firms, where firm 1 is taken as the innovator and firm 2 as the imitator. The process of entry and exit is not considered in our model as this would lead us to analyse existing experience/initial advantage of any firm in the industry (Krugman, 2015). We ignore any cost of establishment i.e. fixed cost, which is in line with the assumption of no entry and exit. We also assume that any sort of innovation leads to horizontal differentiation and not vertical. Horizontal differentiation means that some consumers prefer one good over the other and some prefer the latter over the former if offered at the same price while vertical differentiation means when one good is preferred over the other universally if offered at the same price.

Both firms have similar marginal costs (m). This is again done for simplicity. The model can be subsequently extended to incorporate more complex cost functions. The cost of innovation is taken to be a constant fixed investment (I) since we are taking the case of product innovation which involves invention of new attributes in the product which requires an investment in R&D. Imitation cost rises linearly with the degree of imitation, this is represented by an increase in $F\gamma$. Thus, close imitation in this model increases the cost for the imitator but this increase in cost is always assumed to be lower than the initial sunk cost incurred by the innovator i.e. $F\gamma < I$. We will analyse the effects in both the short run and the long run, where we define the short run as the period when the imitator cannot react to the innovation and the long run as the period when the other firm can imitate the innovator's product to some degree.

The cost structure of the innovator (taken to be firm 1) stays the same in both the short run and the long run —

$$C_1 = \begin{cases} I, & q_1 = 0 \\ I + mq_1, & q_1 > 0 \end{cases} \tag{1}$$

I : investment in R&D (sunk cost)
m : marginal cost (some positive constant)
q_1 : quantity produced by the innovator

The cost structure of the imitator (taken as firm 2) changes when we move from the short run to the long run in the following manner —

Imitator's short run cost:

$$C_2 = \begin{cases} 0, & q_2 = 0 \\ mq_2, & q_2 > 0 \end{cases} \tag{2}$$

Imitator's long run cost:

$$C_2 = \begin{cases} F\gamma \,, q_2 = 0 \\ F\gamma + mq_2, \, q_2 > 0 \end{cases} \quad ; \gamma \in [0,1], F\gamma < I \qquad (3)$$

F: linear cost multiplier (some positive constant)
γ: coefficient of imitation
q_2: quantity produced by the imitator
$F\gamma$: linear cost of imitation

2.1.1. Coefficient of Imitation (γ)

The coefficient of imitation reflects the degree of imitation by firm 2, where $\gamma = 0$ signifies that firm 2 does not imitate the product of firm 1 at all and $\gamma = 1$ analogously refers to the situation when firm 2 fully imitates firm 1's product. When the coefficient of imitation lies between 0 and 1 i.e. $\gamma \in (0,1)$, then firm 2 copies some of the attributes of firm 1's product while maintaining some differentiation of its own. Imitation also involves an additional cost given by $F\gamma$, where F is the linear cost multiplier. When $\gamma = 0$, there is no cost of imitation, when $\gamma = 1$, the cost of imitation becomes equal to F.

2.1.2. Demand Equations

$$q_1 = \frac{A}{2} - \frac{(p_1 - p_2)b}{(1-\gamma)} + c(1-\gamma)I \qquad (4)$$

$$q_2 = \frac{A}{2} + \frac{(p_1 - p_2)b}{(1-\gamma)} - c(1-\gamma)I \qquad (5)$$

A: total market size
p_1: price of firm 1
p_2: price of firm 2
$\frac{b}{(1-\gamma)}$: responsiveness of the quantity demanded to the price differential i.e. $(p_1 - p_2)$
$c(1-\gamma)$: responsiveness of the quantity demanded to the investment expenditure i.e. I

The demand curves are taken such that whatever prices and the other parameters may be, the total market size remains equal to A. This means that in theory, both the firms can get infinite profits if they maintain an adequate price differential while subsequently increasing the absolute value of the prices as much as they wish i.e. we take the market to be perfectly inelastic in prices. However, in reality, the market would not be perfectly inelastic and the firms would have to charge accordingly. The reason for the same is that firstly, we assume that the firms cannot collude, their own price is constrained by what is charged by the other firm and secondly, we want to analyse the impact of innovation and imitation decisions by the firms and not the price decisions which have already been extensively modelled before.

The idea behind the coefficient of imitation appearing in the demand curves is analogous to theory, so an innovation in a product should impact consumer choices and thus the demand curve in the same way that an innovation in process impacts the cost of production and subsequently the supply curve (Rosenberg 1986). How the coefficient of imitation in the equations taken here affects demand can be appreciated when we try and understand what the demand curves will look like under different situations. Suppose, both the firms have the same product and the consumers cannot differentiate between them then γ will be equal to 1 and the coefficients of the demand curves will be transformed such that if any firm charges a higher price than the other, it loses all its market share and the other firm captures the entire market. The only way both firms get any market share is if both the firms charge the same price and their market share will be given by $\frac{A}{2}$ each. This situation is summarised below along the lines of the general Bertrand duopoly result with highly substitutable products (Bertrand, 1883).

$$q_i = \begin{cases} A & , p_i < p_j \\ 0 & , p_i > p_j \\ \dfrac{A}{2} & , p_i = p_j \end{cases}$$

Subsequently, if γ falls from 1 both the coefficients will be finite and there will be some scope of price differences between the 2 firms at profit-maximising equilibrium.

2.2. Short Run Analysis

2.2.1. Before Innovation
Before either firm takes on any type of innovative activity both the firms virtually sell the same product. Since $I = 0$, both the firms only incur marginal cost of production which in turn depends on the quantity that they produce. Since there is no innovation and hence no product differentiation the coefficients will be such that they cannot sell at a price different to the other, simple Bertrand competition implies that the price of each firm will be driven down to their marginal costs which are taken as 'm' in our model. Subsequently, each firm will earn zero profit in the equilibrium. This entire situation can be summarised as below:

$$p_1^* = p_2^* = m \; ; \; I = 0 \; ; \; q_1^* = q_2^* = \frac{A}{2} \; ; \; \pi_1^* = \pi_2^* = 0$$

2.2.2. After Innovation
If firm 1 decides to innovate in the short run, given the assumption that in the short run firm 2 cannot imitate firm 1's product, the coefficient of imitation will be equal

to zero i.e. $\gamma = 0$. This will lead to the following short run demand curves:

$$q_1 = \frac{A}{2} - (p_1 - p_2)b + cI \tag{6}$$

$$q_2 = \frac{A}{2} + (p_1 - p_2)b - cI \tag{7}$$

The cost structure in the short run is given by (1) for firm 1 and (2) for firm 2. Subsequently, by finding out the Nash equilibrium in price competition (algebra involved in solving for equilibrium is left for Appendix 1), the prices for each firm and the price differential are found as:

$$p_1^* = \frac{6mb + 3A + 2cI}{6b} \tag{8}$$

$$p_2^* = \frac{6mb + 3A - 2cI}{6b} \tag{9}$$

$$p_1^* - p_2^* = \frac{2cI}{3b} \tag{10}$$

The subsequent equilibrium profits are:

$$\pi_1^* = \frac{4c^2I^2 + 12cAI - 36bI + 9A^2}{36b} \tag{11}$$

$$\pi_2^* = \frac{-20c^2I^2 + 24AcI + 72cbIm + 9A^2}{36b} \tag{12}$$

2.3. Long Run Analysis
In the long run, firm 2 is assumed to have the ability to carry out some degree of imitation. The long run analysis is done through a two-stage decision-making process. In the first stage, firm 2 will decide on the degree of imitation i.e. γ and the second stage will involve a price competition between the firms. The analysis is done through backward induction where the Bertrand equilibrium prices (the second stage) are found first and then we look at how firm 2 decides on a coefficient of imitation that will allow it to maximise profit found in the second stage. The demand curves in this situation are given by (4) and (5) and the cost functions by (1) and (3). The Bertrand equilibrium prices will come out to be —

$$p_1^* = \frac{6mb + 3A(1-\gamma) + 2cI(1-\gamma)^2}{6b} \tag{13}$$

$$p_2^* = \frac{6mb + 3A(1-\gamma) - 2cI(1-\gamma)^2}{6b} \tag{14}$$

and the subsequent equilibrium profits are:

$$\pi_1^* = \frac{4c^2I^2(1-\gamma)^3 + 12cAcI(1-\gamma)^2 + 9A^2(1-\gamma) - 36bI}{36b} \tag{15}$$

$$\pi_2^* = \frac{-20c^2I^2(1-\gamma)^3 + 24AcI(1-\gamma)^2 + 72cbIm(1-\gamma) + 9A^2(1-\gamma)}{36b} - F\gamma \tag{16}$$

where $\gamma \in (0,1)$. At $\gamma = 0$, profits are same as equations (11) & (12) and at $\gamma = 1$, innovator profit is zero and imitator's is $-F\gamma$, as it is similar to the Bertrand competition when there is no differentiation in the product. The discussion on how an optimum degree of imitation is chosen by the imitator is carried out in section 3.2.

3. INTERPRETATIONS

3.1. Short Run
By looking at the short run equilibrium results, we can see that a price differential has emerged. This tells us that the profits of each firm will be at least as much as it was before innovation i.e. 0. To see why this is the case, see that the imitator can take 0 profit if he produces zero output as his cost function remains the same as before, so if the maximum profit he gets by producing a positive output is negative then he can earn a zero profit by not producing anything in the short run. Only if its profit is greater than zero when he produces a positive output will it have an incentive to produce an output greater than zero. If we look at the innovator, since its cost function has changed after incurring the innovation cost I, firm 1 can have a negative profit but since there's perfect information and if the prices are such that the negative profit becomes a reality, he will not undertake investment in the first place.

In the short run, innovation by one firm has a positive spillover effect for the other, i.e. it benefits not only the innovating firm but also the competing firm.

Equation (10) also makes it clear that firm 1's price is greater than that of firm 2 after innovation. This price differential is also a positive function of c, I and an inverse function of b.

Higher investment and higher investment responsiveness of the market give firm 1 the ability to set a higher mark-up over firm 2's price, while a greater price elasticity of demand diminishes this ability.

3.2. Long Run
The effect of c, b and γ on π_1^* and the effect of γ on π_2^* is formally assessed by utilising the method of partial derivatives in Appendix 2.

If we look at the equilibrium profit of firm 1, the impact of 'b' is unambiguously negative which can be interpreted as the more elastic the demand to the price difference, the less is an incentive to innovate. To see why this is the case, say, all the other parameters are constant then the positive effect of innovation on the ability to charge a higher price than the other is diminished if 'b' is large.

Thus, the lesser the price elasticity of demand in the market, the

greater is the incentive to innovate. The impact of 'c' is positive throughout which means that investment will always have an unambiguously positive impact on the profit.

The linear cost of imitation i.e. $F\gamma$ acts as a deterrent to imitation. Any market where it is easy to imitate without incurring a substantial cost, there will naturally be a higher incentive to imitate and subsequently a lower incentive to innovate. This intuitive result is confirmed by our model in the following manner –

If the linear cost of imitation $F\gamma$ is low, firm 2 can gain a higher profit and has an incentive to imitate to a higher degree. A high γ, in turn, lowers the profit of firm 1 leaving it with a lesser incentive to innovate.

There are both positive and negative impacts of imitation on firm 2's equilibrium profit –

As firm 2 imitates more and makes its product increasingly similar to that of firm 1, it consequentially gains a higher market share by siphoning away some of the customers from firm 1. However, by carrying out this imitation firm 2 also incurs a higher cost i.e. a higher linear cost of imitation, $F\gamma$.

At the same time, firm 2 loses some of its independent price-setting ability as the products being sold by both firms become increasingly similar and price becomes an important determinant of consumer choice between these now similar products or in other words, price competition intensifies.

Given the long run second stage Nash equilibrium results, utilising backward induction firm 2 essentially solves the following maximisation problem –

$$\underset{\gamma \in [0,1]}{Max} \pi_2^* = \frac{-20c^2I^2(1-\gamma)^3 + 24AcI(1-\gamma)^2 + 72cbIm(1-\gamma) + 9A^2(1-\gamma)}{36b} - F\gamma$$

Firm 2 chooses γ to maximise his second stage optimal profit at each level of γ. To see how this is done we must appreciate that at $\gamma = 0$, the profit is positive as discussed above and at $\gamma = 1$, it is negative. So, it must go up as well as down in the interval [0,1]. Say it only goes down then it chooses to not imitate at all, i.e. $\gamma = 0$. It cannot only go up since it ends up below where it started. So, the only possible options are $\gamma \in [0,1)$ for the choice of the optimal. We look at one such scenario in Figure 1 where the maximum profit goes up and then down and the optimal maximum profit is achieved at γ^*.

The long run price differential comes out to be -

$$p_1^* - p_2^* = \frac{4cI(1-\gamma)^2}{6b} \qquad (17)$$

Equation (17) signifies that in the long run, the price of firm 1 can be greater than or equal to that of firm 2. If

Figure 1: Sub-game perfect equilibrium profit of firm 2 (a possible illustration)
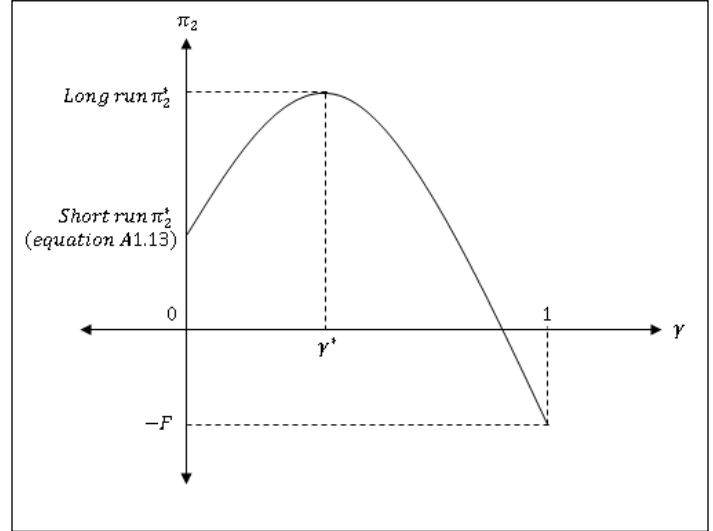
$\gamma = 1$ i.e. firm 2 fully imitates firm 1, then the price differential disappears and the model reverts to the Bertrand Competition result with homogenous goods with prices driven down to the marginal cost i.e. $p_1^* = p_2^* = m$. However, this case can be ruled out since firm 2 is utilising backward induction to obtain a global maximum point $\gamma^* \in [0,1)$ shown in Figure 1.

The long run price differential shows that an increasing level of imitation corresponds to lesser and lesser control over prices for both the firms.

This explains the result in Appendix 2, equation (A2.3) –

A higher γ corresponds to lesser price control for firm 1 and thus a lesser incentive to innovate or in simple words, a higher expected level of imitation reduces the incentive to innovate for firm 1.

4. POLICY IMPLICATIONS

This section deals with the question of an 'optimal' policy from the point of view of a benevolent policymaker trying to maximise social welfare. It is important to note that any analysis of policy recommendations must include perspectives from both the consumption and the production side. This paper has so far only discussed the production perspective so as to arrive at a result of optimal profitability for the existing firms in the market. We continue to look at what leads to an 'optimal' policy by focusing majorly on the producers' side of the market while providing only a brief explanation of what might occur from the consumers' perspective as well. The discussion in this section remains preliminary in the sense that a rigorous analysis from the consumers' point of view might lead to results that contradict the policy recommendations on the basis of only a brief look at the consumers' side.

The policymaker's objective of maximising social welfare might translate into the promotion of innovation or encouraging more competition in the market. It is often argued that some protection must be given to the innovator at the expense of perfect competition to promote the advancement of innovative activity. We consider both of these objectives. As we have seen, there is a positive spillover effect in the model persistent both in the short and long run. This means that given 'commodity', i.e., innovation will be under-produced since firm 1 cannot internalise this positive externality.

4.1. Patent Policy

A patent policy will provide well-defined property rights of the innovation (intellectual property rights) to the innovator, such that he can trade such rights with the other firms who wish to purchase that product technology. The innovator will subsequently internalise this profit as the sale price will be in equilibrium such that it is Pareto efficient (Coase, 1960).

With reference to Figure 2 which looks at a hypothetical Edgeworth box illustration, if we assume Cobb-Douglas utility function for both the firms, we get well-shaped utility level curves as shown in the diagram. The preference direction of firm 1's indifference curves should be clear from the result in Appendix 2 equation A2.3. The preference direction for firm 2 can be directly seen in Figure 1. As γ increases, π_2 increases as well but π_2 reaches a maxima at $\gamma = \gamma^*$ after which an increase in γ leads to a fall in π_2, this means that there will be a bliss point for firm 2 at γ^* and correspondingly the highest possible IC given IC_2^* in Figure 2 beyond which 'intellectual property rights' essentially become a 'bad' commodity for firm 2. If well-defined intellectual property rights are given to firm 1, then the initial point where both firms operate is at ω, where the coefficient of imitation is zero i.e. firm 2 cannot legally imitate firm 1's product. Firm 1 might decide to stay at ω or it can trade its intellectual property rights by allowing firm 2 to imitate its product to a certain degree in return for compensation in terms of money, once again leading to internalisation of the positive spillover effect of innovation.

The enforcement of such a patent policy would imply that firm 1 will remain as the sole producer/seller of its innovated product in the market. A situation such as this would generally lead to the establishment of a monopoly and a corresponding loss of the entire consumer surplus due to monopoly pricing. However, given the assumption of horizontal differentiation in this model, consumers do not objectively prefer one good over the other, i.e., the innovated product of firm 1 is not preferred universally over firm 2's product by the consumers. Thus, firm 2 will still retain market share rather than being completely

***Figure 2**: Edgeworth box illustration of a patent policy*
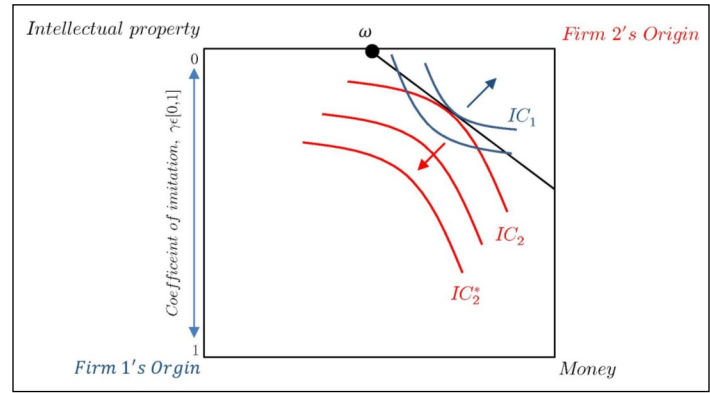
driven out of the market. Since γ is no longer a variable that can be chosen freely by firm 2, it is clear that price competition under this policy framework will be softer than what would be the case if γ could have been chosen freely, this meaning that prices can be reasonably expected to remain higher than what would prevail in a more intense price competition scenario. This implies that a corresponding loss in consumer surplus can be expected, although this loss will most certainly be less than what would be the case under a monopoly.

Thus, the policymaker is able to achieve the objective of maximising innovation in the market while at the same time preventing the establishment of firm 1 as a monopolist and the corresponding loss of consumer surplus that a single seller in the market would imply.

4.2. State Restriction On The Coefficient Of Imitation (γ)

Another possible policy could be a restriction on the degree of imitation to a certain degree say, 0.6 after which the imitator cannot imitate legally. Under such a policy there will be no exchange of money between the firms which means that the profits will not be internalised by firm 1. The second issue is that it is inherently subjective to decide on the legal limit of the degree of imitation. With reference to Figure 3, if the policymaker manages to choose the legal limit of γ at γ^*, then firm 2 will optimally decide to remain at this point. However, since firm 1 receives no compensation for this imitation, it cannot internalise the positive spillover effect and one can imagine firm 1's indifference curve to cross firm 2's indifference curve at this point. Similarly, for any arbitrary $\gamma < \gamma^*$ since firm 2's profit will be at the increasing portion of its profit curve in Figure 1, firm 2 will decide to operate at any such arbitrary point. However, once again firm 1 receives no compensation and its indifference curve crosses that of firm 2 at this point. For any arbitrary $\gamma > \gamma^*$, γ becomes a 'bad' for firm 2 and it will never operate at any such point.

Thus, given that firm 1 receives no compensation for giving up the subjectively set level of γ by the policymaker, any choice of γ by the policymaker will lead to a less than optimal 'production' of innovation due to the inability of firm 1 in internalising the marginal external benefit.

Figure 3: *Imitation restriction policy*
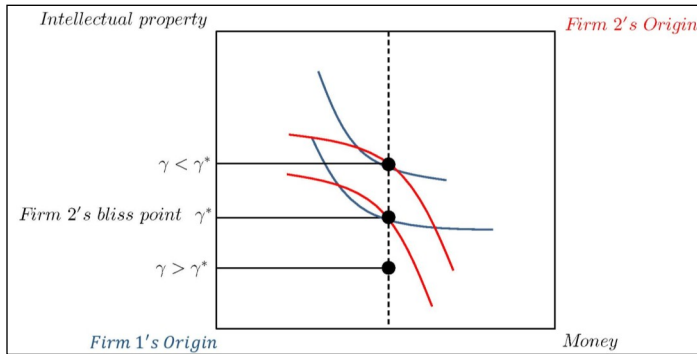
A possible remedy in this policy framework could be that of a subsidy (or a tax cut which will have the same effect) to firm 1 for giving up the level of γ set by the policymaker, this would achieve the twin goal of maximising innovation and fostering more competition in the market. Such a policy, however, has its own problems —

1. The state will need to carry out a cost-benefit analysis before handing out subsidies, i.e., the state will need to accurately measure the externality created by the act of innovation by firm 1 so as to subsidise firm 1 accordingly. Since measuring externalities is virtually impossible, the choice of the subsidy amount will become random. Thus, in trying to solve the underproduction of innovation, the state might very well end up incurring a transfer expenditure from its budget without actually solving the problem of underproduction of innovation.

2. When analysing any policy which essentially 'rewards' an organisation (or firm 1, in our model), one must keep in mind the issue of vested political interests. Given that political interests are not an absent phenomenon in any political system around the world, such a policy might be used inappropriately in order to benefit those who the politicians favour.

Therefore, the model suggests that a patent policy aimed at promoting more innovation in the market will lead to a pareto optimal outcome and the socially optimal level of production of innovation. However, a policy that aims to foster competition by legally limiting the degree of imitation will never lead to a pareto optimal outcome and any attempt to mitigate such a policy is very much likely to create its own problems.

5. GENERALISATION TO 'n' FIRMS

In this section, we try to find an intuitive explanation as to what happens if the model is extended say, 'n' number of firms. Firstly, we analyse the situation when there is only one innovator and the rest of the firms are imitators. This analysis can be carried out by taking only one innovator because we want to analyse the effect of a singular innovative activity on all the firms. Different innovation will have analogous effects so taking many innovating firms does not give any additional information.

Assuming all the imitating firms are symmetric such that they have the same linear cost of imitation (F), then our two-firm analysis is extended analogously to the n firm situation without loss of generality.

This happens because the collection of all imitators can be taken as one big imitator as they will choose an equal coefficient of imitation (γ) as well as price, given their symmetric nature. However, if we assume that the linear cost of imitation is different for each imitating firm then this has interesting implications for the price and range of products available in the market. It is intuitively obvious that higher the cost of imitation, the lesser the incentive to imitate and lower the gamma. If we look at how the difference between the prices acts depending upon gamma, then we find that —

More closely a firm imitates the innovator, the lesser is the difference in the price between the two.

If we arrange the firms in increasing order of cost of imitation ($F_1, F_2, \dots, F_{n-1}$), then the firm with the lowest cost of imitation will have the closest product to the innovator and the closest price level. On the other hand, the firms with the highest cost of imitation will be on the other end of the spectrum. Thus, there will be a range of similar products with different price levels in the market that is caused by different imitation costs. Given the various restrictions of the above model, we were only able to provide an intuitive explanation for the n firm case. A more comprehensive model for the n firm case may provide much better insight into this area.

6. CONCLUSION

Our model gives some real insight despite being quite simplistic. We have seen that it is possible that innovation undertaken by one firm can have a positive spillover effect for the other firm as well as gaining from the investment itself. Our model also outlines the basis on which decisions such as how much to invest and how much to imitate are undertaken in the market and how these decisions are dependent upon the various characteristics of the market. Thus, an industry which is less elastic, say, a market where the products are inherently very expensive, i.e. a market for a luxury good or the market for a neces-

sary good, the incentive to innovate is higher, this is captured by the variable 'b', this is because it offers the opportunity to charge a higher price for your innovated product without much loss of market share. Also, some of the markets are more responsive to new products or a new variety of products that it gives a higher incentive to innovate, this is captured by the parameter 'c' in our model. If we take the case of basic agricultural products, the lack of much profitability with larger investment i.e.

'c', may have characterised the lack of much innovation. Finally, the cost of imitation plays an important role in determining the decisions so a market where imitation is relatively cheap often the markets where innovation is less. This can also be extended to markets where protection is less. This is why markets such as the market of pharmaceuticals, where copying is relatively costless but involves a high fixed cost in innovation, is often one of the most protected markets in the world.

MATHEMATICAL APPENDICES

APPENDIX 1:

The base demand curves for the innovator (firm 1) and the imitator (firm 2) are as follows:

$$q_1 = \frac{A}{2} - \frac{(p_1 - p_2)b}{(1-\gamma)} + c(1-\gamma)I \tag{A1.1}$$

$$q_2 = \frac{A}{2} + \frac{(p_1 - p_2)b}{(1-\gamma)} - c(1-\gamma)I \tag{A1.2}$$

The corresponding cost structures for the firms are given by:

1. Short run costs

$$C_1 = \begin{cases} I, q_1 = 0 \\ I + mq_1, \ q_1 > 0 \end{cases} \tag{A1.3}$$

$$C_2 = \begin{cases} 0, q_2 = 0 \\ mq_2, \ q_2 > 0 \end{cases} \tag{A1.4}$$

2. Long run costs

$$C_1 = \begin{cases} I, q_1 = 0 \\ I + mq_1, \ q_1 > 0 \end{cases} \tag{A1.3}$$

$$C_2 = \begin{cases} F\gamma, q_2 = 0 \\ F\gamma + mq_2, \ q_2 > 0 \end{cases} \quad ; \gamma \in [0,1] \tag{A1.5}$$

Short run equilibrium:

Taking $\gamma = 0$ in equations (A1.1) and (A1.2) and given the short run cost structure equations (A1.3) and (A1.4), the profit functions for both the firms are given by:

$$\pi_1(p_1, p_2) = p_1 \left(\frac{A}{2} - (p_1 - p_2)b + cI \right) - I - m \left(\frac{A}{2} - (p_1 - p_2)b + cI \right) \tag{A1.6}$$

$$\pi_2(p_1, p_2) = p_2 \left(\frac{A}{2} + (p_1 - p_2)b - cI \right) - m \left(\frac{A}{2} + (p_1 - p_2)b - cI \right) \tag{A1.7}$$

Differentiating equation (A1.6) and (A1.7) w.r.t. p_1 and p_2 respectively and setting the derivatives equal to zero gives us the Bertrand reaction functions:

$$p_1 = \frac{A}{4b} + \frac{p_2}{2} + \frac{cI}{2b} + \frac{m}{2} \tag{A1.8}$$

$$p_2 = \frac{A}{4b} + \frac{p_1}{2} - \frac{cI}{2b} + \frac{m}{2} \qquad (A1.9)$$

Substituting equation (A1.9) in equation (A1.8) gives us the Bertrand equilibrium price of firm 1 (p_1^*), which is then substituted back in equation (A1.9) to arrive at the Bertrand equilibrium price of firm 2 (p_2^*). The final equilibrium prices and profits are found as:

$$p_1^* = \frac{6mb + 3A + 2cI}{6b} \qquad (A1.10)$$

$$p_2^* = \frac{6mb + 3A - 2cI}{6b} \qquad (A1.11)$$

Putting the equilibrium prices (A1.10) and (A1.11) in (A1.6) and (A1.7) gives us the equilibrium profits —

$$\pi_1^* = \frac{4c^2I^2 + 12cAI - 36bI + 9A^2}{36b} \qquad (A1.12)$$

$$\pi_2^* = \frac{-20c^2I^2 + 24AcI + 72cbIm + 9A^2}{36b} \qquad (A1.13)$$

Long run equilibrium:

Using the same procedure as carried out above, using the long run cost structure given by equations (A1.3) and (A1.5) and the demand curves (A1.1) and (A1.2) the long run Bertrand equilibrium prices and profits are found as —

$$p_1^* = \frac{6mb + 3A(1-\gamma) + 2cI(1-\gamma)^2}{6b} \qquad (A1.14)$$

$$p_2^* = \frac{6mb + 3A(1-\gamma) - 2cI(1-\gamma)^2}{6b} \qquad (A1.15)$$

$$\pi_1^* = \frac{4c^2I^2(1-\gamma)^3 + 12cAcI(1-\gamma)^2 + 9A^2(1-\gamma) - 36bI}{36b} \qquad (A1.16)$$

$$\pi_2^* = \frac{-20c^2I^2(1-\gamma)^3 + 24AcI(1-\gamma)^2 + 72cbIm(1-\gamma) + 9A^2(1-\gamma)}{36b} - F\gamma \qquad (A1.17)$$

APPENDIX 2:

Partial derivative of (A1.16) w.r.t. c gives us:

$$\frac{\partial \pi_1^*}{\partial c} = \frac{I(1-\gamma)^2\,[3A + 2cI(1-\gamma)]}{25b} \quad > 0 \qquad (A2.1)$$

Since $\gamma \in [0,1] \to (1-\gamma) \in [0,1]$, and parameters c, I, b and A are all assumed to be positive, both the numerator and the denominator will be positive. Thus, (A2.1) will come out to be positive.

Hence, the effect of an increase in c on equilibrium profit of firm 1 is unambiguously positive.

Partial derivative of (A1.16) w.r.t. b gives us:

$$\frac{\partial \pi_1^*}{\partial b} = \frac{-4c^2I^2(1-\gamma)^3 - 12AcI(1-\gamma)^2 - 9A^2(1-\gamma)}{36b^2} \quad < 0 \qquad (A2.2)$$

Since $\gamma \in [0,1] \to (1-\gamma) \in [0,1]$, and parameters c, I, b and A are all assumed to be positive, the numerator will come out to be negative and the denominator will be positive. Thus, (A2.2) will come out to be negative.

Hence, the effect of an increase in b on equilibrium profit of firm 1 is unambiguously negative.

Partial derivative of (A1.16) w.r.t. γ gives us:

$$\frac{\partial \pi_1^*}{\partial \gamma} = \frac{-4c^2I^2(1-\gamma)^2 - 8AcI(1-\gamma) - 3A^2}{12b} \quad < 0 \tag{A2.3}$$

Since $\gamma \in [0,1] \rightarrow (1-\gamma) \in [0,1]$, and parameters c, I, b and A are all assumed to be positive, the numerator will be negative while the denominator will be positive. Thus, (A2.3) will come out to be negative.

Hence, the effect of an increase in γ on equilibrium profit of firm 1 is unambiguously negative.

Partial derivative of (A1.17) w.r.t. γ gives us:

$$\frac{\partial \pi_2^*}{\partial \gamma} = \frac{20c^2I^2(1-\gamma)}{12b} - \left[\frac{16AcI(1-\gamma) + 24cbIm + 3A^2}{12b} + F \right] \tag{A2.4}$$

Since $\gamma \in [0,1] \rightarrow (1-\gamma) \in [0,1]$, and parameters c, I, b, m and A are all assumed to be positive, the denominator will be positive while the sign of the numerator is dependent on the values that the various parameters take. Thus, (A2.4) will come out to be either positive or negative.

Hence, the effect of an increase in γ on equilibrium profit of firm 2 is ambiguous and depends on the values of the various parameters.

REFERENCES

1. Bertrand, J. (1883) "Book review of theorie mathematique de la richesse sociale and of recherches sur les principles mathematiques de la theorie des richesses", Journal de Savants 67: 499–508

2. Coase, R.H. (1960) The Problem of Social Cost. In: Gopalakrishnan C. (eds) Classic Papers in Natural Resource Economics. Palgrave Macmillan, London, pp 87-137

3. Cournot, A. A. (1838) Recherches sur les Principes Mathématiques de la Théorie des Richesses

4. Edgeworth, Francis Ysidro, (1881), Mathematical Psychics, McMaster University Archive for the History of Economic Thought. https://EconPapers.repec.org/RePEc:hay:hetboo:edgeworth1881.

5. Hotelling, H. (1990) Stability in Competition. In: Darnell A.C. (eds) The Collected Economics Articles of Harold Hotelling. Pp 50-63 Springer, New York, NY

6. Krugman, P.R., Obstfeld M., Melitz M., (2015) Chapter8, International Economics: Theory and Policy. Pearson 10th Edition 2015 Global Edition

7. Osborne, M. J. (2004), An Introduction to Game Theory. Oxford University Press

8. Romer, Paul M. (1986) "Increasing Returns and Long-Run Growth," Journal of Political Economy 94, no. 5: 1002-1037.

9. Rosenberg N., Landau R., (1986) The Positive Sum Strategy: Harnessing Technology for Economic Growth. National Research Council, Washington, DC: The National Academies Press. https://doi.org/10.17226/612. Pp 307-325

10. Salop S., Stiglitz J. (1977) "Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion," The Review of Economic Studies, Vol. 44, No. 3 (Oct., 1977), pp. 493–510

AN EVALUATION OF THE PERFORMANCE OF ATAL PENSION YOJANA (APY) IN THE UNORGANISED SECTOR

DIVYA GARG*, BHAVYA HASIJA and BHAVYA SACHDEV

Ramjas College, University of Delhi

Abstract

The study finds that existing channels of the banking industry are very well utilized but due to a lack of attractive features, Atal Pension Yojana is still not accepted by a larger public. There is a requirement of essential changes in the basic features related to the amount of pension, tax exemption and claim settlement. Atal Pension Yojana is still a favourable investment for those who are willing to contribute small but for a longer duration for their pension funds. It is considered a landmark move by the Government of India towards a pensioned society from a pension less society. The Union government is eager to ensure financial security for unorganised sector workers, numbering over 410 million, in their old age. To tackle the prolonged existence risks among the workers in the unorganised sector and to push the workers in the unorganised sector to willingly save for their retirement, Atal Pension Yojana was introduced on 1st June 2015, under the promising Pradhan Mantri Jan Dhan Yojana to provide financial support of pension to all the citizen of India with the motto of "Jan-Dhan Se Jan Suraksha". The study helps us know how many people have enrolled themselves in APY, how they were aware of the scheme and their views regarding the scheme. The study is based on primary data collected through surveys in the areas of North Delhi.

Keywords: Atal Pension Yojana, unorganised sector, insurance, Pradhan Mantri Jan Dhan Yojana

1. INTRODUCTION

The tradition of the joint family system in India precluded the need for a social security cover for its people. However, with industrialisation and the consequent migration of people from rural to urban areas, the joint family started dissolving and nuclear families evolved. Thus developed the need for a social security cover by the government for its citizens. A large proportion of India still exists without any kind of health, accident or life insurance. To ensure an overarching universal social security system which will guarantee that no Indian citizen will have to worry about illness, accidents or pension in old-age, the government introduced the Atal Pension Yojana, a pension scheme especially crafted for the benefit of the unorganised sector workers who are otherwise not generally protected under any statutory social security scheme.

India is a developing country. It has a low standard of living. A person's productivity at a young age is not the same as their productivity in old age. Due to the rise of nuclear families and the migration of young earning members, old people are left alone to fend for themselves. Also, a rise in the cost of the living has added to the woes of the common man.

The Social Sector Schemes of Pension Sector gives an assured monthly income. The unorganised sector constitutes more than 88% of the total labour force. To encourage the workers in the unorganised sector to voluntarily save for their retirement, the Government had started a guaranteed pension scheme - Atal Pension Yojana (APY).

*Corresponding author's email address: gargdivya245@gmail.com

The APY was introduced on 1st June 2015, formally launched by Prime Minister Narendra Modi. This scheme aims to increase the number of people covered under the pension scheme and ensures that the unorganised sector gets pension benefits and social security with a minimum contribution per month. It is Regulated by Pension Fund Regulatory Development Authorities (PFRDA), with transparent investment norms. This scheme provides a defined pension, depending on the amount of contribution, age and its period.

The study highlights the performance of Atal Pension Yojana in the unorganised sector. The study tries to find the number of subscribers in the North Delhi region and the factors behind the subscribers' choice of pension amount. The rest of the paper tries to link these factors with economic perspectives.

2. BRIEF ON ATAL PENSION YOJANA

Atal Pension Yojana (APY) is open to all bank account holders who are not members of any statutory social security scheme. The minimum age of joining APY is 18 years and maximum age is 40 years. Therefore, the minimum period of contribution by the subscriber under APY would be 20 years or more. The main focus of the scheme is to target the unorganised sector[1] workers, giving them benefits of a fixed pension ranging between Rs. 1000 to Rs. 5000 per month, if they join and contribute between the age of 18 years and 40 years. The contribution levels would vary and would be low if the subscribers join early and increase if they join late. APY accepts subscription even from those contributing to other private/ government-backed pension schemes. These are guaranteed for spouse/nominee/next of kin as per applicable rules in case of demise of the APY subscriber. Flexibility in the plan is provided as the pension amount can be upgraded or downgraded based on the subscriber's choice with the option to subscribe on a monthly, quarterly or half-yearly basis.

For enrolment and payment purposes, all bank account holders under the eligible category may join APY with auto-debit facility to accounts, leading to a reduction in contribution collection charges. Apart from banks, all Points of Presence (Service Providers) and Aggregators under Swavalamban Scheme would enrol subscribers through architecture of the National Pension System.

It is a Government of India Scheme, which is administered by the Pension Fund Regulatory and Development Authority. The Institutional Architecture of NPS would be utilised to enrol subscribers under APY.

3. LITERATURE REVIEW

The Government of India is extremely concerned about the old-age income security of the working poor. To address the longevity risks among workers in the unorganised sector and to encourage these workers to voluntarily save for their retirement as they do not have any formal pension provision, the government had started the Swavalamban Scheme in 2010-2011.

As of May 2015, only 20% of India's population had enrolled in any kind of pension scheme. Swavalamban Yojana was a government-backed pension scheme targeted at the unorganised sector in India. It applied to all citizens in the unorganised sector who joined the National Pension Scheme (NPS) administered by the Pension Fund Regulatory and Development Authority (PFRDA) Act 2013. Under the scheme, the Government of India contributed Rs. 1,000 per year to each NPS account opened in the year 2010-11 and for the next three years, that is, 2011-12, 2012-13 and 2013-14. However, the coverage under the said scheme was inadequate mainly because of the lack of clarity of pension benefits at the age after 60. The Finance Minister of the present government, therefore, announced a new initiative called APY in the Budget 2015-16. The Atal Pension Yojana has been designed to bring more clarity in the process. The aim of APY is motivated by the desire of the government to ensure that on contributing continuously, a member gets at least a pension of Rs.1000 per month.

Under this scheme, the government also guarantees a fixed pension benefit. Fifty per cent of the subscriber's contribution or Rs. 1000 per annum, whichever is lower, will be contributed by the government to the account of each eligible subscriber for five years (2015-2016 to 2019-2020) who join the NPS before Dec 31, 2015. Also, unless the subscribers of Swavalamban Scheme opt-out, they will be automatically migrated to APY.

Figures in Table 1 indicate the amount of contribution by subscribers of different age groups under the various monthly pension slabs. For instance, a subscriber who enrolled in this scheme at the age of 18 needs to contribute Rs. 42 per month for a monthly pension of Rs. 1000, Rs. 84 for a monthly pension of Rs. 2000 and so on till he reaches the age of 60.

---

[1]*The definition of the term 'unorganised sector' remains ambiguous and suffers from a lack of precision. Here it has been defined under the Unorganised Workers' Social Security Act, 2008, as a self-employed, home-based, hired workers working in the Unorganised Sector.*

Table 1: *Illustration of contribution chart*

AGE OF ENTRY	MONTHLY PENSION OF RS. 1000	MONTHLY PENSION OF RS. 2000	MONTHLY PENSION OF RS. 3000	MONTHLY PENSION OF RS. 4000	MONTHLY PENSION OF RS. 5000
18	42	84	126	168	210
20	50	100	150	198	248
25	76	151	226	301	376
30	116	231	347	462	577
35	181	362	543	762	902
40	291	582	873	1164	1454

Source: National Securities Depository Limited, Ministry of Finance

4. SAMPLE AND SURVEY DESIGN

4.1. Methodology

The study is based on primary research conducted in two areas, North and East Delhi. Under North Delhi, the people were interviewed in localities like Maurice Nagar, GTB Nagar and Timarpur and in East Delhi, people were interviewed in the Nizamuddin Bridge locality. Primary data was collected by interviewing individuals with the help of the questionnaires. Also, the field survey was initially based on a pilot survey which was followed by the main survey. The final questionnaire was prepared after conducting and evaluating the pilot survey which was carried out on a smaller sample size that includes the area such as Roop Nagar, GTB Nagar, Vijay Nagar, Timarpur, Maurice Nagar and so on. These areas were selected because of the assumption that we will be getting mixed participants for our survey. But due to non-availability of the data with them, we shifted to north-east areas.

The main survey was conducted from July to December 2018. The total number of people interviewed was 115. Two different samples were constructed-

1. The people who were not aware of the scheme
2. The people who were aware of the scheme which was sub categorised as
   a. The people who were aware but haven't enrolled in the scheme
   b. The people who were aware as well as have enrolled in the scheme.

4.2. The Field Area: North-East Distinction

The survey included 60 people that were interviewed in North Delhi in different localities (Maurice Nagar, GTB Nagar, Timarpur) and 55 people interviewed in East

Delhi (Nizamuddin Bridge). We selected the area of North Delhi because of the easy availability of workers in the unorganised sector (i.e. rickshaw pullers, street vendors, gardeners, gatekeepers, etc.).

First, we did the primary survey in North Delhi, but due to lack of the desired data as there was no enrolment and awareness about this scheme in those areas, we shifted to purposive sampling in East Delhi. Instead of asking individuals randomly, we arranged a list of the scheme holder where they have enrolled and then interviewed them.

5. FINDINGS AND ANALYSIS

The analysis has been broken down into two parts according to the two different samples that were surveyed. The first sample comprises of the people who were not aware of the scheme and the second sample is of the people who were aware of this scheme.

5.1. Analysis Of Sample 1

Awareness

According to the survey, out of a total of 115 people, 30 people were not aware of this scheme and the remaining 85 people had heard about this scheme. Of the remaining 85 people who were aware of this scheme, 30 people had not enrolled while 55 people had enrolled in this scheme.

*Figure 1*: *Level of awareness and enrolment*
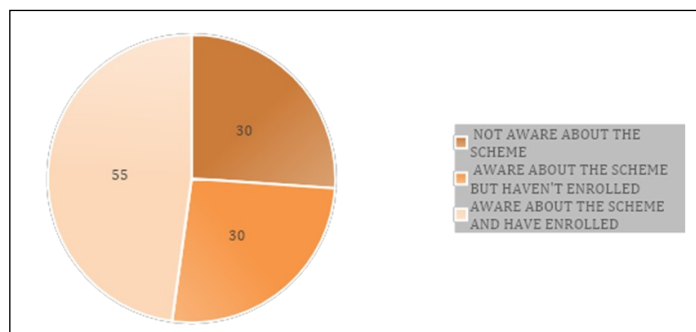
Source: Authors' calculation based on survey data

There was less than 50% enrolment because the people have to contribute for a longer period and a low pension amount is guaranteed in the future, which is why there are fewer people who are availing this scheme.

5.2. Analysis Of Sample 2: Aware And Enrolled In The Scheme

Number Of Working People In The Family

The survey showed that 65% of the people who had enrolled in the scheme have one working member in their family.

*Figure 2*: *Number of working people in the family*
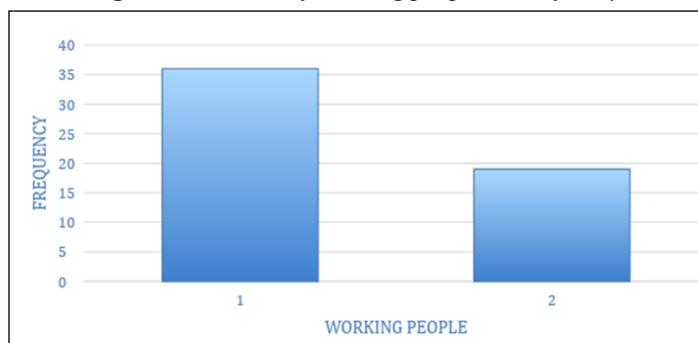
Source: Authors' calculation based on survey data

The high percentage of one working member in the families could be because of the following reasons-

1. Lack of job opportunities in the unorganised sector.

2. A high proportion of females are engaged in house chores rather than working outside. It raises the concern that female participation should be increased by appropriate policy action.

3. According to PFRDA (Pension Fund Regulatory and Development Authority), both males and females enrol in this scheme but on analysis the result is opposite.

Age Of The Enrolled People

The survey shows that among the people who have enrolled in this scheme, the majority of people lie in the age group of 24-29 years, although some outliers belong to the age of 35 years.

Figure 3: *Age of the enrolled people*
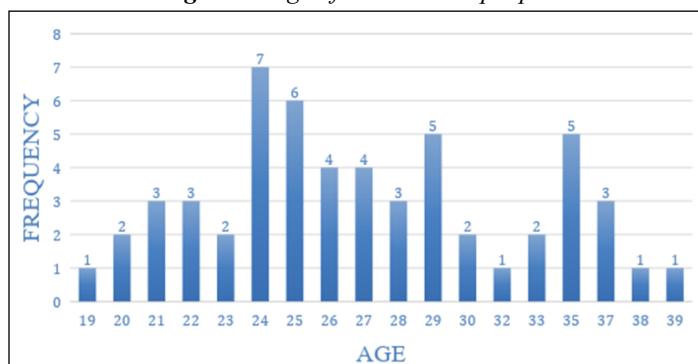
Source: Authors' calculation based on survey data

The major reason turns out to be that the young population is more informed about this scheme and hence has more enrolment. Also, the majority of working members are in families so there exists a positive relationship between age and consumption expenditure, and hence the negative relationship with investment in any scheme.

Family Size Of The Enrolled People

The family size of the people is also an important factor in analysing the enrolment of people in this scheme.

Figure 4: *Family size of the enrolled people*
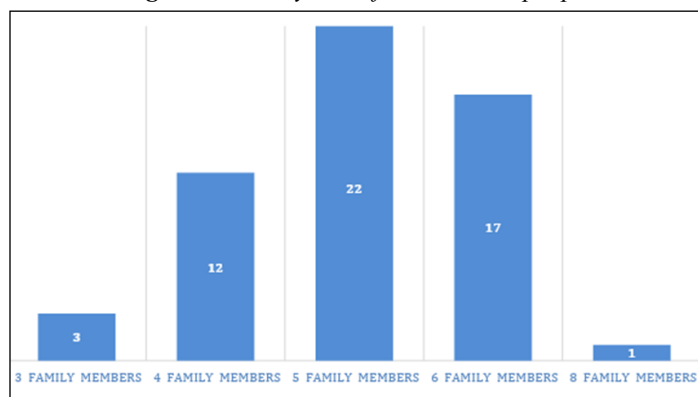
Source: Authors' calculation based on survey data

According to the survey, the majority of the families have 5 members which roughly gives the idea of the structure of the family. It shows there is a negative relationship between the size of the families and people enrolled in the scheme. It is because of the income constraint and lack of employment opportunities.

Literacy Level

Another important factor that shows a relationship with enrolment is the literacy level of the enrolled people. 40% of the people belong to the secondary level of education and the remaining 60% belong to the primary and upper primary level of education.

Figure 5: *Literacy level of the enrolled people*
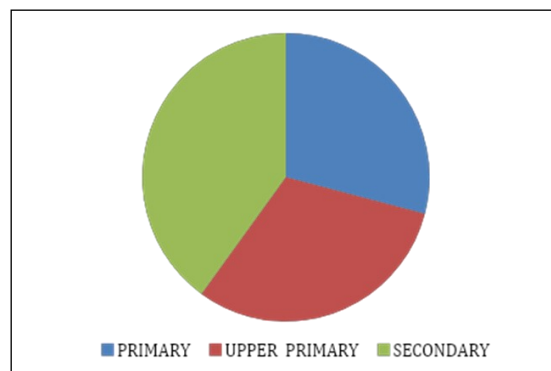
Source: Authors' calculation based on survey data

It shows an uncertain relationship between the literacy level and the people enrolled in this scheme because of the following reasons: -

1. The majority of the people surveyed don't have a high level of literacy because according to them, expenditure on education is a wastage of money.

2. Since they need a working hand, they took out their children from the educational institutions once they are matured enough to contribute to earnings of the family.

3. Also, the majority of the people surveyed have not

completed the classes they were enrolled in.

Wages

Wages are one of the important factors which categorise subscribers enrolled in this scheme into different slabs. Since people who belong to the unorganised sector have limited wages, they have to consider various factors before enrolling in any scheme.

*Figure 6: Wages per month of the enrolled*
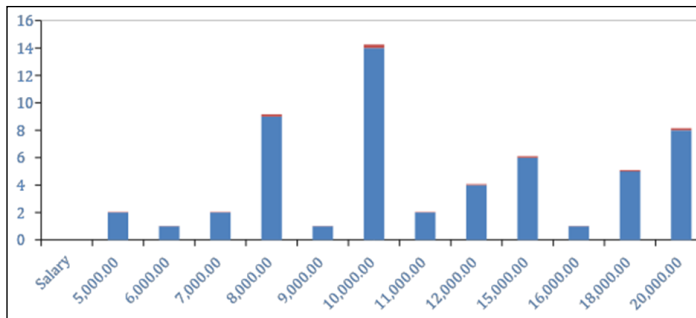
Source: Authors' calculation based on survey data

According to the survey, wages of the people who have enrolled in the scheme vary between Rs. 5,000 to Rs. 20,000 per month. The highest percentage of wages among people is Rs. 10,000 per month. This means that wages are another constraint. If wages increase, people would like to get enrolled in the scheme keeping other factors constant.

Pension Slabs

Atal Pension Yojana or APY guaranteed pension scheme from government. Under it, subscribers get pension ranging from Rs.1000 to Rs.5000 per month.

Figure 7: Pension slabs
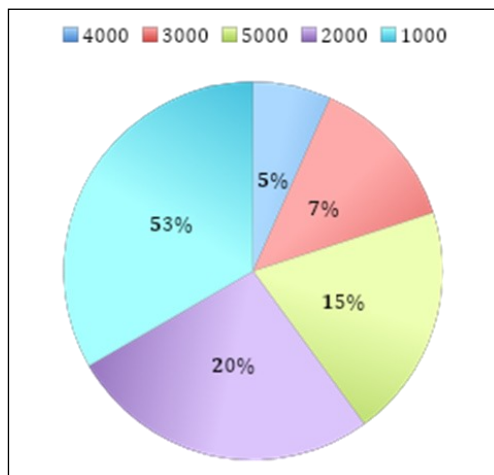
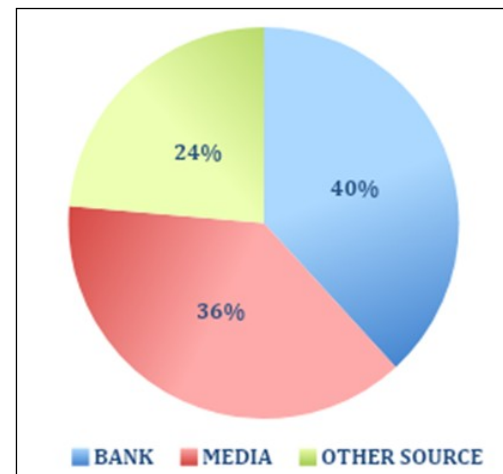*Source: Authors' calculation based on survey data*

Different pension slabs involve different amount to be contributed for the scheme. Say, if you are 18 years old and you choose the slab of Rs. 1000 then you have to contribute Rs 42 per month and similarly different amounts for the other slabs.

In our survey, we found most people get enrolled themselves in the Rs 1000 scheme. The reason for choosing the slab of least amount can be their wages, family size, etc. Therefore, as the slab increases the number of people enrolled decreases.

Source Of Information

Individuals can get to know about a scheme through various ways like media, bank, relatives, newspaper, radio, friends etc.

Figure 8: Sources of information

Source: Authors' calculation based on survey data

The various means of communication played an important role in spreading information about the scheme APY. Results from the survey conducted by us tell that media (eg: TV, Newspaper, radio etc.) are the main factor through which people got to know about this scheme.

Reasons To Avail

There were a total of 55 people who availed in this scheme out of the 115 being surveyed.

Figure 9: Reasons to avail
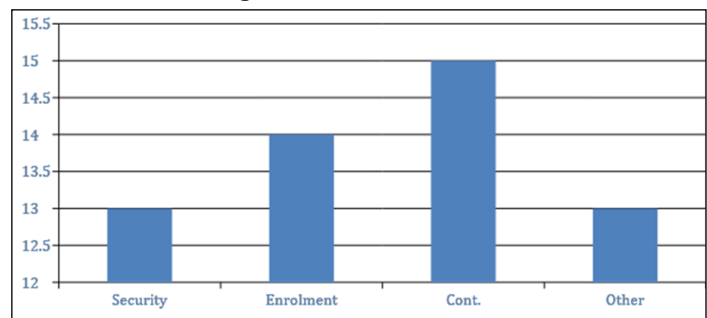
Source: Authors' calculation based on survey data

People have different reasons for availing in the scheme. Prospectives of individuals vary according to their expectations from the scheme.

About 13 people enrolled due to the security amount they can get in retirement, 14 people enrolled because of the simple enrolment process, 15 people due to the small

amount they need to pay for getting security in retirement and the remaining due to other reasons.

Hence, we got to know that people are more attracted to the less amount one needs to contribute to this scheme.

Awareness About Scheme Before Enrolment

According to the survey, 75% of the people knew about the scheme before enrolment and hence they took the decision rationally and the remaining 25% knew nothing about the scheme and hence joined this scheme under the influence of their colleague, friends or relatives.
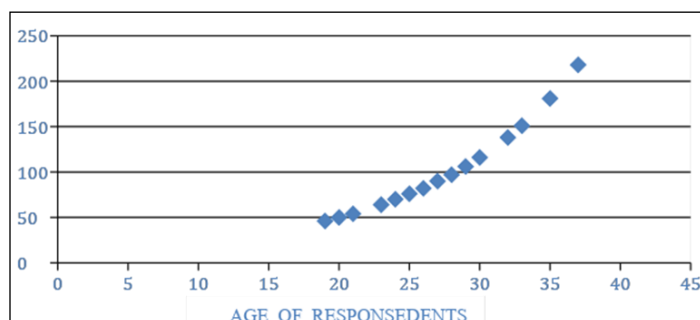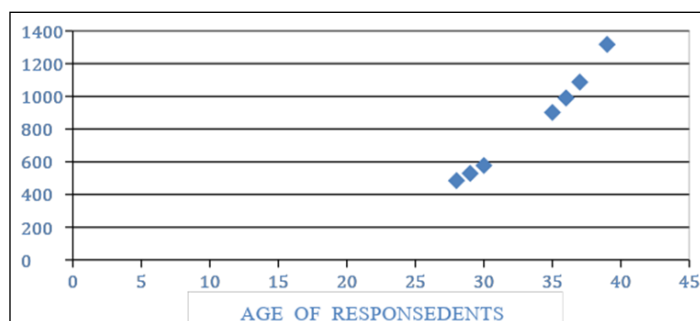
Figure 10: Awareness about scheme before enrolment
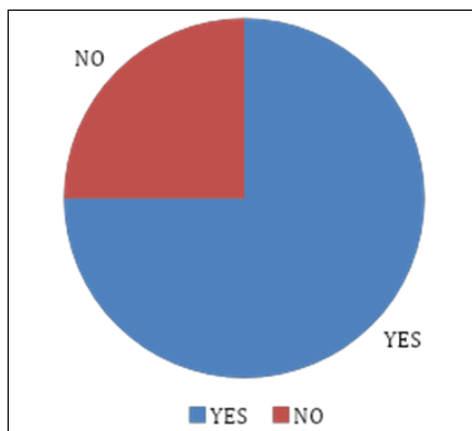
Source: Authors' calculation based on survey data

Relationship Between Contribution Amount And Age Of The Scheme Holder

Figure 11: Monthly contribution for the pension amount of Rs.1000

Figure 12: Monthly contribution for the pension amount of Rs.5000

Source: Authors' calculation based on survey data

According to the Subscriber's Contribution Chart, there is a positive relationship between the age of the subscriber and the monthly contribution irrespective of the future guaranteed pension amount.

Through the survey, we also found out that as the age of the respondent increases, the monthly contribution also increases irrespective of the future guaranteed pension amount (i.e., Rs. 1000, Rs. 2000, Rs. 3000, Rs. 4000 & Rs. 5000)

6. CONCLUSION

Our findings depict that the Atal Pension Yojana has not been a great success in Delhi and has not been able to meet their aims to a large extent. The Government has tried to adopt a persuasive approach for this scheme to get as many registrations as possible. Some of the methods are – very low penalties on default, low monthly contributions, a very easy procedure for registration and exit. Nevertheless, the results are not as expected. The reasons that we can see from our survey behind it not being a success are that, firstly, the defined pension does not guarantee a decent standard of living to the scheme holder. The scheme is less beneficial to the people who join at a younger age. It can be seen from the data collected that the subscriber should be at least in his 30s to ensure a social security cover for him. The policymakers should redesign the existing plan so that the bandwidth of the age group is increased from 18-40 to 30-50 to serve the objective of ensuring social security.

Secondly, it can be seen that a mere amount of Rs. 1000 per month does not serve the purpose of ensuring a minimum standard of living. A person joining the slab of Rs. 1000 monthly pension plan is ensured 15% of his monthly expenditure at the age of 60 years. Thus, restructuring of the scheme is required. Contextualising the scenario following the Keynesian model, the lower the interest rate or lower the benefit given to the subscribers more will be the tendency to hold the money with them and not invest it in the above scheme. Therefore, the speculative demand for money would rise, thereby putting more money in the hands of people. Thus arises the need for inflation indexation so that the benefits can keep pace with inflation. If both the subscriber and government contributions are indexed annually, it can provide the subscriber with higher returns. The NPS-Main scheme follows a lifecycle investment mix which can be adopted by the current APY scheme.

Also, there is a need to remove the gender disparity that exists among the holders of this scheme as the majority of the scheme holders are men. More women are to be involved. In India, particularly in the unorganised sector,

women are housewives and they generally do not have any fixed income. Their life-span is greater than the men, which becomes a cause for gender discrimination. Such discrimination against women needs to be diminished and female participation should be increased. Moreover, the Finance Ministry is considering a proposal to relax the maximum monthly pension paid under the Atal Pension Yojana (APY) to Rs 10,000 and raise the maximum age limit for enrolling in the scheme to 50 years. The PFRDA proposed merging the pension schemes available separately for farmers and shopkeepers with APY to avoid confusion.

ACKNOWLEDGEMENTS

REFERENCES

1. Basu, Debashis. 2015. "Why Atal Pension Yojana may struggle". *Business Standard.*

2. Gupta, Meeta and Pandey, Rakesh. 2018. "The Bright Future of Pension: Atal Pension Yojana". *Swaranjali Publications.*

3. Rathod, Prahlad and DV, Vidyashree. 2015. "Financial inclusion –A study on Modi's PMJJBY, PMSBY and APY". *International Journal of Applied Research.*

4. Sandeep, J and Sharma, Namratha. 2015. "A study on Atal Pension Yojana". *International Journal in Management and Social Science. Vol 3 . Issue7.*

5. V R, Surinder. 2016. "Feasibility analysis of Atal Pension Yojana*". International Journal of advanced research. Vol 4. Issue 3. Journal homepage: https://www .journalijar.com*

FEMINISATION OF AGRICULTURE AND FOOD SECURITY

Fizza Suhel

Ramjas College, University of Delhi

Abstract

The paper aims to analyse the determinants of feminisation of agriculture with emphasis on food security. It studies the effect of cereal consumption, migration, rural literacy, rural poverty, female wages and gender wage differential on the number of female agricultural workers. The paper checks the theory of work capacity curve which states that work productivity is positively related to one's nutritional level by using cereal consumption as an indicator of nutrition. It further explores the role of women in major aspects of food security and the barriers which arise due to gendered division of labour and assets. Women have been denied land rights and control which adversely affects food production. They contribute more than their male counterparts in the domestic sphere and almost equally in the fields, yet do not get recognition as farmers. The nutritional context of women is also studied in the paper, identifying their disadvantage as compared to men in nutrition and food security. By highlighting women's role in major aspects of food security and the determinants of their participation in the labour force, especially in agriculture, this paper captures the feminisation of agriculture and food security.

1. INTRODUCTION

In recent years South Asian countries have seen an increasing presence of women in the male-dominated field of agriculture. For instance, in countries like Bangladesh, Bhutan, India, Pakistan and Nepal, 60-90 per cent women are employed in agriculture, showing higher participation than their male counterparts (FAO, 2005). Women have been at the core of food security in households for a very long time through their contribution in all three aspects of food security- production, accessibility and utilisation. However, it is no surprise that this results from a gendered division of labour which puts the burden of caretaking on the woman, often by glorifying this social obligation. In spite of a traditional perspective of their lower social status, if a male-dominated field observes a rise in female labour force, it becomes an important question to study. This paper looks at the factors which influence participation of women in agriculture with special emphasis on food security of households.

Women face inequality not just in the social sphere but at the household level too. Although they are the providers of food, they often eat the least and after the male members have eaten. Consumption data in National Family Health Survey- II (NFHS-II) shows that 55 per cent of adult women in India consume milk or curd at least once a week, 33 per cent eat a fruit at least once a week and only 28 per cent eat an egg. In terms of health, 52 per cent of all adult women are anaemic and 36 per cent have a body mass index of less than 18.5 which is associated with chronic energy deficiency (Dreze, 2012). To understand how nutrition and food security affect female labour force participation, this paper studies the theory of work capacity curve. The theory draws a positive relationship between nutrition and work productivity which implies that one is able to supply his/her labour after receiving a certain level of nutrition required by the body to work.

Apart from food security, there are other factors which are capable of influencing the participation of women. Women's work increases due to migration undertaken by the male members of the family. Their work remains invisible in households. Places with high level of male migration see more women coming out and working as cul-

tivators. Rural male migration for employment purpose was 33 per cent as compared to 3.6 per cent for rural females (Swarna S. Vepa, 2005). This limits possibilities for women who are now left with local work. Marginalisation of agriculture has resulted from doubling of the workforce from 97 million to 185 million between 1950 to 1991 (Rao and Hanumappa, 1991). All high paying agricultural and non-agricultural jobs are taken up by males, leaving low paid work for women. With the exception of Tamil Nadu, states which offer lesser wages employ more women. Similarly, states with high wage differential between men and women observe more number of female workers. Thus, wage becomes an important factor for understanding female participation in work outside the household. The paper further explores role of education in increasing the participation of women. The relationship between low literacy and higher female participation in agriculture, as observed in countries like Papua New Guinea and the Solomon Islands, is concerning as low literacy hinders women's access to technology and the power to take decisions (FAO, 2005). In such a case, their increasing number is reflective of their existence as wage labourers and not as heads or leaders. Their nature of work in household production revolves around traditional gender roles based on cultural and religious perspectives. Rural poverty is a factor which acts as a push for women to work outside the household despite the social constraints and the paper delves deeper into this narrative.

This paper explores the determinants of female labour force participation in agriculture using a multiple regression model. It discusses the issues faced by women in the context of food security and their role in the three main aspects- production, accessibility and utilisation. The next section presents a literature review of the studies which have been referred to in producing this research. After the literature review, the dataset used is described in detail followed by the methodology used in deriving results. A multiple regression model is used to determine the effects of several attributes discussed previously on the dependent variable- the number of female agricultural workers. The next section discusses the regression results from the model. An extensive discussion on food security and women follows which talks about their role in the major aspects of food security. One must understand that agriculture and food security do not exist in isolation and a study on women and food security will necessarily relate to agriculture.

2. LITERATURE REVIEW

An important study positively relating nutrition and labour force is Debraj Ray's work capacity curve (2009).

This curve shows that, at initial stages of nutrition, the body uses the energy to maintain resting metabolism. As more and more is consumed, it goes into productive work and productivity increases. When the nutrition level for resting metabolism is achieved, productivity increases with an increasing rate after which there is a phase of diminishing return because of natural limits. Ray used income as an indicator of nutrition due to the relation between high income leading to high consumption and nutrition. This paper studies this relationship between nutrition and work for female agricultural workers by using cereal consumption instead of individual income.[1]

Figure 1: Relationship between nutrition and work capacity.
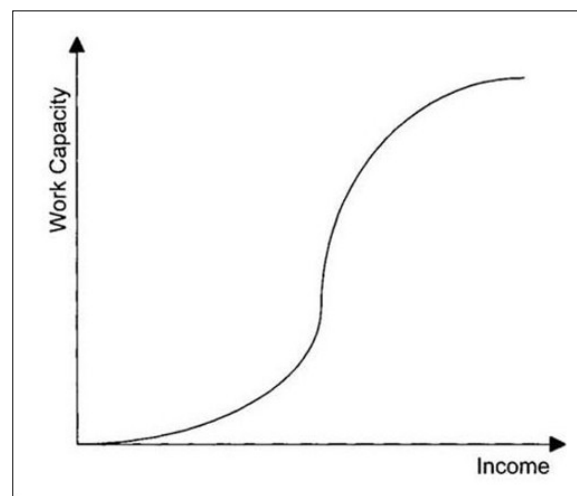
Source: Development Economics, Debraj Ray

Swarna S. Vepa's work on "Feminization of Agriculture" gives a broad picture of women's stake in agriculture. The contribution of women has been increasing and if the work in livestock, poultry and fisheries, water conservation, forestry and work related to common property resources is included, it exceeds that of men. Their access to credit, technology and resources like land, livestock and machinery is limited. Burden on women is increasing and low wages add to their deplorable condition, making female headed households the lowest income class. She reports how female main workers are replacing male main workers in rural sector by pointing out that the percentage increase in women workers has been 7.2 per cent as compared to 3.2 per cent for men workers. Women put in 23.6 hours a week in agriculture and get paid for only 60 per cent of their work. This reflects marginalisation of women workers with high levels of unpaid work in Haryana and Meghalaya where participation was higher in non-crop agricultural activities. She makes a distinction between marginal and main workers, elaborating how the former grew due to a lower pace of work opportunities as compared to the demand. Women have a disadvantage here as well and almost equal proportion in both catego-

ries (46% marginal and 54% main). Her study emphasises on state level analysis highlighting Tamil Nadu, Rajasthan, Maharashtra, Madhya Pradesh, Andhra Pradesh and Gujarat for having more than 50% of agricultural labourers as women. Backward districts employ higher per cent of women as seen in Andhra Pradesh's Warangal, Nalagonda, Mahaboobnagar and Vizianagram which are less prosperous. This is due to two reasons. First, mechanisation has replaced women's labour and second, possible shift from rice cultivation to other crops has reduced labour requirements. Shortage of rice in states and increase in its price has led to lower calorie consumption. To study wage inequality, Vepa explores the proportion of female wages to male wages. Kerala, where absolute female wages are high, also has high inequality. Punjab, with low inequality, has just 13 per cent of female cultivators. These results highlight the importance of studying wage differentials and how it affects the labour force. Her paper discusses policy objectives of increasing wages, skills, incentives and access to resources for women who should be considered as regular workers and not those who occupy spaces left by men. Community participation and awareness creating activities burden them even more without bringing any economic benefit. Employment Guarantee Schemes could focus on employment opportunities specifically for women. They can be employed in environment restoration activities and focus should be to provide land and resource ownership.

The paper also draws reference from the neo classical theories of migration like those of Ravenstein's (1885) and Stouffer's (1940) which state that migration occurs due to differential in wages, economic conditions and opportunities. Intense stress arising from population growth, unemployment and inefficient agricultural practices push out a large workforce from agriculture to informal economy leading to urbanisation of rural poor. Social obligations and barriers lead to more migration of males than females for the purpose of employment. This migration forces women to work on household farmlands or secure position as agricultural labourers to meet household expenditure. Thus, migration turns out to be a critical factor for women to enter the labour force and the paper further explores this aspect.

3. RESEARCH OBJECTIVES

The paper studies the relationship between the number of female agriculture workers and cereal consumption, migration, female literacy, male literacy, average female wages, wage differential between males and females and rural poverty. It checks whether the theory of work capacity curve model holds true for the female labour force in agriculture by looking at their relationship with cereal consumption. The objective of the paper is to understand

the reason behind the increasing female participation in agriculture while highlighting their role in food security. In the knowledge of the author, enough empirical research on this question has not been pursued and this paper could help in setting the context. Apart from this empirical model, the research focuses on presenting existing literature on the role of women in food security and the problems faced by them in this field. Agriculture and food security are closely related as agriculture ensures enough food production. Therefore, a study of women in food security cannot be complete without looking at their contribution in agriculture.

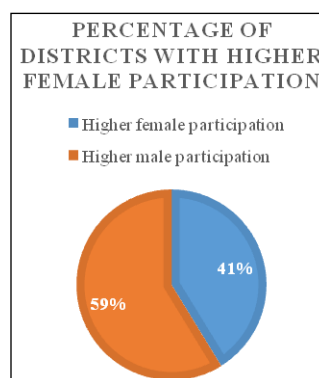## 4. DATA & METHODOLOGY

4.1. Data Source
The paper makes use of secondary data available from the Indian Human Development Survey (IHDS- II) database for the year 2011-12. It is a collaborative work by the National Council of Applied Economic Research, New Delhi (NCAER) and University of Maryland. The goal of this data collection was to observe changes in the daily life of Indian households in a transforming world. It nationally represented 42,152 households from all states except Andaman and Nicobar Island and Lakshadweep. Data from rural households was used and compiled to give district wide results for 274 rural districts. Parts 1 and 2, which pertained to individual and household data respectively, were used.

4.2. Data Description
Before moving to the regression model, it seems important to understand the following overview:

A considerable number of female agricultural workers can be observed through this data. As shown in Fig. 2, 41.24% of all districts show a higher number of female agricultural workers than males. Though numbers are high, women still lack decision making powers and ownership of resources. The percentage of women who can

Figure 2: Districts with higher female participation   *Figure 3: Women and decision making power*
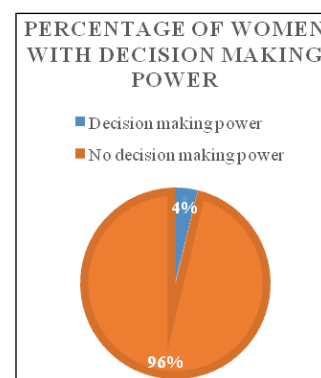
Source: Author's compilation

take decisions on farmland owned by their households remains extremely low as seen in Fig. 3.

Rajasthan has the highest ratio of female to male agriculture workers followed by Chhattisgarh and Madhya Pradesh. These states perform fairly low in terms of average wages proving how women are concentrated in areas which are not preferred by their male counterparts when it comes to earnings. Table 1 gives the ranks of the top states with respect to the ratio of female to male workers and their ranks with respect to female wages.

Table 1: Ranks of States

State	Rank in Ratio of Female to Male workers	Rank in female wages
Rajasthan	1	4
Chhattisgarh	2	25
Madhya Pradesh	3	21
Bihar	4	23
Andhra Pradesh	5	16
Uttar Pradesh	6	13

Source: Author's compilation

Chhattisgarh, Madhya Pradesh and Bihar belong in the top six for the ratio of female to male workers. However, they belong to the bottom 10 when it comes to agricultural wages.

Jammu and Kashmir, Bihar and Uttar Pradesh observe the highest average consumption of cereal while Kerala observes the lowest.

Figure 4: Consumption- Top and Bottom 5 states
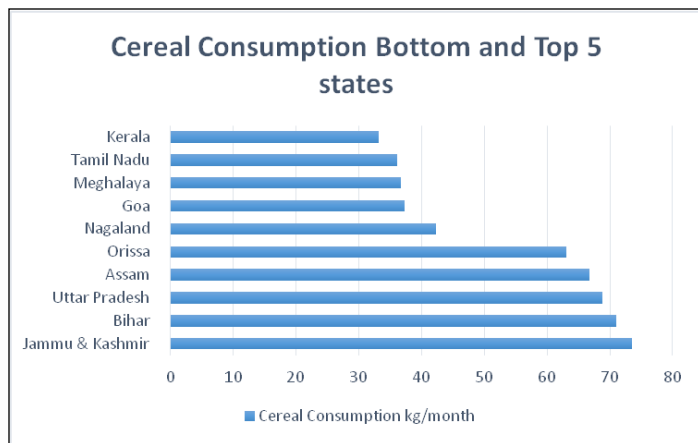
Source: Author's compilation

4.3. Econometric Model

Econometric analysis is done using a Multiple OLS Re-gression. Cross sectional data for 274 districts has been taken. The effect of cereal consumption, migration, wages of female workers, wage differential between males and females, rural poverty, literacy of females and males on the number of female agriculture workers is estimated.

$$FemAg_i = \beta_0 + \beta_1 Cereal_i + \beta_2 Mig_i + \beta_3 Wagefem_i$$
$$+ \beta_4 Wagediff_i + \beta_5 Pov_i + \beta_6 Litfem_i$$
$$+ \beta_7 Litmale_i + u_i \qquad (1)$$

A brief discussion of the various attributes is given below

Table 2: Description of attributes

Attribute	Variable	Description
Female Agriculture Workers	FemAg	It measures the number of rural females in each district who work in the field of agriculture as an economic activity. It does not include those women who work in household farms as cultivators because data for their individual wages cannot be measured separately.
Cereal Consumption	Cereal	Average cereal consumption of rural households in each district is taken into consideration. Consumption of cereal like rice, wheat and other cereals were taken.
Rural Migration	Mig	Measures total migration in each district from all rural households
Wage of Female Workers	Wagefem	Average wage given to rural female agriculture workers in district i.
Wage Differential	Wagediff	Differential of average wage of male agriculture workers and average wage of female agriculture workers in district i.
Poverty	Pov	Rural Poverty is measured as the number of rural household below poverty line.
Female Literacy	Litfem	Total number of literate rural females in district i
Male Literacy	Litmale	Total number of literate rural males in district i

Source: Author's compilation

5. RESULTS AND DISCUSSION

5.1. Regression Results

Table 3: Regression results

	Coefficient	Robust Std Error	t-statistic
Intercept	40.29782	6.084594	6.62
Cereal	-0.71665***	0.1046331	-6.85
Mig	0.904256***	0.2387852	3.79
Wagefem	-0.00382*	0.0024971	-1.53
Wagediff	-0.00103**	0.000455	-2.27
Pov	0.114785	0.1646211	0.70
Litfem	-0.19983***	0.0789254	-2.53
Litmale	0.250257***	0.0814637	3.07
R^2	0.285141		
Adjusted R^2	0.266329		
Observation	274		

Source: Author's calculations

Notes: Hypothesis testing done using t-test.
Heteroscedasticity was observed using Breusch Pagan Test.
Robust standard errors have been used to deal with heteroscedasticity.
***significant at 99 % level
**significant at 95% level
*significant at 90% level

5.2. Interpretation

Using one tailed t-values to check significance (for hypothesis testing), Cereal, Migration, Male Literacy and Female Literacy is significant at 99% significance level. Wage differential is significant at 95% significance level and Female wages at 90% significance level. Poverty is not significant. The result for cereal consumption contradicts the theory of work capacity curve. The negative sign of the coefficient would mean that, with an increase in cereal consumption, the number of women working in agriculture falls. Two propositions can be noted. First, the relationship between nutrition and work capacity does not hold. At low levels of nutrition, there are more women going out of the house to work. This relates to the issue of affordability of food. At low levels of cereal consumption, to be able to afford food becomes more important than maintaining enough nutrition for work. Although contradictory, this result is not surprising at all because the general perception around the employment of rural women is not for achieving an economic position for the woman but to push it towards employment to fulfil the needs of the household, which, in this case, is food security through cereals. Secondly, it is probable that cereal consumption does not capture nutrition entirely. An individualistic approach can be a better fit to measure women's nutrition as inequalities within household members do exist which make women the most vulnerable to undernutrition.

When cereal consumption decreases by one kilogramme, the mean number of women increases by 0.717.

Migration gives expected sign of the coefficients. With every person migrating from the district, 0.9 women join agriculture. Wage differential between females and males is significant at 95% significance level. It can be interpreted as an excess of wages of males over that of females. There seems to be a negative relationship between wage differential and the number of female workers. As the gap widens, lesser women participate. Similarly, the sign of coefficient of female wages is negative. Districts with low female wages have more female agriculture workers as seen in Table 1.

Interesting results were observed for poverty as it turned out to be insignificant, contradictory to existing literature which states that poor economic conditions force women to join the labour force.

Female literacy is significant and the coefficient takes a negative sign. An increase in the number of literate women in the district leads to a decrease in the number of women in agriculture. Male literacy has a positive relationship with female participation which shows two things. First, literate men could be more capable of migrating and their migration forces women to work. Second, literate males could be more aware and support women's employment despite social barriers.

R^2 is a measure of goodness of fit of the model. A value of 0.285 shows that the model is able to explain 28.5 per cent of changes in the dependent variable. Its value increases as more and more regressors are added which develops the need for adjusted R^2, a better indicator for comparative purpose. By looking at the adjusted R^2, the model explains 26.6 per cent of changes in the regressor.

To conclude this section, the work capacity curve theory does not hold true for women in agriculture and cereal consumption. It could be possible that cereals do not serve as a good indicator of nutrition in women and there is a need to look at more individualistic indicators. However, measurement of such individual consumption patterns becomes difficult. Migration serves as a highly criti-

cal variable along with literacy of males and females and the wage differential. It was surprising to observe that poverty was insignificant to the model.

6. WOMEN AND FOOD SECURITY

Chaudhary and Parthasarathy (2007) describe food security as " a state where all individuals have stable access to minimum amounts of food required for a healthy and active life." Household food security is explained as a function of time and market commodities producing tangible and intangible (nutrition, warmth and health) commodities entering the utility function while individual food security depends on visible and invisible intra household factors like age and gender. Household food security does not ensure individual food security primarily due to gender inequality which puts women in a lower position in nutritional status and food distribution. This disadvantage faced by women is because of a weak bargaining power depending on their fallback conditions (Aggarwal, 1997). This position is a result of women's unpaid work which is often looked down upon and can be hard to measure in monetary terms. Even in cases of paid work, their contribution is considered "insubstantial". Scholars have tried to measure their work by looking at time contributions. This section explores the issues which arise for women in ensuring food security and their position in the various aspects of food security.

6.1. Issues

6.1.1. Lack Of Ownership Of Assets

Kelkar (2011) in his paper "Gender and Productive Assets" explores the gender divide in ownership of assets with emphasis on land. He explains how lack of asset control affects economic inequality, individual life, wages and decision making rights. He links this lack of control negatively to development and female empowerment. Rural women, who are mostly landless, are disadvantaged for they cannot be eligible for institutional credit structures as seen from only the 5 per cent of women who own a Kisan Credit Card. A high number of women work with livestock (93 per cent of employment) but they are absent from diary cooperatives which are controlled by men. Female agricultural workers and female headed households are the most deprived stakeholders in agriculture because they not only lack land rights but also access to public service and technology. For instance, projects promoting commercialisation of vegetable production often train men. A knowledge barrier is a result of the perception of gender roles and disregard of women's economic activity. Giving women control over assets leads to increased productivity. In Andhra Pradesh, when women-run dairy units were monitored, milk yield increased from 380 to

610 litres per diary and profit from 3 lacs to more than 5 lacs per year. Similarly, findings from Integrated Rural Development Program and Tamil Nadu Women's Development Program reveal that decision making influence of women increases when credit transfers are made directly to them. Even in situations where women have access, they continue to face social barriers in exercising control. A study by Chen et al (1989) explained how households with boys used larger proportion of inputs like fertilisers and irrigation. This shows that male presence in households ensures access to resources and thus provides greater incentive to investment.

6.1.2. Female Unpaid Work

Women are generally not as represented as men in economic activities due to their added responsibility of house work. They are responsible for child care as well as livestock rearing which serves as a constraint to the time and their capacity to engage in work. FAO reports show that women devote 85-90 per cent of time spent on household food preparation across countries. Despite such a role, women dedicate an increasing amount of their time in farm activities like land preparation, cultivation, threshing and drying etc. A study by Chaudhary et al (2007) tries to quantify women's unpaid work in two villages (Ashta and Umra) of Maharashtra. Work is divided on the basis of gender roles and perception in both villages where repetitive and monotonous tasks are the responsibility of women and mechanically advanced tasks are carried out by men. There is a clear distinction of household as a female's domain and workplace as male's domain. Results from the village of Ashta are presented below:

Table 4: *Time devoted to farm work and domestic activities by men and women*

Household Category	Number of hours devoted to farm work per day		Number of hours devoted to domestic activities per day	
	Male	Female	Male	Female
Large MHH	1.75	1.7	1.1	5.05
Medium MHH	1.62	1.8	1.93	5.3
Small MHH	0.74	0.71	2.17	7.6
FHH	0	0.065	0	6
All	1.02	0.91	1.25	6.37

MHH- Male Headed Households
FHH- Female Headed Households

Source: Chaudhary and Parthasarathy (2007)

Table 4 shows that across all sizes of households, women's contribution to farm work is almost equal to men's and way more in case of domestic activities. In total, women spend six times more hours in household work than men and men spend only 1.12 times more

Table 5: *Monetary value of domestic work and food security*

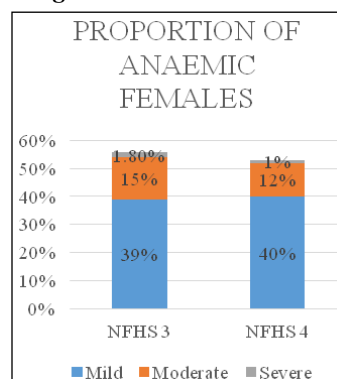| Household category	Monetary Value of Per Day Domestic Work Done by Men and Women in the Household			Per day male and female contribution in rupees to household food security.		
	Male	Female with male wage rate	Female with female wage rate	Male	Female with male wage rate	Female with female wage rate
Large MHH	33	160.6	101	85.5	202.5	35
Medium MHH	57.9	204.9	106	113.2	196.7	132
Small MHH	65.1	203.7	152	106.2	258.06	175
FHH	0	180	120	9.8	196.7	136
All	37.5	192.4	127.4	81.5	221.4	150.4

Source: Chaudhary and Parthasarathy (2007)

hours in farm work than women. Quantifying this contribution in monetary terms gives a clearer picture of women's contribution.

When women's domestic work is quantified, it is more than men's contribution with both male wage rates and female wage rates. Women's support to food security is more than that of their male counterparts. Assessing at female wage rates, women remain responsible for 70 per cent of their families' food requirement.

6.1.3. Nutritional Status

India Health report 2015 confirms that 55 per cent of women between 15-49 years of age are anaemic with state numbers as high as 76.3 per cent as in West Bengal. Children born of malnourished mothers are underweight and face 20 per cent higher mortality (UNICEF). An important health indicator for women is body mass index (BMI). A BMI of less than 18.5 is associated with chronic energy deficiency and higher than 30 is associated with obesity. All India proportion of thin women (BMI less than 18.5) is 23 per cent in the NFHS-4 with an urban rural variation. The proportion of thin women is 27 per cent in rural areas as compared to 16 per cent in urban areas. In NFHS-4, 53 per cent of women and 23 per cent of men are observed as anaemic without any change in trend over the last 10 years. Prevalence of anaemia in adults is negatively related to their schooling and household wealth. Figures 5 and 6 show the proportion of anaemic adults (both men and women) over the past 2 surveys. NFHS also reports data on consumption of food for both women and men. Women mostly consume green leafy vegetables but their consumption of non-vegetable, non-cereal diet is concerning. Only 45 per cent consume milk or curd daily, 23 per cent consume once a week, 25

per cent consume occasionally and 7 per cent do not consume at all. Similarly, 54 per cent do not consume fruits at all. This shows lack of diversification in the diet of females.

Figure 5: *Anaemic Females*   **Figure 6**: *Anaemic Males*
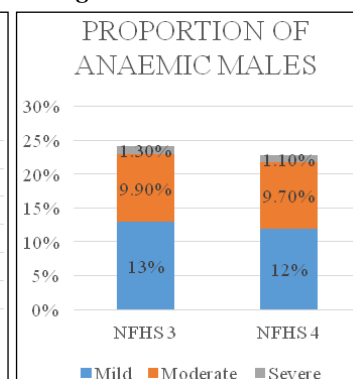
Source: NFHS 4

6.2. Role Of Women In Food Security

6.2.1 Food Production

Women have always been producers of food. They have involved themselves in household work of food preparation, collection of firewood and water and caregiving along with farm related activities. Despite such contributions, there is a lack of recognition of women as farmers. The Women Farmers' Entitlements Bill, 2011 aimed at providing recognition by issuing 'Women Farmer Certificate'. Census 2011 defines cultivator as someone who operates on a piece of land. Since a large number of women do not own land, they fall under the ambit of cultivators and not farmers, affecting their access to government schemes and Kisan Credit Cards. Swaminathan Reddy, who introduced the bill, explained "an identity card for women is useful for access to entitlements. The

Kisan Credit Card, for example, requires land ownership title."

Women offer most of the labour for producing food crops and control the sale of food produced on their land but asymmetries in asset ownership negatively affect food production. Time use studies help in explaining how much time women put in agricultural activities. Kadiyala et al (2014) explain that women employed in agriculture are unable to improve nutritional condition for children due to lack of time. They are held responsible for both domestic and farm work. Even though women hold such intrinsic role in food production they can be easily displaced. As their work in agriculture becomes mechanised, men take over their position. Policy makers need to realise that women could be used as an instrument for better food production and more security by giving them the recognition they deserve.

6.2.2. Access

Nutritional status is not ensured through food production. Accessibility of food is the second step to ensuring food security and women play a major role here. Two studies are able to explain their importance in this context. Mehcar (1998) in an intrahouse study in Kerala talks about how women contribute more to household income (both in absolute and proportional terms) than men despite earning less because of low personal expenditure. Hoddinott and Haddad show that a $10 increase in women's income has the same effect on child nutrition as $110 increase in men's income, highlighting the importance of female income of wage rates. When it has been established that a large part of women's income goes into child nutrition and food security it becomes all the more essential to ensure equal if not high wages for women. Women earned 71 per cent of male wages in 2007-2008 with variation like 90 per cent in Gujarat and 54 per cent in Tamil Nadu (Rao, 2017). Studies show that rural women are confined to agricultural activities and earn half as much as males for the same nature of work. Even though they earn less, they work more than their male counterparts. A time use study shows that male contribution to house and farm work is declining in both rural and urban areas while women perform 53 per cent of the work. At times, higher income does not necessarily lead to better health status. This can be clearly seen at the macro level by comparing performance of countries. India has a per capita GNI of $730 which is higher than most of the sub Saharan countries but its child stunting rates are as high as 46 per cent. Gambia, with a per capita GNI of $290, has a 19 per cent child stunting rate. This shows that distribution or inclusive growth is required to ensure well-being. India has been able to ensure a certain level of social protection through its much celebrated Public Distribution System (PDS) under which poor households receive cereals at a very low price. Dreze and Khera (2013) clearly point out the effect of an efficient system. In Chhattisgarh, one of the poorest states in the country, 73 per cent of rural households buy food from the PDS. Accounting for the PDS transfer, head count ratio dropped by 17 per cent and poverty gap index dropped by 39 per cent in Chhattisgarh. The National Food Security Act (NFSA) of 2013 has changed food security from a welfare approach to a rights approach and recognises women as head of households for food provision and management. Both NFSA and PDS are essential in changing the way food security is dealt within the country. Female specific interventions are still lacking and need a space in policy.

6.2.3. Food Utilisation

Women's role in this aspect can be much more important than the two aspects discussed above. Through gendered division of labour, women are also responsible for preparation of food and thus the burden of diversification of food consumption falls on them. Cereal consumption does not fulfil the requirement of micronutrients like Vitamin A, Vitamin C, Iron, Zinc and Iodine. Lack of proper diet not only affects individual health but can also have economic repercussions. In Sierra Leone, Iron deficiency in agricultural workers can cause a loss of $100 million in the economy in 5 years (World Bank). Food utilisation is set in the context of nutrition and health and women are at the centre of this issue as they work for household and child nutrition. India has been one of the worst performers in child nutrition indicators. Nearly half of the children are underweight and stunted and 16 per cent are wasted. Although mothers play a crucial role in securing better health for children, it was observed that only 55 per cent of children less than 4 months of age are breastfed (Arnold et al, 2004). Since women spend long hours in the field in unpaid and wage labour, they cannot give enough time for child care. This holds true for Schedule Caste (SC) women as 67 per cent of SC children below 5 years of age are underweight (Rao et al, 2017). In the case of women belonging to the Schedule Tribes (ST), a significant share of their time goes into forest related activities like collecting and selling forest products and gathering mushrooms and bamboo shoots for household consumption. This affects the health of their children which is similar to the SC children, though wasting levels are higher. When women do not engage in agriculture or wage work, the time they devote to childcare increases. This result can hold true for all employed women but the need to stress on women in agriculture arises because of their unrecognised status. Rural women spend more income as well as more time towards food security and initiatives promoting equal burden of work and efficient usage of resources for diversification of food consumption are required.

7. SCOPE FOR FURTHER STUDY

The paper tries to measure nutrition through household cereal consumption due to lack of data. Further research can be done by taking different indicators of nutrition like non- cereal consumption, Body Mass Index etc. to check the relationship between nutrition and work productivity. Public Distribution System has become a major initiative for ensuring food security. However, it cannot be efficient in the presence of leakages. Studies on understanding these leakages due to corruption can help in realising its actual benefit. There is a requirement to obtain individual consumption patterns for women. Household food security is not the same as individual food security. Women have been the disadvantaged sex in this sphere and there is a need to have studies specifically mapping their individual food security.

8. CONCLUSION

The discussion on women and their contribution has been able to establish the position they hold in agriculture and food security. They contribute to both domestic as well as work spaces but it is considered as a social obligation instead of an economic activity. Issues of women are mostly taken up by social groups and do not get enough space in policy. Based on the discussions in this paper few needs of women for improved agriculture and food security can be identified. Policies and programmes need to recognise women as equal contributors and have women specific interventions. Awareness about technology should be kept in mind for women who do not have access to it and proper training should be ensured. Women

should be given land rights and the support to pursue agriculture enterprises irrespective of their land rights. Emphasis should be on infrastructure to reduce the burden of longer hours and unpaid work. Young girls travel long distances to collect water and firewood for households. Village panchayats can take the responsibility for providing such facilities and give a platform for women to share their opinion. Educating women about their rights in employment and ensuring equal wages for both sexes should be a priority for the welfare of female headed households.

Quantification of women's work in food security, as mentioned in the previous sections, gives a clear picture of a higher contribution by women than men. Such studies should be promoted to highlight the areas where men can put more effort and work in coordination with women. The paper has been able to explain how women take up a huge space in the area of agriculture and food security. It has highlighted the barriers to their development which are necessary for framing any policy. It started with the discussion on factors affecting the female labour force participation in agriculture. Migration, gender wage differential, female wages and literacy of males and females were proved to be critical factors. It was interesting to observe that poverty had no effect on their participation. The theory of work capacity curve relating nutrition and work did not hold true in this analysis which highlights the importance of nutrition indicators observing individualistic behaviour. Apart from the empirical model, the paper described the food security situation and women's position in this sphere by looking at the existing studies in this area.

REFERENCES

1. Agarwal, B., 1997. "Bargaining" and Gender Relations: Within And Beyond The Household.

2. Arnold, F.; Nangia, P. & Kapil, U., 2004. Indicators of Nutrition for Women and Children: Current Status and Recommendations. Economic and Political Weekly, Vol. 39, No. 7, pp. 664-670.

3. Balakrishnan, R., 2005. Rural Women and Food security in Asia and the Pacific: Prospects and Paradoxes. Food and Agriculture Organization publication.

4. Chaudhary, N. & Parthasarathy, D., 2007. Gender, Work and Household Food Security. Economic and Political Weekly, Vol. 42, No. 6, pp. 523-531.

5. Chen, M., 1989. Women's Work in Indian Agriculture by Agro-Ecologic Zones: Meeting Needs of Landlessand Land-Poor Women. Economic and Political Weekly, Vol. 24, No. 43, pp 79-89.

6. Doss, C., 2011. The Role of Women in Agriculture. Agricultural Development Economics Division ESA Working Paper No. 11-02.

7. Dreze, J. & Khera, R., 2013. Rural Poverty and The Public Distribution System. Economic & Political Weekly, Vol XIVIII, Nos 45 & 46, pp 55-60.

8. Dreze, J., 2012. Food and Nutrition. The New Oxford Companion to Economic in India. Oxford University Press.

9. Kadiyala, S.; Harris, J.; Heady, D.; Yosef, S. & Gillespie, S., 2014. Agriculture and Nutrition in India: Mapping Evidence To Pathways. Annals of the New York Academy of Sciences.

10. Kelkar, G., 2011. Gender and Productive Assets: Implications for Women's Economic Security and Productivity. Economic and Political Weekly, Vol. 46, No. 23, pp. 59-68.

11. Mathur, A., 2011. Women and Food Security: A Comparison of South Asia and South East Asia. Asia Security Initiative Policy Series Working Paper No. 12.

12. Rao, M. & Hanumappa, G., 1999. Marginalisation Process in Agriculture: Indicators, Outlook and Policy Implications. Economic and Political Weekly, Vol. 34, No. 52, pp. A133-A138.

13. Ray, D., 2009. Development Economics. Oxford University Press.

14. Roy, N., Pradhan, M., & Roy, D., 2017. Gender Justice and Food Security in India. International Food Policy Research Institute (IFPRI) Discussion paper 01600.

15. Vepa, S., 2005. Feminisation of Agriculture and Marginalisation of Their Economic Stake. Economic and Political Weekly, Vol. 40, No. 25, pp. 2563-2568.

FACTORS AFFECTING THE OFF-FIELD BRAND VALUE OF A FOOTBALL TEAM AND EXTENT OF THE IMPACT OF ON-FIELD PERFORMANCE

RITWIK KHANNA*, RAGHAV MONGA and PRAKSHI GAMBHIR

Hansraj College, University of Delhi

Abstract

Football is the world's most popular sport and there is no doubt that its popularity in the Indian subcontinent is growing at an exponential rate. There are huge investments made in the sport on a daily basis both domestically and internationally. Top clubs like Barcelona and Manchester United are looking at India as potentially one of the largest markets for their clubs. The sport in itself attracts such a large number of people because there is no other sport which gives you such an innate sense of belonging to absolute strangers. Within a football stadium, everyone wearing the same colour is a brother in arms regardless of whether you know their name or not. It is this fervour that we explore in this paper and attempt to explain the impact of it. Commercially, the sport has made great strides across the world. Investors from around the world flock to Europe for an opportunity to invest in the top clubs and their enthusiasm is repaid by the extravagant revenues generated through ticket sales, merchandise sales, broadcasting use rights, etc. With these huge sums of money involved, the sport has seen rapid commodification which is another aspect that we explore towards the end of the paper. Thus, the football industry is multi-faceted and while from an idealistic perspective, a club should only grow if they perform well on the pitch, this is not the case. It is this disparity which we look at and attempt to explain in this paper.

1. INTRODUCTION

Football is a global phenomenon. It is by far the most popular sport in the world and, in the past few decades, it has seen rapid expansion into geographical regions where it is not traditionally popular. India is one of these areas where the sport has seen widespread growth in recent years and it is no surprise that it is viewed as one of the prospective hotspots of talent and a highly profitable market as well.

The Indian Super League (ISL) is in its nascent stages compared to European leagues but despite the large amounts of investment, it has failed to truly capture the attention of not only the general public but also of pre-existing Indian football enthusiasts. Undoubtedly, there exists a great divide between the quality of football across the two leagues but ISL has failed to generate the passionate relationship that is usually expected of supporters with football clubs. Therein lies one differentiating factor of

football clubs from wholly commercial organisations - the reliability of consumers. No category of consumers is perhaps as reliable for content intake as sports fans. This factor is one of the reasons why this topic has been chosen for the research paper.

With this swift expansion has come sharp commercialisation of the sport with the European football market estimated to be worth 28.4 billion USD in 2017-18 by Deloitte (Deloitte, 2019). Millions of dollars are at stake for all parties involved and the pressure to perform for players is higher than ever. However, the question arises - how much does on-field performance actually matter for the commercial end of the football club? Surely, there lies a positive relationship. Otherwise, why would an enterprise's value grow if it fails at achieving its core goals.

Yet, we must also ask ourselves - "Is on-field performance the only thing that matters for a club's brand value and net worth?" A quick glance at the off-field activities

of a club can assure us that this is not true. If it were, clubs wouldn't be having an army of staff handling the commercial end; they would devote all their resources towards on-field success. Thus, this research delves into the extent of the impact of on-field performance on the net worth of the club and explores other factors which affect the club's market value. Later on, the case study of Manchester United is taken up to study in-depth how the stated factors affect the net worth.

2. LITERATURE REVIEW

The commercial value of the football industry has increased multi-fold over the past few decades and several studies into this industry have taken place and continue to do so on a regular basis.

KPMG releases an annual document titled 'The European Elite' wherein the enterprise value of top football clubs across Europe is calculated on the basis of five major factors. This document follows a similar structure that we wish to undertake but KPMG's research is targeted towards finding the enterprise value while we are aiming to wards explaining that value. Further, we feel that the factors accounted for ignore the emotional and non-quantifiable aspects of the club's net worth.

Deloitte releases an annual document titled 'UK Annual Review of Football Finance' which explores the value of the football industry and is comparative in nature with respect to previous years and to other countries. This document is centred around the club's revenue and finances. Similar to KPMG, we feel that this research is only number oriented and ignores the qualitative and football-related off-field factors which affect the net worth of a club.

On a whole, there is a lot of literature available which calculates the value of a football club along various lines but there is little research available on how the value is actually built and what qualitative as well as quantitative factors are behind it. This is why we have decided to take a combination of statistics and theory to explain a club's net worth and brand value.

3. HYPOTHESIS

It is hypothesised that the on-field performance has a positive effect on the brand value. This impact is limited by several other factors such as prestige, squad value, sponsorship deals, manager value, ticket and merchandise sales, youth structure, and owner profile.

4. DATA AND METHODOLOGY

This study is conducted to analyse the impact of the on-field performance of a football club on its net-worth. A regression has been performed on the number of wins (independent variable) of a team in a particular season on its net-worth (dependent variable). The regression is run on Excel. The second regression is performed taking time as another independent variable. The time period which has been chosen is a recent one because of the increasing popularity of football at an exponential rate. Moreover, various other factors have started to play a bigger role in the net-worth of the clubs.

5. SELECTION CRITERIA

i. Premier League: There are many reasons why the Premier League has been chosen for this study. The primary reason for selection is the level of competitiveness in the league which is unmatched across Europe. Results are unpredictable and there are fluctuations in the number of victories over time which helps us in our evaluation. Secondly, the Premier League is the most popular football league in the world and no other league comes close with respect to viewership and broadcast outreach. Further, Fantasy Premier League is the most popular fantasy league in football which engages fans even when "their" team is not playing.

ii. Teams: 10 teams have been chosen according to their performance in the Premier League. These teams have not been relegated in the time period taken. The number of teams taken gives us enough data points for Central Limit Theorem to hold and for regression to be viable.

iii. On-field performance: It is assumed that the number of wins in a season indicates how well a team has played throughout the year. There are 38 match days in a season which represents the total number of matches each team plays.

6. RESTRICTIONS AND ASSUMPTIONS

i. Total wins: It is possible that a team plays well but still ends up drawing or losing to the other team. Various factors like possession, shots on target, player ratings, fouls, corners, etc determine the level of the game.

ii. Margin of winning: A win is considered but not the margin. A 6-0 win would be given the same weightage as a 2-1 win.

iii. Date: The data has been taken at the end of the season. This implies that it does not account for any trends in improvement throughout the season but accounts for trends throughout the year.

iv. Periods: In the case of taking time as an independent variable, the first time period (2013/14 season) is taken as period 1, the second time period (2014/15 season) is taken as period 2 up until the sixth time period (2018/19 season) taken as period 6.

v. Variables: In the first two regressions, the difference is of taking time as an independent variable. The purpose is to find the off-field variables influenced by time. In the next 2 regressions, time is not taken as an independent variable. The factors influenced by time remain a part of the error term. The purpose is to find the off-field variables influenced by the size of the club.

7. DATA COLLECTED

Secondary data has been collected for the purpose of our research. All the net-worths have been taken from Transfermarkt, which is a German website and one of the largest sports websites. The website has scores, results, transfer news, fixtures, and player values. The values have been compared to the number of wins by the same club in a particular season. The number of wins has been taken from the official Premier League website. The data collected for 6 years is as follows:

Table 1: Net-worths and wins of 10 teams from the year ending 2014-2016

TEAMS	2013/14 Net worth (millions)	Number of Wins	2014/15 Net worth (millions)	Number of Wins	2015/16 Net worth (millions)	Number of Wins
Manchester United	€378.50	19	€425.00	20	€418.25	19
Manchester City	€451.00	27	€418.25	24	€501.75	19
Liverpool	€282.00	26	€310.50	18	€365.35	16
Chelsea	€395.75	25	€487.00	26	€495.75	12
Tottenham	€271.50	21	€262.75	19	€312.50	19
Arsenal	€370.50	24	€388.75	22	€440.00	20
Everton	€171.75	21	€179.50	12	€234.00	11
West Ham	€96.70	11	€119.75	12	€172.00	16
Crystal Palace	€57.00	13	€85.75	13	€125.75	11
Southampton	€111.75	15	€189.25	18	€206.75	18

Table 2: Net-worths and wins of 10 teams from the year ending 2017-2019

TEAMS	2016/17 Net worth (millions)	Number of Wins	2017/18 Net worth (millions)	Number of Wins	2018/19 Net worth (millions)	Number of Wins
Manchester United	€469.00	18	€750.50	25	€796.00	19
Manchester City	€525.25	23	€856.50	32	€1,140.00	32
Liverpool	€372.20	22	€548.00	21	€950.50	30
Chelsea	€515.00	30	€741.75	21	€885.75	21
Tottenham	€429.00	26	€720.00	23	€835.50	23
Arsenal	€492.50	23	€499.00	19	€625.50	21
Everton	€253.30	17	€344.00	13	€420.00	15
West Ham	€209.45	12	€218.00	10	€323.00	15
Crystal Palace	€186.50	12	€195.70	11	€266.15	14
Southampton	€230.50	12	€248.50	7	€224.60	9

Note: The data has been split into two tables for convenience.
Source: Transfermarkt and official Premier League website

8. ANALYSIS

Regression 1

The first regression is run taking the independent variable as the number of wins and the dependent variable as net worth. The confidence interval taken is 95%. The number of observations is 60. We get the following analysis of variation from the same:

Tables 3-5: Results of regression 1

Regression Statistics	
Multiple R	0.70001472
R Square	0.49002061
Adjusted R Square	0.48122786
Standard Error	4.29520636
Observations	60

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1028.15307	1028.153067	55.7300852	4.84E-10
Residual	58	1070.03027	18.4487977		
Total	59	2098.18333			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	11.6630399	1.09555512	10.6457 8102	2.90E-15	9.47004 81	13.8560 3176	9.47004 81	13.8560 3176
X Variable 1	0.01763649	0.00236248	7.46525 8546	4.84E-10	0.01290 748	0.02236 5501	0.01290 748	0.02236 5501

Source: Author's calculations

The equation obtained is

Y = 11.6630399 + 0.01763649X   (1)

Where,
Y represents Net-worth
X represents Number Of Wins

Interpretation of Regression 1

The p-value of the intercept as well the coefficient of variable 1 is close to 0. This implies that both variables are statistically significant. The R squared obtained is 49%. This implies that the number of wins explain only 49% of the change in the net-worth. The rest of the 51% involves more variables like prestige, sponsorships, manager values, etc. This shows that the on-field performance alone is not able to explain even half of the change in net-worth.

Regression 2

The second regression is run taking two independent variables. The first independent variable is the number of wins as before and the second independent variable is taken as time. The first 10 data points belong to the season of 2013/14, so

they are given the value of 1, as explained before. The dependent variable is net worth as before. The confidence interval taken is 95%. The number of observations is 60. We get the following analysis of variation from the same:

Tables 6-8: *Results of regression 2*

Regression Statistics	
Multiple R	0.88721
R Square	0.787142
Adjusted R Square	0.779674
Standard Error	111.1025
Observation	60

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	2601876	1300938	105.3922	7.09E-20
Residual	57	703595.1	12343.77		
Total	59	3305471			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-377.959	55.69937	-6.78569	7.23E-09	-489.495	-266.423	-489.495	-266.423
X Variable 1	74.91863	8.399046	8.919897	2.09E-12	58.09983	91.73742	58.09983	91.73742
X Variable 2	27.55238	2.425645	11.35878	2.87E-16	22.69511	32.40965	22.69511	32.40965

Source: Author's calculations

The equation obtained is

Y =-377.959 + 74.91863X1 + 27.55238X2 (2)

Where,
Y represents net-worth
X1 represents the time period
X2 represents Number Of Wins

Interpretation of Regression 2

Similar to the first regression, the p-value of the intercept, as well as the coefficients of variables 1 and 2, are close to 0. This implies that both variables are statistically significant. The adjusted R squared, in this case, is 77% as compared to 49% in the first case. This is caused by various factors. There are many factors which are impacted by time which change the net-worth of the club accordingly. If we take ticket sales and merchandise into consideration, the sales of these usually increase with time. This increase in sales leads to a direct increase in net-worth. The increasing popularity of Premier League can also be a very important factor which explains the change in net worth.

23% of the changes in y still remain unexplained due to various variables like manager value, youth structure, prestige value which are explained in the next section.

Difference Between Top 5 Teams And Bottom 5 Teams With The Same Analysis

In this section, we attempt to prove that there is a significant difference between the 5 bigger teams and the 5 smaller teams. We divide the 10 teams into 2 parts on the basis of their net worth at the end of the first season which was 2013-14.

The rank of the clubs in terms of their Net-worth is as follows:

Table 9: *Premier League Clubs ranked according to their net-worth*

Rank	Team
1	Manchester City
2	Chelsea
3	Manchester United
4	Arsenal
5	Liverpool
6	Tottenham
7	Everton
8	Southampton
9	West Ham
10	Crystal Palace

Source: Transfermarkt

Regression 3

In the 3rd regression, we are taking the regression in the same fashion as the 1st regression. Again, we take net-worth as the dependent variable and the number of wins as the independent variable. The bottom 5 teams are considered in this case.

The regression results are as follows:

Table 10: *Results of Regression 3*

Regression Statistics	
Multiple R	0.585566
R Square	0.342887
Adjusted R Square	0.319419
Standard Error	138.3152
Observations	30

Source: Author's calculations

Figure 1: *Comparison of the bottom 5 teams in the Premier League from 2012-18*
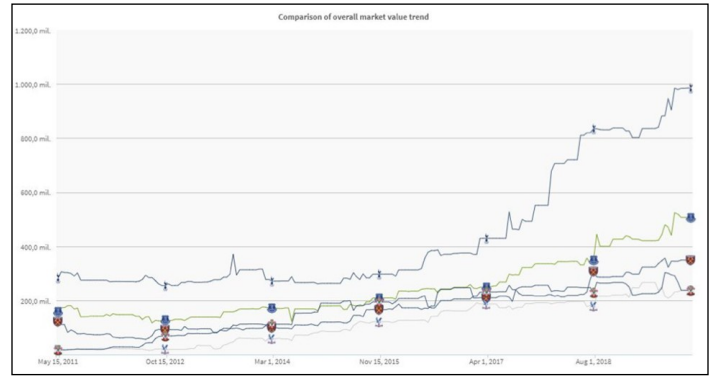
Source: Transfermarkt

Regression 4

Now we take the regression of the top 5 teams and compare the results:

Table 11: *Results of Regression 4*

Regression Statistics	
Multiple R	0.45644
R Square	0.208337
Adjusted R Square	0.180064
Standard Error	188.6762
Observations	30

Source: Author's calculations

Figure 2: *Comparison of the top 5 teams in the Premier League from 2012-18*
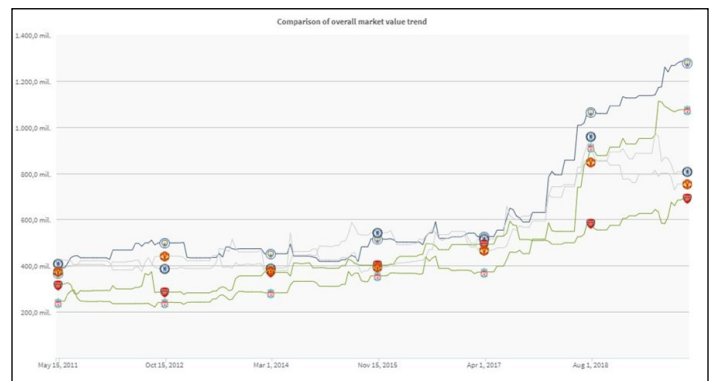
Source: Transfermarkt

Comparison of 3rd and 4th regression:

In both cases, the p-value of coefficients is less than 5%, this implies that the coefficients are statistically efficient. When we compare the R square in both cases, we see that in the case of the top 5 teams, the R square suddenly falls to 20% from 34%. This indicates that there are more factors influencing the top 5 teams than the bottom 5 teams.

This is in line with our objective of proving how other variables also have an impact on the net-worth of a club. The variables which we discuss in the following section are of various types but we can create a distinction between them. For example, the squad value of the top teams adds to the merchandise sales since fans are more likely to buy the jerseys of players who are renowned. Higher squad value has been a common observation in the bigger clubs. Another example could be that of sponsorship deals. Bigger clubs are more likely to get huge sponsorship deals and the difference is very high if compared to the bottom half of the teams. This variation in the R square can be explained by these variables which are to be considered thoroughly in the later section.

Table 12: *Comparing R square of all the regressions*

Regression	1	2	3	4
R square	49	77	34	20

Note: Adjusted R square has been taken in the second regression since it has two independent variables as compared to one in the rest.

Source: Author's calculations

This gives us a summary of the differences in R squared when we took different dependent and independent variables. Keeping all these differences in mind, we move on to the next section where we discuss the other variables affecting net-worth.

9. FACTORS WHICH AFFECT NET WORTH APART FROM ON-FIELD PERFORMANCE

Prestige
Prestige of a football club refers to its past achievements, fanbase, popularity and 'reputation'. Prestige acts as a stabiliser of the brand value in the sense that if a team has one bad year of on-field performance, the prestige of a team softens the impact on its brand value because of the goodwill that it has built with its supporters and in the market, with the shareholders, through better performances over the past few years. Similarly, prestige will also prevent over-shooting up of a team's brand value on the back of only a short spell of success on-field. This can be seen in the example of Leicester City who won the Premier League unexpectedly in 2016. While their net worth increased, it was also kept in check by their historical achievements and likelihood of such an event to occur again.

Prestige is also interlinked with one of the following reasons: player value. For a player in the market who is looking to switch clubs, prestige is of great importance. Prestige, combined with squad potential, can often lead to players choosing clubs with worse on-field performance

Figure 3: *Factors which affect net worth apart from on-field performance*
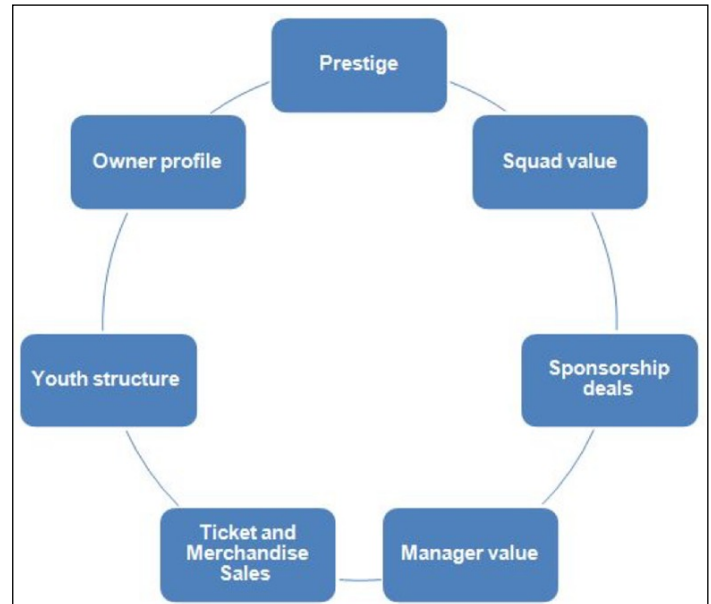
in the immediate past over clubs who performed well in the immediate past but do not have a bigger reputation.

Two prime examples of this are Paul Pogba's transfer from Juventus to Manchester United, despite the lack of Champions League football at Manchester United and N'Golo Kante's transfer from Leicester City to Chelsea, despite Leicester winning the Premier League title and Chelsea finishing as low as 10th in the table. Player value, in turn, affects the net worth and brand value which is explored later.

Squad Value
The cumulative value of the players is a psychological factor for the investors and the market in general as it represents the potential of the team to perform and win trophies. If prestige keeps an eye on the past, then the squad value keeps an eye on the future and the prospective on-field performance in the near future. The players are the key assets of the club and thus, it becomes necessary to host the best possible talent for any club with respect to its wage-bill and prestige capacity.

The value of a player doesn't solely rely on his on-field performance but also on age, nationality, position, contracts, media presence, etc. The sale and acquisition of players also act as a litmus test for the club's administration since it checks whether the best possible players are being recruited or not. It acts as a major mood-defining factor at the start of the season and majorly affects not only the on-field performance but also the morale and motivation of the players, fans and this can easily get converted into investor sentiment.

Sponsorship Deals

Sponsorship deals affect football teams the same way they would affect any other commercial entity. Being the most popular sport in the world has its benefits with big brands constantly looking to associate themselves with football clubs in an effort to increase their own brand's visibility. In a simple chain, sponsorship deals increase the club's revenue which, in turn, raise the wage bill capacity and transfer fee budget. This attracts better players which increases the squad value and ideally, on-field performance along with the brand value, net worth, investor sentiment and market position. The increase in revenue also reflects well in the year-end financial records of the club which reinforces trust in the commercial side of the club if not the on-field side.

Along with the sponsorship deals, another major factor which affects the net worth via its revenue is the television broadcasting rights deal. The Premier League has a bumper TV rights deal worth more than 5 billion currently. The impact of this can be seen on-field as well visa-vis the promoted teams who are unable to compete and often find themselves immediately relegated the following season because they do not have the spending power to compete in the premier league which can be largely put down to the two previous major TV rights deals.

Manager Value

Similar to squad and player value, the manager value represents on-field optimism which can have a positive effect on the brand value of the club. The manager is responsible not only for the on-field performance but also deals with the media on a regular basis and is thus responsible for the image of the club. Managers also often foray into the administrative aspects of the club, those which they think will help improve on-field performance. Therefore, a manager is also symbolic of the administrative structure of the club which is an important factor from the eyes of an investor.

A factor that is interlinked with manager value is squad value. Marquee managers attract better players who want to work with specific managers. This has a secondary positive effect on the brand value since it increases squad value and improves the on-field prospects of the club.

A good representation of the importance of manager value can be seen in the case of Arsenal, where the club was shrouded in a negative blanket towards the end of Arsene Wenger's long reign as the manager. Post his departure, Arsenal's net worth jumped from 499 million dollars to 625.5 million dollars in one year despite a negligible improvement in the on-field performance. In comparison, their net worth had increased by a mere 7 million dollars in the final year under his management.

Ticket And Merchandise Sales

Tickets and Merchandise sales signify the core revenue stream of the club. These two specific revenue streams have also been chosen because they are a measure of the fan sentiment and the public perception of the club. Why is it necessary to showcase this aspect? For any commercial organisation, customer satisfaction is one of the prime determinants of growth. Fans are the end consumers of the football team's 'product' and their level of satisfaction is a direct representation of how well they are able to achieve their end goals.

While fan sentiment is linked deeply with the trophies won and on-field performance, it is also representative of the quality of football being played and how well the club is run. It is not only a quantitative assessment but also a qualitative evaluation by the end consumers. If fans aren't satisfied with the club then they will often not turn up to matches as shown by AC Milan fans in recent years and they will also 'protest' by not purchasing club merchandise as a symbolic gesture of discontentment as taken up recently by Arsenal fans.

The revenue aspect of ticket and merchandise sales is portrayed well by Tottenham Hotspur, who have recently moved into a much larger stadium which boasts the largest retail merchandise store across Europe of any football team. Both of these investments have led to a higher expected revenue resulting in the purchase of Tanguy Ndombele and Giovanni lo Celso at high transfer fees. In context, Tottenham had not signed a single player in the two transfer windows preceding their shift to the new stadium.

Youth Structure

All of the above-mentioned factors look at the club from the perspective of the investors, fans, or the general public. However, there is one key stakeholder whose opinion also needs to be factored in - the players. More specifically, up and coming players who need to make a decision about which club to join. Player value, which positively affects the brand value, is highly volatile and can easily grow worth several million within a single year. Thus, it becomes important for a club to be viewed positively by players. More so by fresh talent because if identified at an early age, talent acquisition is cheap. However, the more renowned a player becomes, the more he will cost. So, early talent acquisition and developing players become one of the assured ways of increasing squad value and in turn, the brand value.

However, the question remains - what makes a club lucrative to youth players? The prestige and current team certainly factor in as all youngsters want to go and win trophies. A young player will also look at the number and

quality of opportunities that he will get at a club for his personal growth. Big clubs have a lot of pressure to perform well so they cannot always put their trust in the youth and therefore, frequently rely on big-money transfers and experienced heads. Thus, several promising players go to tier-2 or tier-3 clubs at the start of their professional career and make the step-up to the best clubs later in their career when they are more experienced and accustomed to the pressure. This presents a revenue-generating opportunity for the smaller clubs who can consider players as assets which are bought at a low rate and sold when their market value is maximum.

Southampton is a classic case of the above. Their academy is renowned across Europe, producing top-level talents such as Gareth Bale and Alex Oxlade-Chamberlain while also having one of the finest scouting systems. This scouting system has led them to make major profits off player sales such as Sadio Mane, Virgil van Dijk, and Adam Lallana who were bought for a low price and sold at a very high rate relatively. Southampton earned a net 74.13 million euros from 2014-15 till 2017-18 solely through the transfer market, showing the shrewdness with which they operate.

Owner Profile

Owners here refer to the majority of stakeholders in the football club. The owners of a club aren't directly involved with the running but they control the financials and thus exude control over the players in terms of wage-bill capacity and transfer fees along with bonuses and other incentives. Owner profile also affects the public image and maintain healthy relations with fans.

Some owners spend lavishly into the club, often circumventing financial rules of regulatory bodies to do so. They're well-loved by their clubs' fans but loathed by the general media such as the Middle-Eastern Sheikh owners of Manchester City and Paris Saint-Germain who transformed the clubs from mid-table sides to European powerhouses. On the other hand, there are owners who are in it purely for the financial benefits and are loathed by fans and media alike. Newcastle United's Mike Ashley and Arsenal's Stan Kroenke would fall under this category. A lack of cordiality between owners and fans casts a negative cloud over the club and affects the brand value similarly but only when things sour beyond a certain point will the owner profile be questioned by the shareholders and the market.

10. MANCHESTER UNITED - A CASE STUDY

Manchester United is one of the biggest clubs in the world. It was established as Newton Heath Football Club in 1878, before changing its name to Manchester United in 1902 and moving to their current stadium, Old Trafford, in 1910. Historically, United have been the leaders in British football, winning a record 20 Premier League titles, 3 European Cups (champions leagues), 12 FA Cups, 5 League Cups, and a record 21 Community Shields along with one Europa League and FIFA Club World Cup each.

Why has Manchester United been taken up as a case study? United's success has largely come in two distinct sustained time periods under two managers - Matt Busby and Sir Alex Ferguson. After the first such period under Matt Busby, the club lost its position as the biggest club of the country. The on-field performance waned, they found it hard to attract top-level talent, the quality of managers went down, and as a whole, the brand value of Manchester United reduced. After Ferguson's retirement in 2013, a similar downturn was expected and while on-field performance has degraded, the off-field brand value has increased at the same pace if not at a higher one. Thus, we have chosen Manchester United as our case study to explore the reasons as to why their on-field performance hasn't affected the commercial side of the club and how have they have managed to create a sustainable brand which can perform even when the core goals of the organisation are not being achieved.

Prestige

In Manchester United's case, prestige plays an important role as it has kept the brand value intact despite a fall in the on-field performance post-2013. Manchester United has high prestige because of a dominant period from 1990 onwards in English football wherein they won 13 Premier League titles, 2 Champions League victories, and 5 FA Cup triumphs till 2013. This ultra-successful period, amongst other factors, has ensured that the lack of trophies since has not led to a decrease in the market value of the club but prestige can only count for so much and the most recent data in 2019 shows that this effect is wearing off because of a sustained spell of poor on-field performance.

Squad Value

For Manchester United, the purchase of Paul Pogba and Zlatan Ibrahimovic in the summer of 2016 and later Romelu Lukaku in 2017, combined with the appointment of marquee manager Jose Mourinho, represented positive market activities which are also reflected in an upturn in brand value trends from 2017 to 2018 even if the results did not improve as much as expected. The following table represents the data of net worth and squad value over the past few years of Manchester United.

Table 13: Comparison of net-worth and squad value of Manchester United

Period	squad value	net worth
2012	398.25	374.7
2013	456	418.5
2014	511.75	378.5
2015	522.4	425
2016	374.15	418.25
2017	533.25	469
2018	645.1	750.5
2019	833	796

Note: Correlation calculated between squad value and net-worth is 0.894092

Figure 4: Squad value and net-worth of Manchester United over time
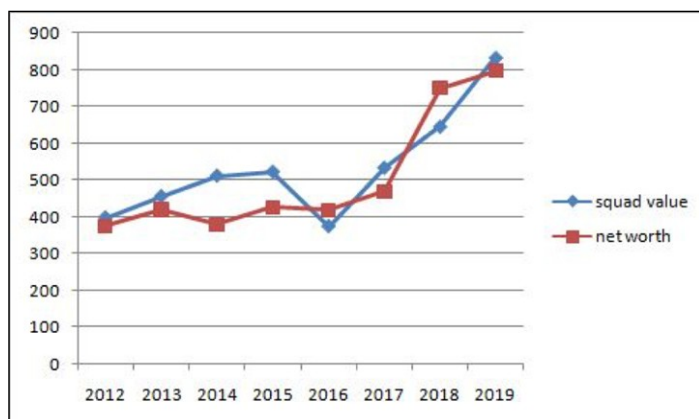
Source: Transfermarkt

Sponsorship Deals

For Manchester United, sponsorship deals have perhaps been the strongest driver of commercial growth in the last few years. In 2018, Manchester United earned 269 million euros in sponsorship deals, the highest in the world with Barcelona being the only other team which earned more than 200 million euros. United has a very organised structure, with sponsors being divided into four groups - Global, Regional, Financial, and Media. They had a whopping 68 in 2018, with partner titles ranging from shirt sponsors to pillow partners. Despite gaining much flak for how he has handled the football side of affairs, Ed Woodward, the CEO of Manchester United FC, has undoubtedly completely exploited the brand that is Manchester United to increase the revenue inflow from off-field sources.

Manager Value

The manager value was perhaps most pungently felt by Manchester United after 2013 when Sir Alex Ferguson retired and was replaced by David Moyes. The departure of Ferguson did not only lead to poor off-field performance but also led to negative changes in the administrative performance of the club and falls in player value. Further, Ferguson's successor Moyes, who wasn't a marquee manager, found it hard to attract with only two signings to his name in two transfer windows. Thus, the net worth fell after his year in charge. Moyes' successor Louis van Gaal, an experienced and successful manager, was able to attract better talent in the form of Angel di Maria and Memphis Depay amongst others but the on-field performance barely improved and he too was sacked after two years at the helm. Post his departure, he has revealed about his clashes with the administration and the lack of support which highlights the lack of organisational discipline within the club. The significance of manager value can be observed at the time of the hiring of Jose Mourinho, one of the most successful managers of all time and an enigmatic character, who attracted the most sought after players such as Paul Pogba, Zlatan Ibrahimovic, Romelu Lukaku, and Fred to the club.

The appointment of Jose Mourinho along with the signings of the above-mentioned players led to an increase in the net worth and is reflected in the share value which peaked under his tenure. His sacking in late 2018, preceded by a tumultuous relationship with the club administration, portrayed the club in a negative light in the media. Rumours regarding a change of ownership surrounded the club at the time. Thus, the case of Manchester United truly shows the importance of the manager on the off-field image and market position of the club.

Ticket And Merchandise Sales

Manchester United's ticket and merchandise sales have been constantly high and are growing at a rapid rate. This is largely due to the global reach of the club and the sheer amount of fans that the club has. The fanbase has been supportive of the team even when the performance has been poor and this has supported the club's off-field growth.

Youth Structure

Manchester United's youth structure has been a strong characteristic of the club historically. It has been one of the few bright spots even in their recent troubles. Promising talent often prefers United because there is a culture of giving youngsters a chance. Manchester United have had an academy graduate in their matchday squad for 3,990 consecutive matches, a streak which goes back over 80 years. The culture continues with 11 academy graduates already being used in the 2019-20 season in 15 matches. Thus, Manchester United stays as an attractive place for players which has a positive effect on the brand value.

Owner Value

The majority stakeholders in Manchester United are the Glazers, an American family of businessmen who owned sporting teams in the USA before diverging into European football. The Glazers aren't popular with United's fan base because they have led the club into debt worth over 200 million pounds, having received it debt-free. Further, fans raise questions over their devotion to the club and abilities of running it efficiently because of a lack of sporting director in the boardroom which is a common practice in top clubs. The effect of this has been cancelled out by the factors mentioned above and thus, has not had a negative impact on the market value of the club.

11. CONCLUSION

From the data analysis we can see that a P-value of close to 0 signifies that the number of wins in a season is relevant to a club's net worth. However, the R-squared value shows that the number of wins can only explain 49% of the increase in net worth. This, however, increases to almost 80% when time is factored in. This happens because several of the factors that we explore in the paper such as squad value, sponsorship deals, etc tend to increase with time and thus, help in explaining the increase in net worth along with the number of wins. However, 20% of the net worth increase still remains unexplained after factoring in time. Here, we can see the importance of non-quantifiable factors such as prestige, youth structure, manager value, etc which can help explain the remaining portion of net worth changes.

The case study of Manchester United reinforces the findings, showcasing that the extent of the impact of the on-field performance on the net worth of the club can be minimised if the commercial side is run well. Blockbuster sponsorship deals, eye-watering player transfers, and a very high prestige value are key factors in explaining why the Manchester United brand has continued to grow post-2013 when their results started declining. Within the case study, a small correlation between the squad value and net worth exhibits how important the players are to a club's net worth with a very high correlation of 0.89 (approximately) between the two variables.

In conclusion, we can say that the hypothesis has been verified and that the findings of the research paper show that other factors limit the impact of on-field performance on the net worth of a football club.

What can we infer from the results highlighted above? For starters, cultural context can be given to these results by evaluating them with respect to the Indian football scenario. Indian clubs do not devote sufficient time and resources to build their prestige, fanbase, and youth structure which all contribute to the club's brand value. Clubs like Manchester United spend lavishly to make sure that their fans are never dissatisfied with the off-field structure. For example, when Manchester United played FC Rostov away in Russia in 2017 in the Europa League, the club bore the visa fees of all travelling fans of almost 120 pounds per fan to make sure that the fans found it financially feasible to support the club. Indian club owners are often criticised for being overly money-oriented. They also often lose sight of the end goal of the development of the game.

This brings us to the second implication - the rapid commercialisation of the sport can lead to a change in the priorities of the club's administration. This effect can be seen very clearly in the case of Manchester United where, one of the biggest clubs in the world is struggling to compete at the highest level. This is in part due to the lackadaisical approach of the club administration which has seen that it can exploit the brand commercially even without the on-field results. This has been criticised by former manager Louis van Gaal along with several former players like Ander Herrera, Gary Neville, etc., who have been deeply involved with the club and have genuine insider knowledge. Thus, a question arises over where the sport is headed and whether this commodification will help it or not.

Another question that arises after this paper is whether this commercialisation and astronomical numbers are deserved or not? Is the football industry turning into another bubble which might burst at any point? Take, for example, the transfer of Neymar from Barcelona to PSG for a whopping 220 million euros. The question of allocation of resources arises here. To give context, ISRO's Chandrayaan-2 mission cost approximately 125 million euros. Surely, a footballer doesn't justify that price tag.

One thing is for sure that the football market will continue to grow in the coming years, especially in India given the scope for expansion. It is to be seen whether Indian clubs will be able to capture the market or will the march of European clubs squash the budding Indian football industry.

ACKNOWLEDGEMENTS

REFERENCES

1. *The European Elite.* KPMG, 2016-2019.

2. *UK Annual Review of Football Finance.* Deloitte, 2019.

3. *UK Annual Review of Football Finance.* Deloitte, 2017-2019.

CARE WORK- ANALYSING THE INDIAN UNPAID CARE ECONOMY

SAMRIDHI TRIPATHI

Ramjas College, University of Delhi

1. INTRODUCTION

According to Business Line, Care work and care economy is a system of activities in relationships involved in meeting the physical, emotional, and psychological aspects of care. Care work can be direct or indirect, paid or unpaid, short term or long term. This kind of work is not restricted to any particular field as well. Paid work like nannies for small children and housemaids etc. or caretaker of disabled people and the elderly come under long term as well as short term work and is dominated by the female population.

On the other hand, unpaid care work consists of work done by an individual relating to the care of other individuals, which in no way is accounted for and they are definitely not paid for it. This kind of work is mostly seen to be done in the households, and again, is predominantly done by the women in the households.

Even outside the house, in the agriculture sector or labour-intensive areas, significant work is done by a woman which is not accounted for and they don't get any payment for it. A stark difference is noted here, between the jobs done by men in similar fields as women outside the household, for which they are paid. Moreover, that job is considered to be work. It should be noted that globally, women do 3.2 times more unpaid work than men.

2. HISTORY OF UNPAID WORK

All over the world, after economists James Meade and Richard Stone came up with national income accounting which later came to be known as a country's Gross Domestic Product (GDP), a problem was discovered in this system as it did not include the economic value of preparing and cooking food, collecting firewood, cleaning the household, taking care of children, etc. This was pointed out at the time by a woman named Phyllis Deane, hired by Meade and Stone themselves. This was mainly because all these jobs were commonly viewed as women's work.

Nearly 80 years later, we have still chosen to not include these activities in our National Income Accounts. Various

South Asian and African nations where women do a lot of work in the fields and their houses do not get proper representation for their work.

3. INDIA

India has a large labour force consisting of both men and women. Apart from being in the paid labour force, a very large number of these women are not represented for the work that they do, as mentioned earlier. These women work in the household for a major portion of their day and are not acknowledged for the same.

Figure 1: *Unpaid work per day done by women in comparison to men*
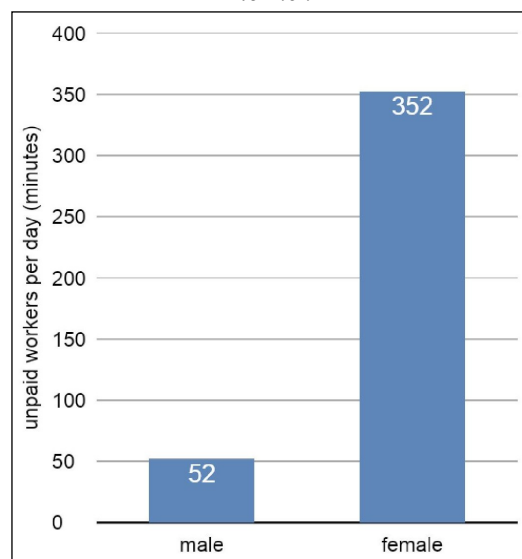
Source: Organisation for Economic Co-operation and Development (OECD)

This is the case for both working and non-working women. A study conducted by A. Sengupta for both rural and urban households in a district of West Bengal shows how the unpaid labour hours for women exceeds that of men by a large number. The female unpaid work hours for both rural and urban are very high as compared to their male counterparts. This shows how education, as well as employment, do not play a definitive role in the portion of unpaid work done by women in a household.

The major reason behind this would be the increasing gender inequality and deep-rooted patriarchal system of our society. It is believed that men are not supposed to contribute to the household work as they are the primary breadwinners. Despite the importance of a woman's role in household work, she is not considered to be working. This leads to a fall in productivity of women as well. Their economic development is not taken into consideration, and they remain unrepresented.

According to ILO, women do four times more unpaid care work than men in Asia. In India, men only perform 31 minutes of unpaid care work, amongst the lowest in the world.

4. COMPARISON: THEN AND NOW

In 1998-99, when the first and only Time-use Survey until now was conducted for India, the ratio of female to male unpaid work hours was 17.78. Average hours spent by women on total work is 69.03 hours, and that of men is 62.71 hours per week.

Figure 2: Female to male ratio of unpaid care work hours
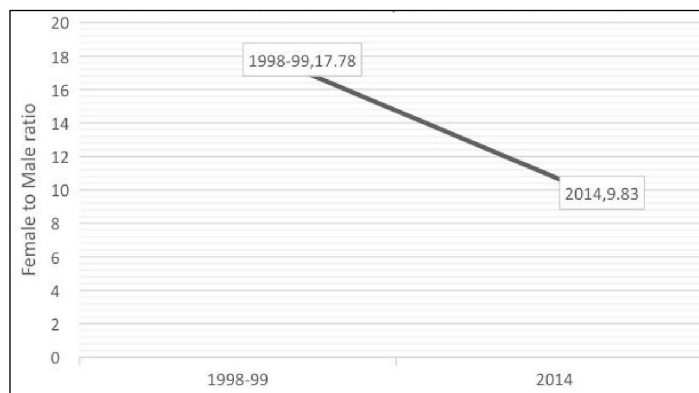
Source: Data by OECD and National TUS Survey

Women's unpaid work hours including all household work and care activities of children and the elderly added up to 33.43 hours a week. And the same for men was merely 1.88 hours. This shows the vast disparity between men and women during the time. Even with the advancement of our economy in the many years after this, the situation has not improved much. Men are still not sharing the burden of this unpaid work with women. Women continue to work more than men, due to the additional unpaid work which is so much more than the paid as well as the unpaid work done by men. As shown above, the female to male ratio for unpaid work hours in 2014 is 9.83. Per 100 hours of unpaid work done by men, women do 980 hours of unpaid work. Furthermore, the average hours worked by women at home in both rural and urban households according to the research of a particular area, that is a district in West Bengal, in 2016, according to the survey done by A. Sengupta, give us a glimpse into how

this inequality still persists. It also shows that educational qualifications do not affect the number of hours spent doing unpaid work by women. The difference is minimal. This comparison brings to light that the decline in female work hours in unpaid work is not as much as it should have been in the last sixteen years. The position of women has not changed much since then in our country.

5. UNPAID WORK AND GDP

The amount of unpaid work done by women is so much that a parallel cannot be drawn between it and the same work done by men. But the huge amount of hours that have been given by the women in the country can help our economy develop in a better way than before. This is because almost a major part of the unpaid labour force makes up women and these women also make up an important part of the county as well as the economy. In recent times, the importance of care work has increased. It is expected that by 2030, 2.3 billion people would need care work in the world. At this rate, we need to start investing more in the care economy and since it already is a major portion of the labour force, it will boost our economic development.. The value of unpaid work globally is 9% of the global GDP. It becomes all the more important for us to divert our focus on these labour hours. Countries will soon have to invest more in this sector, this shows how important a role it plays, and the fact that it has been ignored for too long.

6. A STEP TOWARDS CHANGE: URUGUAY

In Uruguay, South America, the government came up with its Care Act in 2016. It has been stated as a model for care work in the future, according to ILO news. The UN Women and UNFPA conducted surveys in the country which showed the difference between men and women's share of paid and unpaid work in a week. It showed how only one-third of the week is given to paid work by women and two-third of it to unpaid work.

The main aim for this was to promote childcare and help the elderly, via which more women can be entered into the labour market. An in-depth analysis of this inclusion led to a conclusion that this may lead to the betterment of those who are already better off, but in turn, it also prevents the middle class to opt out of the public services. Moreover, a lot of unemployed women could start working in a manner comfortable to them. This has helped in creating new services in the care sector.

The rise of care services and the loss of work hours of women propelled this change in the care sector. Women have been given a chance to work in the care sector with paid jobs and this can lead to a better chance for them to

support their living and give themselves representation.

Similarly, in Costa Rica, an integrated care system in their healthcare sector is present.

7. CONCLUSION

In the coming years, an investment in the GDP of our economy by 2 per cent of our GDP could create 11 million jobs and 32.5 per cent of these jobs would be done by women, as mentioned in a report by International Trade Union Confederation, 2019. Such large implications to our economy should not be ignored for long. The government of India is working towards this aim as well, with a planned Time-use survey in 2019, with its first report coming out in May-June, 2020. This would give us a plethora of information and updates on the condition of paid and unpaid labour in the country.

The demand for care work in the world is going to surge by 2030 and the world could soon face a care crisis. This calls for a more active response by countries, like Uruguay, which has already taken steps to facilitate the growth of the care economy and reduce the unpaid labour hours of women.

Adding unpaid labour hours spent by women in the GDP of our country would not only give them representation in the economy but also bridge the gap between males and females in work disparity. It would lead to an advancement of women's economic as well as social standing. It would also result in a change in the societal perspective of women. Men would be encouraged to help in household work, and this would allow more women to invest in their development, thus strengthening the public policy of a county.

REFERENCES

1. *2019 ITUC Global Rights Index,* International Trade Union Confederation (Belgium, 2019)

2. Addati, Laura. *Care Work and Care Jobs for the Future of Decent Work,* International Labour Organisation

3. Amarante, Verónica, Maire Colacce, and Victoria Tenenbaum. National Care System In Uruguay: Who Benefits And Who Pays?, WIDER Working Paper 2017/2 Helsinki: UNU-WIDER, 2017.

4. Anindita Sengupta. "Measurement of Unpaid Household Work of Women in India: A Case Study of Hooghly District of West Bengal." (working paper, 34th IARIW General Conference, Dresden, Germany, 2016).

5. Central Statistical Organisation (CSO). India - Time use survey. 1998-99

6. *Gender, Institutions and Development Database.* Distributed by OECD

AGRICULTURE AND SECTORAL INTER-LINKAGE IN TIMES OF GLOBALISATION - A CRITICAL EVALUATION

ABHIGAYAN ADHIKARY*, PRIYANKA MAZUMDER and AMRITA BASU

St. Xavier's College (Autonomous), Kolkata

Abstract

The aim of this paper is to describe a static and dual economic model which is also open. We attempt to explain the nature of sectoral inter-linkage in a dual economy in light of globalisation and liberalisation and put forward a simple framework which discusses the agricultural-industrial inter-linkage in an open economy. We have considered the situation where industrial production is demand driven and food prices adjust to clear the market. The main objective of the paper is to show that better performance of the agricultural sector has a strong positive effect in generating growth and employment in the industrial sector.

1. INTRODUCTION

India is predominantly an agrarian economy because of high share of agriculture in employment and livelihood creation. The agricultural sector accounts for nearly 50% of the employment opportunities and 1/3rd of the GDP in the Indian Economy. Empirical evidence confirms the existence of strong inter-linkages between the agricultural sector and all the other sectors including the industrial sector. The linkages have been extensively investigated in development literature. In early analyses agriculture was assumed to play the role of providing raw materials, food and labour for the development of the industrial sector. In subsequent analyses, inter-sectoral linkages both from the demand and supply side have gained prominence.

After the green revolution bumper production of some crops occurred mainly due to hybrid seeds, fertilisers, machinery etc. The positive impact of the new agricultural strategy ran in terms of converting India to a net exporter of food through higher food production from a net importer of food grain primarily due to higher agricultural productivity per hectare. After the reforms of 1991 and the WTO provisions, the agricultural sector was opened due to trade liberalisation. Thus due to gradual export orientation, our agricultural goods started finding markets abroad. Data shows that the share of agriculture and allied goods account for one-fifth of the total export earnings in India. The industrial sector, however, is import-dependent in India. The greater availability of foreign exchange through agricultural export has helped in the import of machinery. This has stimulated the industrial production and increased employment opportunity in the industrial sector. More employment has led to poverty reduction and improvement in the social sector (health and education) and has also reduced regional and other disparities.

Hence keeping in mind the present scenario, in light of Globalisation Reforms of 1991, we consider a labour surplus economy similar to Rakshit (1982) and augment it with an open economy approach. In this model, we will explain the working of the agricultural sector in shaping macroeconomic development in developing countries. There is no gainsaying that openness, agricultural export and industrial employment are highly interconnected. The dual economic model constructed in the paper may be applicable to a large class of emerging economies. The agricultural output is not only used for domestic purposes, but the surplus is also exported. The agricultural sector is characterised by flexible prices and market-clearing wage rate. On the other hand, the industrial sec-

---

* *Corresponding author's email address: abhigayan1999@gmail.com*

tor is demand-driven.

The paper can be categorised in the following sections. Section II deals with literature review, Section III explains the working of the model, Section IV discusses the comparative statics and section V serves as a conclusion and provides a detailed summary of the findings.

2. LITERATURE REVIEW

The emphasis on analysing prioritised sectors and studying the interlinkages across sectors rather than studying them in isolation has assumed significance from Hirschman's Theory of 'Unbalanced Growth'. The theory primarily states that the sectors with the maximum linkages can stimulate a rapid growth of production, employment and income. Economists have now realised that the study of these interlinkages in an economy can serve as a major guideline for framing relevant policies for accelerating the process of growth and development.

In developing countries like India, the symbiotic relationship and mutual interdependence between the agricultural and the industrial sectors can be considered as a driving force for the process of development. There exist several works of literature on the topic of sectoral inter-linkages between the agricultural and the industrial sectors. They often emphasise on how strong sectoral inter-linkages ultimately prove to be beneficial for both the sectors as good performance in one sector causes better performance in the other.

Dilip Saikia (2011) says that even though India has seen exponential growth in the service sector and the contribution of the agricultural sector towards the Gross Domestic Output has seen a fall in the past decades, it need not necessarily imply that the sector has no meaningful implication for India's economic growth and industrialisation. Even now, the agriculture sector accounts for approximately one-fifth of national income and supports more than 52% of the population in the country. Though the "agriculture-industry" linkage has been deteriorating over the years, it still plays an important role in determining the overall growth of the economy.

Jorn Rattso and Ragnar Torvik (2003) gave the example of how Sub-Saharan Africa adopted a policy of heavy taxation on agriculture and used it to boost industrialisation. However, this policy fell flat on its face as the much-promised industrialisation did not take place and both sectors suffered; further affirming our belief that a strong agricultural sector is essential for better performance of the industrial sector.

Agriculture and industry are integral components of the development process due to their mutual interdependence and symbiotic relationship. The contribution of agriculture in general, and industry, in particular, is well known in almost all developing countries. This interdependence may vary over time. According to empirical literature this inter-relationship has been discussed from various channels. This linkage becomes stronger as the technology of agricultural production improves. Rangarajan (1982) mentions that the linkage will be weakened if the agricultural inputs used in industries are exported from abroad instead of being domestically processed. An upsurge of production in the agricultural sector improves government savings which may be reflected in higher public investment boosting the production in the capital goods industries. Ahluwalia (1986) and Rangarajan (1982) also describe how the fluctuations in agricultural production may affect profitability due to the impact of the terms of trade. These linkages present the potential capacity of each sector to stimulate other sectors. Rangarajan (1982) also found that a 1 per cent growth in agricultural production can bring about a 0.5 per cent increase in industrial production.

Satyasai and Baidyanathan (1997) reflects on the close relationship between the agricultural and industrial sector due to the agro-based industrial structure. They found that the output elasticity of industry with respect to the output of the agricultural sector during 1950-51 to 1965-66 was 0.13. According to Rangarajan (1982), Bhattacharya and Rao (1986) describe the cause of deteriorating linkages between agriculture and industry is the decline in demand for agricultural product coupled with a dwindling share of agro-based industries and slow growth in employment. Sastry et al (2003), Chowdhury and Chowdhury (1995) found an increase in the backward production linkages between these two sectors and a decline in the forward production linkage. They also found a significant impact of agricultural output on industrial output and the fact that the industry's demand linkage to agriculture has increased.

Ahluwalia (1985) argued that it was poor infrastructure and poor productivity performances during the mid-sixties and not the wage good constraint that acted as supply constraints to the industrial growth.

Although we have referred to the papers above, our model is independent of the aforementioned papers. We have drawn references from these papers only, our model uses other mechanisms and arrives at a different conclusion about the role played by sectoral inter-linkages and how Globalisation affects the agricultural sector.

The Lewisian "two-sector" growth model emphasised on the crucial role of capitalist surplus in the development

process. His model suggested how cheap surplus labour speeds up capital accumulation and leads to high productive growth in the modern sector. Lewis (1954) largely stressed on the quantitative growth in the savings rate and income distribution in favour of the saving class. Fei and Ranis (1961) stressed on the 'balanced-agricultural-industrial growth' path as a successful development strategy. Kuznets (1968) revealed that technological advancement can bring about improvement in agricultural as well as industrial production. He stressed on how agricultural productivity was an indispensable base of growth.

Thus, the theoretical literature has broadly highlighted 'agriculture-industry' linkages and the contribution of agriculture, non-agriculture and the industrial sector in augmenting output and employment growth. At this juncture, it is important to note that although we have drawn inspirations from the aforementioned papers, the model presented in the following section has been developed independently of the sources mentioned above.

3. THE MODEL

3.1. Assumptions

i. The economy has a given labour force. There is no mobility of labour between the agricultural and industrial sectors due to differences in skill requirements.

ii. The agricultural sector uses fertilisers distributed by the Government at an administered price.

iii. Labour Supply is perfectly inelastic in the agricultural sector (fixed at $\overline{L_X}$)

iv. The Agricultural Sector produces one output i.e. food, which is sold in both the domestic and international markets. We assume a fixed exchange rate in this model.

v. The industrial output is demand determined. So, we consider a perfectly elastic aggregate supply curve.

vi. While the wage rate in the agricultural sector is market-clearing, wage in the industrial sector is partially indexed to the food price due to the existence of trade unions.

vii. The price of the industrial output follows the Kaleckian markup technique.

We define the following symbols to be used in the representation of our model

X = Output of the agricultural sector
Y = Output of the industrial sector
$L_X = \overline{L_X}$ = Labour employed in the agricultural sector

P_X = Food price
R = The amount of fertiliser supplied
T = Land acquired for agricultural purposes
λ = Productivity of land
P_R = The government administered price of fertiliser
P_T = The rental cost of land
W_X = Nominal wage of labour employed in the agricultural sector
P^* = Price of foreign goods in foreign currency
$e = \bar{e}$ = Nominal exchange rate which is assumed to be fixed
$\bar{P}$ = Minimum procurement price
G_1 = Government expenditure on agricultural product
G_2 = Government expenditure on industrial product
C_C = Marginal propensity to consume of the capitalist
P_Y = Price in the industrial sector
k = Kaleckian mark-up
L_Y = Labour employed in the industrial sector
β = Proportion of wage income spend on consumption of food by workers of both the sectors
ω = Nominal wage received by the workers in industrial sector
A = Fixed expenditure on industrial goods by landlords
I = Investment Expenditure (considered to be autonomous)
$l = \frac{L_Y}{Y}$ = Labour coefficient in the industrial sector (assumed to be fixed)
Z = Lump sum tax collected by the government (levied on the industrial sector)
γI = Investment expenditure on domestically produced capital goods
a_I = Input coefficient of the intermediate good (assumed to be fixed)
P_I = Price of the intermediate input in foreign currency

3.2. The Agricultural Sector
As we have already mentioned that our economy has a dualistic nature, we begin our discussion with the agricultural sector.

The agricultural sector produces a single output (say food) which is sold both in the domestic markets and the foreign markets. We consider the key determinants of agricultural production to be labour, fertiliser and land. The food price P_X is market-clearing. Accordingly, we define our production function as-

$$X = F(L_X, R, \lambda T), \qquad \lambda > 0 \qquad \text{(i)}$$

All the factors of production exhibit diminishing returns to factor proportions and thus, we have,

$$\frac{\partial F}{\partial L_X} > 0 , \frac{\partial^2 F}{\partial L_X{}^2} < 0$$

$$\frac{\partial F}{\partial T} > 0 , \frac{\partial^2 F}{\partial T^2} < 0$$

$$\frac{\partial F}{\partial R} > 0 , \frac{\partial^2 F}{\partial R^2} < 0$$

Profits of the landlords can be given as:

$$\pi_A = XP_X - W_X L_X - \overline{P_R}R - P_T T$$
$$\pi_A = F(L_X, R, \lambda T)P_X - W_X L_X - \overline{P_R}R - P_T T \quad \text{(from (i))} \quad \text{(ii)}$$

The optimisation conditions are as follows-

$$MP_L{}^X = \frac{W_X}{P_X} \quad \text{(iii)}$$

$$MP_R{}^X = \frac{\overline{P_R}}{P_X} \quad \text{(iv)}$$

$$MP_T{}^X = \frac{P_T}{P_X} \quad \text{(v)}$$

Factor Markets:
The labour market in the agricultural sector is perfectly competitive. Labour supply is perfectly inelastic at $L_X = \overline{L_X}$. Since the labour market is perfectly competitive, the Labour demand curve (L_d) is given by $MP_L{}^X$. Thus, we can write,

$$MP_L{}^X = L_d$$

Now we have the following figure:

Figure 1
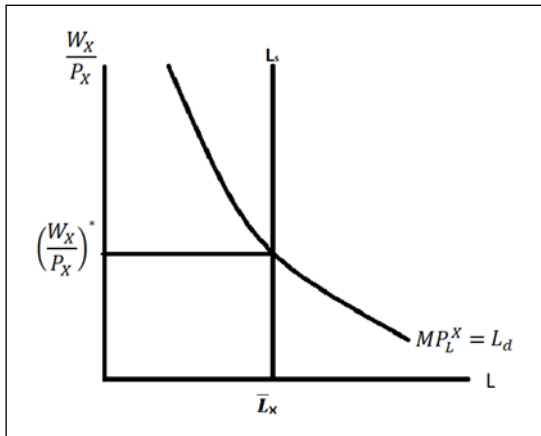
The equilibrium wage obtained is $\left(\frac{W_X}{P_X}\right)^*$ which is market-clearing.

Equilibrium in the Agricultural Sector:
We measure the market demand for food in terms of food units. Now the demand for food comes from four sources, demand from agricultural and industrial workers who spend a fixed proportion of their income (β) on consumption of food and lastly, the amount of food exported which is a function of real exchange rate $(\frac{\bar{e}P^*}{P_X})$. Here P* is the price of the foreign good in foreign currency and is assumed to be fixed. The government also demands an amount G_1 at a price $\bar{P}$.

$$X = \beta\left(\frac{W_X\overline{L_X} + \omega L_Y}{P_X}\right) + X\left(\frac{\bar{e}P^*}{P_X}\right) + \frac{\bar{P}G_1}{P_X} \quad \text{(vi)}$$

Or,

$$X = \beta\left(\frac{W_X\overline{L_X} + \omega lY}{P_X}\right) + X\left(\frac{\bar{e}P^*}{P_X}\right) + \frac{\bar{P}G_1}{P_X}$$

Which is the food market equilibrium condition.

The agricultural output is already determined, given the labour supply. Thus, from equation (vi) we determine the equilibrium food price, such that

$$P_X = f(Y, X, \omega, \bar{e}, G_1) \quad \text{(vii)}$$

Thus, primarily we observe that if industrial output (Y) rises, then the consumption demand of the industrial workers goes up, as a result of which the food price will also rise. Hence, we have

$$f_1 = \frac{\partial P_X}{\partial Y} > 0$$

Further, as the supply of food increases, prices fall, hence we get

$$f_2 = \frac{\partial P_X}{\partial X} < 0$$

As the wage of the workers rise, demand for X also rises and hence, food price rises.

$$f_3 = \frac{\partial P_X}{\partial \omega} > 0 \; ; f_4 = \frac{\partial P_X}{\partial W_X} > 0$$

Lastly as government expenditure on agricultural goods increases, food price rises.

$$f_5 = \frac{\partial P_X}{\partial G_1} > 0$$

3.3. Industrial Sector
The industrial sector is said to be demand determined. Thus, the Aggregate Supply curve is perfectly elastic in the Industrial sector.

There are two factors of production namely labour (L_Y) and an intermediate input (In) that is imported from the foreign market.

Here, we have abstracted from the real world in the sense that we have considered only two factors of production. This simplified assumption enables us to avoid algebraic complexities without affecting the economic logic of the

scenario.

The nominal wage of the industrial workers is partially indexed to food price

$$\omega = aP_X{}^\alpha;\ 0 < \alpha < 1 \tag{viii}$$

Price of the industrial output follows the Kaleckian markup pricing formula.

$$P_Y = k\left[\omega\frac{L_Y}{Y} + \bar{e}P_I a_I\right], k > 1$$

Or

$$P_Y = k[\omega l + \bar{e}P_I a_I], k > 1,\ where\ l = \frac{L_Y}{Y} \tag{ix}$$

Where k > 1 reflects the oligopolistic structure of the industrial sector.

Here, $\dfrac{\partial P_Y}{\partial P_I} = ka\bar{e} > 0$

Further, we also note that,

$$\frac{\partial \omega}{\partial P_X} = \alpha a P_X{}^{\alpha-1} > 0$$

$$\frac{\partial^2 \omega}{\partial P_X{}^2} = \alpha(\alpha - 1)aP_X{}^{\alpha-2} < 0\ (since\ 0 < \alpha < 1)$$

This clearly indicates that an increase in food price raises the wages of the industrial workers less than proportionately.

The demand for the industrial output also accrues to capitalist's consumption of output (here we relaxed the standard assumption that all profits are saved by the capitalists), the demand of industrial goods by the landlords. Here we explicitly assume that the landlords have a fixed nominal expenditure (A) on the industrial good. A proportion of the investment expenditure (γI, where $0<\gamma<1$) is on domestically produced industrial goods and the remaining $[(1-\gamma)I]$ is on foreign capital goods. Thus, the industrial profit net of tax is given by-

$$\pi_Y = (Y - \frac{\omega lY}{P_Y} - Z - \frac{\bar{e}P_I a_I Y}{P_Y}) \tag{x}$$

The aggregate demand for the industrial good is given as:

$$AD_Y = C_c\left(Y - \frac{\omega lY}{P_Y} - Z - \frac{\bar{e}P_I aY}{P_Y}\right) + \frac{A}{P_Y} + \gamma I + G_2 \tag{xi}$$

Where $0 < C_C < 1$ is the MPC of the capitalists

Here, $\dfrac{\partial AD_Y}{\partial \pi_Y} = C_c > 0$

Equilibrium In The Industrial Sector:
Since the industrial output is demand determined we have, $Y = AD_Y$

Hence,

$$Y = C_c\left(Y - \frac{\omega lY}{P_Y} - Z - \frac{\bar{e}P_I aY}{P_Y}\right) + \frac{A}{P_Y} + \gamma I + G_2 \tag{xii}$$

Or,

$$\left[1 - C_c\left(1 - \frac{\omega l}{P_Y} - \frac{\bar{e}P_I a}{P_Y}\right)\right]Y = \left(\frac{A}{P_Y} + \gamma I + G_2 - C_c Z\right)$$

We have the equilibrium value of the industrial output as:

$$Y^* = \frac{\eta_1}{\eta_2} \tag{xiii}$$

Where, $\eta_2 = \left[1 - C_c\left(1 - \dfrac{\omega l}{P_Y} - \dfrac{\bar{e}P_I a}{P_Y}\right)\right]$

And $\eta_1 = \left(\dfrac{A}{P_Y} + \gamma I + G_2 - C_c Z\right)$

Therefore, the equilibrium output can be expressed as:

$$Y = f(P_X, P_Y, P_I, \omega, I, G_2) \tag{xiv}$$

We now try to explain the partial effect of each variable on industrial output. If food price increases then the wage of industrial workers increases due to wage indexation, hence the capitalist consumption of industrial goods falls, the demand for industrial output falls too.

We now try to explain the partial effect of each variable on industrial output. If food price increases then the wage of industrial workers increases due to wage indexation, hence the capitalist consumption of industrial goods falls, the demand for industrial output falls too.

$$\mu_1 = \frac{\partial Y}{\partial P_X} < 0$$

An increase in industrial price would result in reduced demand for industrial output.

$$\mu_2 = \frac{\partial Y}{\partial P_Y} < 0$$

An increase in the wage bill of industrial workers leads to a decrease in capitalist consumption, hence the demand for industrial output decreases due to an increase in the wage rate.

$$\mu_3 = \frac{\partial Y}{\partial \omega} < 0$$

An increase in investment demand would raise the industrial output. Further, an increase in Government expenditure leads to an increase in demand in the industrial sector.

$$\mu_4 = \frac{dY}{dI} > 0$$

$$\mu_5 = \frac{\partial Y}{\partial G_2} > 0$$

Further if the price of the imported intermediate input increases then the cost of production increases and correspondingly the profit of the capitalists fall and hence the demand for the industrial output falls.

$$\mu_6 = \frac{\partial Y}{\partial P_I} = \frac{\partial Y}{\partial P_Y} \cdot \frac{\partial P_Y}{\partial P_I} = \mu_2 \frac{\partial P_Y}{\partial P_I} < 0$$

3.4. Equilibrium In The Economy:

The four endogenous variables that we aim to determine simultaneously in this model are P_X, ω, P_Y, Y. These can be obtained from equations (vi), (viii), (ix) and (xii) respectively.

Logically, it can be explained as Y rises, we observe an increase in labour employment and imported intermediate inputs in the industrial sector. Hence the workers' consumption of food increases and the food prices P_X increases. Thus, we get a positively sloped locus FF between P_X and Y representing the food market equilibrium. Solving equation (vi) for food price for each output level of the industrial sector will also generate the same.

Solving equation (xii) for industrial output level for each level of food price will generate a negatively sloping locus YY. By virtue of intuition, we observe as the price of the agricultural output increases, due to partial indexation, the wages of the workers of the industrial sector will also increase. As a result, the profit of the capitalists will fall and since the capitalists actually spend a portion of their profits in consumption of the output, the demand for the industrial output falls and this generates the negatively sloped YY curve.

The fall in profit of the capitalists is evident as shown below:

$$\pi_Y = \left(Y - \frac{\omega l Y}{P_Y} - Z - \frac{\bar{e} P_I \, aY}{P_Y}\right)$$

Replacing the values of equations, we get,

$$\pi_Y = \left(1 - \frac{1}{k}\right) Y - Z$$

$$\pi_Y = \left(1 - \frac{1}{k}\right) Y(P_X, P_Y, \omega, I, G_2, P_I) - Z$$

$$\frac{\partial \pi_Y}{\partial P_X} = \left(1 - \frac{1}{k}\right) \left[\frac{\partial Y}{\partial P_Y} \cdot \frac{\partial P_Y}{\partial P_X} + \frac{\partial Y}{\partial P_X} + \frac{\partial Y}{\partial \omega} \cdot \frac{\partial \omega}{\partial P_X}\right]$$

Now, $\frac{\partial P_Y}{\partial P_X} = kl\left(\alpha a P_X^{\alpha-1}\right) > 0$

$\frac{\partial P_Y}{\partial P_X} = kl \frac{\partial \omega}{\partial P_X}$ (since $\frac{\partial \omega}{\partial P_X} = \alpha a P_X^{\alpha-1}$)

Now we have

$$\frac{\partial \pi_Y}{\partial P_X} = \left(1 - \frac{1}{k}\right)\left[\frac{\partial Y}{\partial P_Y} \cdot kl \frac{\partial \omega}{\partial P_X} + \frac{\partial Y}{\partial P_X} + \frac{\partial Y}{\partial \omega} \cdot \frac{\partial \omega}{\partial P_X}\right]$$

$$\frac{\partial \pi_Y}{\partial P_X} = \left(1 - \frac{1}{k}\right)\left[\frac{\partial \omega}{\partial P_X} \{kl. \frac{\partial Y}{\partial P_Y} + \frac{\partial Y}{\partial \omega}\} + \frac{\partial Y}{\partial P_X}\right] \tag{xv}$$
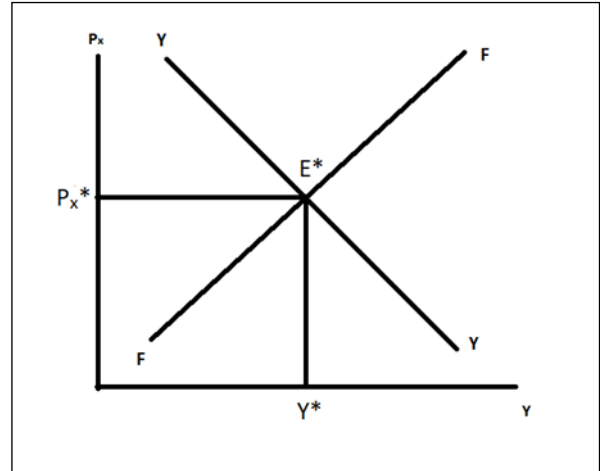
Where,

$$\frac{\partial \omega}{\partial P_X} > 0, \frac{\partial Y}{\partial P_Y} < 0, \frac{\partial Y}{\partial \omega} < 0, \frac{\partial Y}{\partial P_X} < 0, \frac{\partial G_2}{\partial P_X} = 0, \frac{\partial P_I}{\partial P_X} = 0 \, k > 0$$

Thus, $\frac{\partial \pi_Y}{\partial P_X} < 0$

Finally, we draw the two loci and obtain the equilibrium values of P_X, Y as shown in Fig 2 below.

Figure 2

FF and YY curve are shown together in the above figure. From equilibrium E* we obtain the values of $P_X{}^*$ and Y* which clears both the food market and industrial output market simultaneously. By plugging the values of $P_Y{}^*$ in equation (viii) we get ω^* and by plugging that in equation (ix), we get $P_X{}^*$ (since L_Y is determined earlier).

3.5. Balance of Payments:

To maintain the balance of trade the net exports must be equal to the net imports. In domestic currency export is given by $P_X X(\frac{\bar{e}}{P_X})$ where P_X is the food price and X represents the exportable agricultural commodity. The right-hand side of the equation gives the volume of import demanded which includes import of the intermediate good. P^* is the price of the foreign good in foreign currency and 1-λ is the proportion of investment expenditure on foreign capital good. P_I is the price of the intermediate good and a is the coefficient of intermediate import.

$$P_X X\left(\frac{\bar{e} P^*}{P_X}\right) = \bar{e} P^* (1 - \gamma) I + a_I P_I Y \tag{xvi}$$

The above equation will be stable if it satisfies the Marshall-Lerner's condition that the sum of absolute import and export elasticity should be greater than 1. If food price falls the export of agricultural good must rise more than proportionally, therefore, we find a rise in the volume of exports. To maintain the balance of payment equi-

librium Y must also rise. We get an inverse relation between industrial output and food price, that is if the price of the agricultural output falls there is an expansion in the industrial sector. This relation is graphically represented by the BB curve which is negatively sloped.

Figure 3
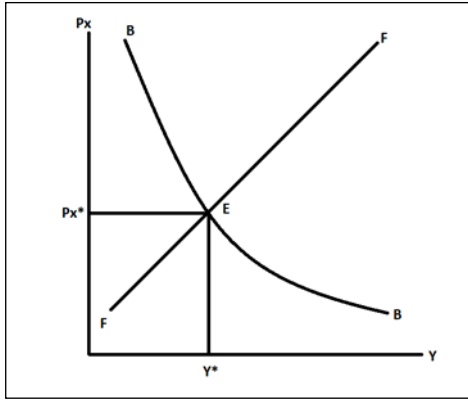
The above shows the point where the exporting sector and the foreign exchange market clears.

4. COMPARATIVE STATICS

In this section, we perform comparative static exercises to explain how the expansion of the agricultural sector, fiscal expansion and an increase in autonomous imports affects our dual economic model.

4.1. Expansion Of Agricultural Output:

We assume that food supply has increased in the agricultural sector through technological progress. The increased production of food causes food prices to fall which brings the food market to equilibrium. As a result, the FF curve shifts downwards.

As food prices fall, due to partial wage indexation of the industrial workers, the nominal wage of the industrial workforce falls less than proportionately (as discussed earlier), as a result of which the demand for capitalist consumption of the industrial output increases which results in an expansion of industrial output and the food price falls. However, it should be noted that the industrial output increases by a lesser amount as compared to a fall in the price of the agricultural output due to a less than proportionate fall in the wages of the industrial workers.

In Fig 4, E_2 corresponds to the new equilibrium denoting lower food prices and higher industrial output.

We have assumed that the factors of production in the agricultural sector are complements, hence an increase in the productivity of the land causes the $MP_L{}^X$ curve to shift outwards as shown in Fig 5. As a result, there is an increase in the real wage rate of agricultural workers. Thus,
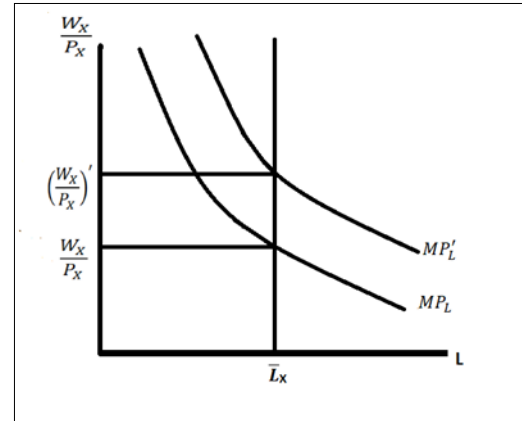
Figure 4
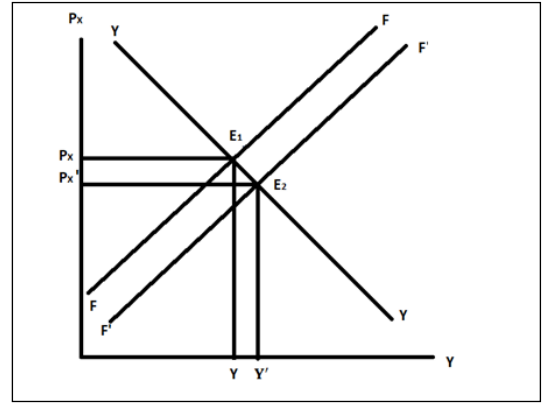
we can unambiguously conclude that agricultural workers are better off. We have already seen that

$$\frac{\partial P_Y}{\partial P_X} = kl\frac{\partial \omega}{\partial P_X} \left(since \ \frac{\partial \omega}{\partial P_X} = \alpha a P_X{}^{\alpha-1}\right)$$

This clearly implies that the real wage of the industrial workers $\left(\frac{\omega}{P_Y}\right)$ falls.
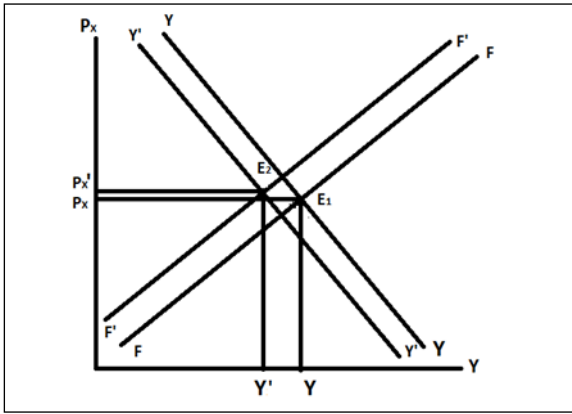
Figure 5

4.2. Fiscal Expansion

Case 1

We first assume the case that Government imposes solvency constraint $G_1 + G_2 = Z$ (FRBM Act) is binding on the government. Here G_1, G_2, Z are in terms of the industrial output. An increase in G_1 will lead to a decrease in G_2, where G_1 is government spending on agricultural output and G_2 is government spending on industrial output. At the initial equilibrium food price, an increase in G_1 results in an increase in demand for food and the price of food rises which causes a shift of the FF curve towards the left. Given solvency constraint G_2 falls which results in a shift of YY curve towards the left. In this diagram, E_1 and E_2 are our initial and final equilibria respectively.

It is worth mentioning that although our model implies industrial contraction, the effect on food price remains

ambiguous. This is because industrial contraction reduces employment which in turn reduces the demand for food. Hence, food prices would not increase as much as it would have risen for a given industrial production. Fig 6.1 and Fig 6.2 below portrays the two possible cases.

Figure 6.1

Figure 6.2
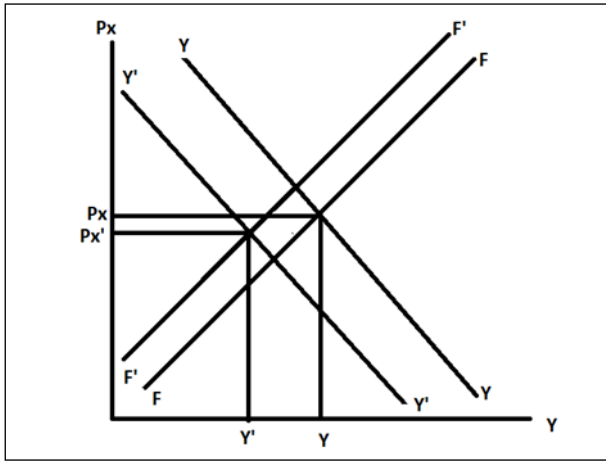
Here, we obtain interesting implications for the workers. Given an increase in G_1 the demand for the agricultural output increases which in turn increases the demand for labour and thereby leading to an increase in the real wages of the agricultural workers. However, as the effect on food price remains ambiguous, the implications for the real wage of the industrial workers also remains ambiguous.

If the net effect is an increase in the food price, then as it is already mentioned P_Y changes more than proportionately than ω and thus $\left(\frac{\omega}{P_Y}\right)$ falls. If the reverse occurs, i.e, the net effect is an increase in the food price in $\left(\frac{\omega}{P_Y}\right)$ rises and the industrial workers are better off.

Case 2:
We now take the opposite case where a rise in G_2 is accompanied by a fall in G_1. The rise in G_2 shifts the YY curve towards the right, a fall in G_1 shifts the FF curve downwards. Hence our model analyses a possibility of an

increase in Y, however, the effect on food price remains ambiguous. Given industrial expansion, there is higher employment which fuels a rise in the demand for food. Naturally, food prices will not fall as much as it would for a given industrial output. But the ambiguity still remains. Fig 7.1 and Fig 7.2 shows the two possible cases.

Figure 7.1
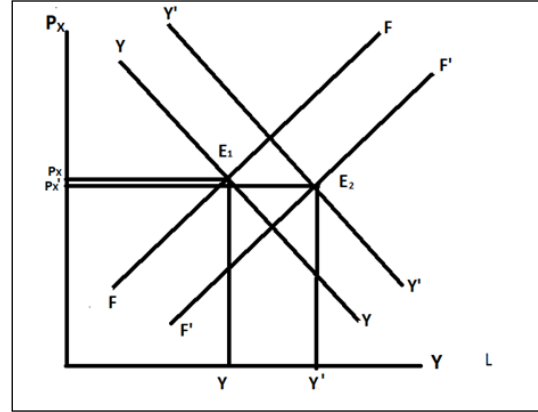
Figure 7.2
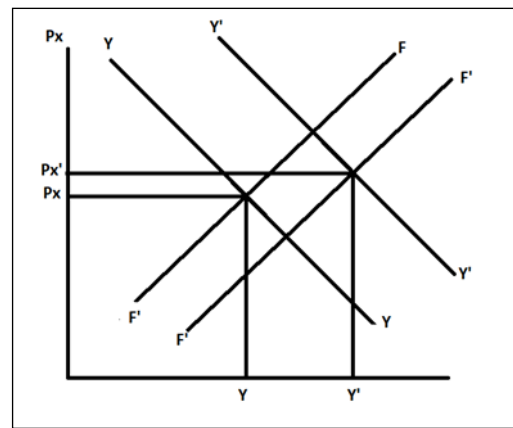
Here, as the ambiguity with respect to the effect on food price is still prevalent and we have considered the case exactly opposite to *Case I*, the implications for the welfare of the agricultural and the industrial workers would just be the reverse of that presented in *Case I*.

Case 3:
If we relax the solvency constraint of the Government, an increase in G_2 need not be followed by a fall in G_1 or vice versa. Hence, we get a new set of economic implications.

As food price P_X increases, industrial production falls due to the partial wage indexation in the industrial sector, higher food prices lead to higher wages, and hence capitalist consumption falls resulting in industrial Stagnation.

Hence in Fig 8, our new equilibrium E_2 corresponds to both increase in food price and fall in industrial output.

Figure 8

Figure 10
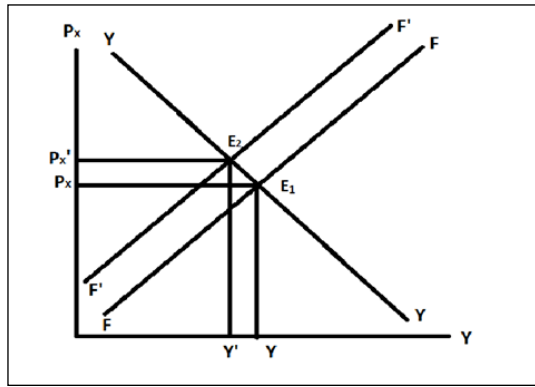
Case IV:

Lastly, we consider a balanced budget fiscal expansion, which implies that an increase in Government expenditure is accompanied by a rise in taxes (Z), in such a way that the initial budgetary position remains unchanged. The taxes reduce the profits of the capitalists as they are the only taxpayers. However, since the capitalists actually spend a fraction of their profit on industrial output, the rise in G_2 outweighs the fall in capitalist consumption, ultimately leading to a rise in industrial output as evident from Fig 9.

Figure 9
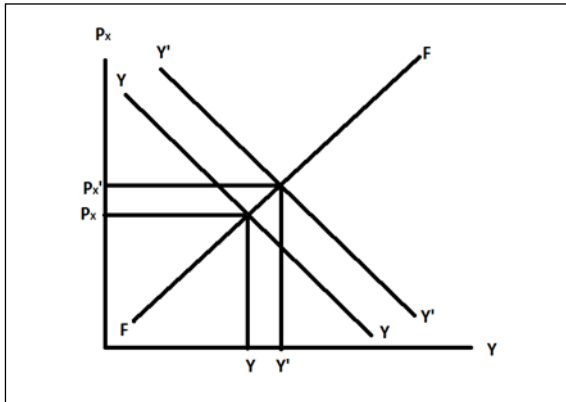
4.3. Increase In Imports:

We have already assumed that a proportion of the investment expenditure is on domestically produced capital goods. As a result of import penetration due to globalisation, γI falls which in turn raises $(1-\gamma)I$. The resultant effect is the leftward shift of the YY curve denoting a fall in the output level. Here the new equilibrium is E_1, Fig 10. Industrial output falls implying industrial stagnation.

Now, an increase in the volume of imports in the industrial sectors reduces the capitalist's profits which in turn reduces the demand for the industrial output. The food market is also affected as it leads to a decrease in demand for the agricultural output and thus P_X falls and thereby we can directly conclude that the real wage of the agricultural workers falls while that of their industrial counterparts $\left(\frac{\omega}{P_Y}\right)$ rises.
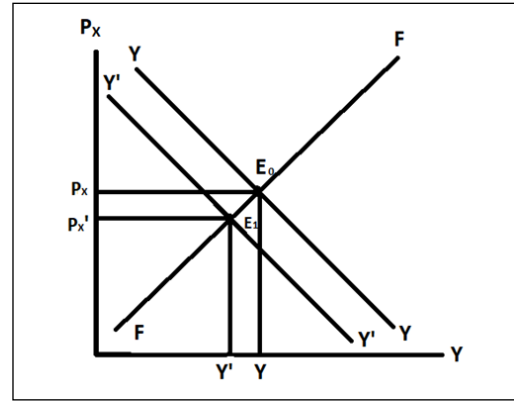
5. CONCLUSION

The paper shows how the economy of a developing country can be explained with the help of a static dualistic framework, which is open at the same time. The agricultural sector is of utmost importance in any developing economy given the fact that it has strong interlinkages with all the sectors including the industrial sector. In our model, we have shown how better performance of the agricultural sector can result in better performance of the economy as a whole in the light of globalisation.

Thus, in a nutshell, the basic findings of the paper are the following: Increased food supply through technological progress has led to an expansion in the industrial sector and results in a positive macroeconomic outcome which includes generation of employment. When the solvency condition of the government is binding, a higher government expenditure in the agricultural sector may not help as it leads to industrial stagnation and the effect on food price remains ambiguous. On the flip side, a higher government expenditure in the industrial sector leads to output expansion but the effect on food price remains ambiguous. Relaxing the solvency conditions, a rise in government expenditure in the agricultural sector leads to unambiguous fall in industrial output and unambiguous rise in price. A balanced budget fiscal expansion leads to rise in output and food price. As a result of globalisation, more import penetration has led to less industrial output, hence an import surge may trigger an economic slowdown.

Finally, we can conclude that agricultural development paves the way for inclusive growth. As in our model, an agricultural sector expansion has led to industrial sector expansion accelerating the trickle-down effect by generating employment, reducing poverty and regional inequality. Hence agricultural development has significant potential in achieving inclusive growth and propagating social and economic inclusion.

ACKNOWLEDGEMENTS

REFERENCES

1. Rakshit, M. 1983 *The Labour Surplus Economy*. Humanities Press Inc

2. Rattso, Jorn, and Ragnar Torvik. 1998. "Economic openness, trade restrictions and external shocks: modelling short run effects in Sub-Saharan Africa. Economic Modelling." *Science Direct* 15: 257-286. https://doi.org/10.1016/S0264-9993(97)00024-2

3. Rattso, Jorn, and Ragnar Torvik. 2003 "Interactions between Agriculture and Industry: Theoretical Analysis of the Consequences of Discriminating Agriculture in Sub-Saharan Africa." *Review of Development Economics* 7(1): 138-151. https://doi.org/10.1111/1467-9361.00181

4. Saikia, Dilip, Trends in Agriculture-Industry Interlinkages in India: Pre and Post-Reform Scenario (May 1, 2011). In D. Saikia (ed.) "Indian Economy after Liberalisation: Performance and Challenges", New Delhi: SSDN Publication, pp.122-73, 2012. Available at SSRN: https://ssrn.com/abstract=1858203 or http://dx.doi.org/10.2139/ssrn.1858203

5. V.S. Vyas. "Agricultural Trade Policy and Export Strategy." Economic and Political Weekly 34, no. 13 (1999): A27-33. Accessed March 19, 2020. www.jstor.org/stable/4407791.

Ramjas Economic Review
Team of the Year 2019-20

Front (Left to Right)
Tanvi Vipra, Kshitiz Aggarwal, Fizza Suhel (Editor-in-Chief), Dr. Sonia Goel (Teacher-in-Charge), Dr. Apoorva Gupta

Back (Left to Right)
Vedant Deshpande, Ritik Goel, Udeshay Khurana, Rijul Alvan, Samvid Uday (Deputy Editor-in-Chief), Dr. Mihir Pandey (Staff Advisor), Mr. Pawan Prakash