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WTO Security Exceptions: A Sliding Scale Approach to Protect the Rules-Based System for Global Free Trade

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Editorial

This is 13th Edition of Aarthika Charche and includes six research articles on current economic policy issues at national and state levels. The range of subjects covered include the WTO security exceptions and its implications for India, financial inclusion in India, MNCs and transfer pricing, energy-smart agri food value chains in India, macroeconomic relationships between savings, investments and growth in India, and status of women in Karnataka. I am thankful to all the distinguished contributors to this Edition.

On the WTO security exceptions, a new methodology called sliding scale system is proposed for identifying the essentialness of the claimed security interest and to determine the level of burden of proof that may be applied in disputes to reduce the probability of their abuse. India is a founding-member of WTO and security exceptions enforcement are of importance and relevance for the design of a comprehensive approach to security concerns. On financial inclusion, a comprehensive index is constructed that incorporates both commercial and cooperative banks and distinguishes between the rural and urban regions. In general, the results show that Karnataka has done well in financial inclusion. Empirical analysis show that changes in tax policies towards MNCs have their impacts on transfer prices in India, and MNCs reduce their reported transfer prices to reduce the inflow of tax income in the home country of the MNCs. Research findings from agri-food value chain show that decoupling fossil fuel dependence and adoption of cost-effective alternative energy saving systems that use energy efficiently without compromising on product quality are important for strengthening agri-food value chains including agri-tech start-ups in Karnataka. Evidence for long-run relationship among saving, capital formation and economic growth show the unidirectional causality between saving, capital formation and economic growth and need for strengthening India's financial sector to mobilise the savings for economic growth. Socio-economic status of women in Karnataka are highlighted with reference to employment, education, domestic violence, child marriage, maternal and child health services including nutrition and select policy interventions for improvement of current status of women in Karnataka are suggested especially to offset the socio-economic effects of Covid-19 pandemic situation.

This Edition includes the review of the book: Technology Business Incubators in India: Structure, Role and Performance, written by M.H. Bala Subrahmanya and H.S. Krishna and published by Walter de Gruyter GmBH (Berlin/Boston). I am glad that our journal is recognised by leading international publishers for review of their latest published books.

I am thankful to Sri. I. S. N. Prasad, Additional Chief Secretary (Finance Department), Government of Karnataka and Chairperson, Governing Council, Fiscal Policy Institute, for his continued support, guidance, and encouragement for all initiatives and endeavours for improvement of this Journal.

Sujit Kumar Chowdhury
Director, FPI

Grateful thanks are due to (a) all the contributors for timely submission of well researched and policy insightful articles, (b) internal and external reviewers for strengthening the peer reviewing of the articles, and (c) a copy-editor for professional copy-editing services. In addition, grateful thanks are due to Walter de Gruyter GmBH (Germany) for patronage of latest books for Book Review in our Journal.

M.R. Narayana
Editor-in-Chief

Financial Inclusion in India: An Analysis Using a New and Comprehensive Financial Inclusion Index

Meenakshi Rajeev [1] and Shika Saravanabhavan [2]

Abstract

This paper examines the state of financial inclusion (FI) in India by constructing a comprehensive index that incorporates both commercial and cooperative banks and distinguishes between the rural and urban regions. The results show that economically better-off states such as Himachal Pradesh, Goa, and Karnataka have done well in FI, but the rural-urban financial inclusion gap shows an increase for several states. While the access has increased significantly after the Jan Dhan Yojana programme, usage does not show the much-needed improvement. Further, a panel data regression model is estimated to examine whether credit access has improved for the self-employed, who are in regular need of credit for their businesses. To do this, we have used the constructed indices as the dependent variable and have brought in explanatory variables on self-employment from NSSO sources. The estimation results show that for the self-employed household, credit access has not improved as much during the drive period as compared to pre-drive years.

1. Introduction

Financial inclusion (FI) is important for developing countries to reduce poverty and improve the welfare of their people (Burgess & Pande, 2005; Honohan, 2007). Financial inclusion ensures that all individuals, particularly the socially and economically disadvantaged populations, should have access to a wide range of suitable financial services at affordable costs. Access to financial services allows people to save, facilitates human capital development, opens up new economic opportunities, and helps to buffer against future contingencies (Banerjee & Newman, 1993; Galor & Zeira, 1993; Ghosh et al., 2000). Despite these documented benefits, the number of unbanked adults is still high in developing countries across the world. For example, according to the Findex data, 1.7 billion adults globally were unbanked in 2017 (Demirguc-Kunt et al., 2018). Out of this, India accounts for 190 million unbanked adults and ranks second, lower than China. India, along with Pakistan, Indonesia, China, Nigeria, Mexico, and Bangladesh, have almost half of the world's unbanked adults (ibid.).

Though the situation has improved in recent years in India, more needs to be done to bring the excluded into the financial mainstream. To hasten the progress in financial inclusion, we first need to identify the regions that remain excluded as well as the areas in which financial inclusion is deficient. For this, we need a measure for financial inclusion that is comprehensive and representative of the financial inclusion scenarios in the various states of the country.

There have been several attempts at constructing an index in the Indian context. These indices, however, are based on the spread and services of commercial banks only (Chakravarty & Pal, 2010; Sarma, 2012). There is much focus

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All opinions in this article are of the authors and usual disclaimer applies.

on commercial banks, mainly because data on their operations are easily available, and they account for a bulk of activity in the financial system. However, an important financial institution that has not been accounted for in current literature is the cooperative banks. Even though they have played a critical role in improving rural financial inclusion in India since independence, recent literature has neglected these institutions' impact on improving financial inclusion.

The cooperative system is a three-tiered system with the primary agricultural credit societies at the lowest tier. The primary agricultural credit societies (PACSs) in rural India have allowed farmers to access credit at a relatively low-interest rate. Also, another advantage of these organisations is that they have better access to customer information which allows them to serve poor households and small businesses. Additionally, due to the Government's support over the years, these organisations have developed a widespread ground presence in the villages. In this paper, we propose to utilize the indicators of cooperative banks and scheduled commercial banks to develop a comprehensive financial inclusion index. The index is also split into rural and urban sub-indices to measure the heterogeneity between the two sectors in India.

Further, in this paper, we also focus on understanding the supply-side factors that impact on financial inclusion. For instance, using the FI index we developed as dependent variable, we estimate a panel data model to analyse how the FI drive period has affected financial inclusion. The Union Government of India has introduced financial inclusion drive policies as early as 2006, and since then, there have been a variety of different policies and programmes. Among these policies, the ongoing Jan Dhan Yojana (since 2014) has been a significant one. This programme aims to provide access to a basic savings account, overdraft facility, and insurance cover to the account holder. Given this background, understanding the impact of financial inclusion drive on improving financial inclusion is an important exercise.

Another specific aspect we address pertains to the self-employed people. The self-employed people in a developing country like India are poor and are forced to adopt self-employment as a survivalist strategy due to a lack of alternative employment opportunities (Banerjee & Duflo, 2011). As entrepreneurs with limited resources, the self-employed require a regular flow of credit services to cover their working capital needs as well as formal systems for saving money to mitigate risks, which an effective financial inclusion drive can ensure. Thus, a crucial question that arises in this context is regarding the credit access of the self-employed, especially whether or not the FI drive has improved access to credit for the self-employed.

Our analysis of the indices constructed using macro-level data from the Reserve Bank of India (RBI) sources reveal that the extent of financial inclusion has indeed increased in many states. However, there has been a marked bias toward urban financial inclusion in most states, and rural financial inclusion has not changed much despite several efforts. This is concerning, as most poor people reside in rural areas, and their lives could be improved if they had access to various financial services. Further, the results from the analysis of the supply-side determinants suggest that the determinants of financial inclusion drive positively impacts of financial inclusion. Additionally, the binary variable representing the Jan Dhan Yojana period shows a significant and positive impact on the overall financial inclusion index. However, as far as actual usage is concerned in terms of credit for the self-employed, no significant improvement has been observed during the drive period.

Against this backdrop, this paper proceeds as follows: the next section provides a brief overview of relevant literature on financial inclusion. Section 3 explains the data and methodology used. Section 4 discusses the analysis and results. The last section provides the concluding observations.

2. Brief Literature Review

We have divided the literature review into three sections: the importance of financial inclusion, measurement of financial inclusion, and the importance of local institutions with special reference to cooperatives. This review provides a background for subsequent analyses where we study the effect of drive policies and other factors on financial inclusion.

2.1 Importance of financial inclusion

Access and use of different financial services are beneficial in several ways. Having a savings account helps people to store their money safely, smoothen consumption during difficult times, and improve productive investment (Deaton, 1990; Dupas & Robinson, 2013). Another essential basic financial service is the bank credit. In a country like India, where the majority are self-employed, access to suitable credit is crucial (Rajeev & Vani, 2017; Saravanabhavan & Rajeev, 2018). Facilitating credit allows individuals to start new businesses and provides businesses with the capital for their daily expenditures (Rajeev & Scherrer, 2021).

Furthermore, finance enables risk-taking and encourages innovation and technology in society (Schumpeter, 1934). This is particularly relevant for the agricultural sector, where incomes are low. Access to agricultural credit has been found to increase incomes and ultimately contribute to the growth in agricultural GDP (World Bank, 2008).

2.2 Measuring Financial Inclusion and factors determining financial inclusion

The Government of India has long placed special emphasis on financial inclusion (FI) and has introduced several financial inclusion policies over time, which have increased the number of bank accounts. Despite years of policy support, however, the actual usage of financial services by the poor has not improved adequately, and the gains have been unevenly spread across the country (Goedecke et al., 2018).

To enhance FI in the country, it is crucial to understand the actual inclusion level. There have been attempts to develop a suitable measure for financial inclusion across Indian states (Chakravarty and Pal, 2010; Sarma, 2012). Indices to measure financial inclusion in India have been based on indicators mainly related to scheduled commercial banks. For example, Sarma (2008) uses three indicators: banking penetration, availability, and usage. Similar indicators have been used in most other studies to develop indices (Arora & Arora, 2010; Kumar, 2013; Mehrotra et al., 2009).

Further, studies have also looked at the various factors that impact FI. Income is an important factor determining FI, especially in developing countries where more affluent adults are likely to be financially excluded than poorer ones (Demirguc-kunt & Klapper, 2013; Pal & Pal, 2012). Also, when it comes to credit, adults in lower-income countries depend on informal services (Bhattacharjee & Rajeev, 2014), which may include money lenders, friends, family, local credit groups, etc., than adults in higher-income countries (ibid.). Macroeconomic factors such as inflation volatility and bank concentration also impact FI (Rojas-Suarez, 2013).

Socio-economic factors also influence the access and use of financial services. For instance, Kumar (2013) has studied the effect of population density, the average population per branch, credit deposit ratio, proportion of factories, and employment status on credit penetration and deposit penetration. Another study (Chakravarty and Pal, 2013) examined the role of social banking policy on FI and found that the pro-market policies after 1991 had an adverse effect on the pace of FI.

2.3 Importance of local institutions with special reference to cooperatives

In rural areas, the number of branches of scheduled commercial banks is lower than in urban areas (Burgess et al., 2005; RBI, 2019). As a result of the lower outreach of bank branches, last-mile access has been a critical issue in determining the efficacy of the FI drive. In such a scenario, Primary Agricultural Credit Societies (PACSs) can play a significant role as these institutions are spread across 79% of total Indian villages (NAFSCOB, 2017). However, several cooperatives today are ailing due to structural, managerial, and loan recovery issues (RBI, 2012). Despite these problems, their wide presence indicates the relevance of cooperative banks in the rural regions of India and the critical role they could play in improving FI in these regions in the current scenario (Pramanik et al., 2014). Recognizing the potential of the cooperative system, especially for rural areas, the Government has used them to reach out to the poor (RBI, 2020). In many states of India, they remain as one of the prominent institutions through which the state governments disburse credit to the rural poor at a subsidized cost.

Since rural credit cooperatives are widespread and an important avenue for formal financial access among rural populations, it is necessary to consider them while examining the progress of FI in the country. There is also a lack of more updated and comprehensive FI indices at the state level that demarcates rural and urban regions, which the current paper wishes to address.

3. Data and Methodology

The data for constructing the comprehensive FI indices are taken from various government sources. Information on scheduled commercial banks is collected from multiple issues of the Basic Statistical Returns of Scheduled Commercial Banks, published by the Reserve Bank of India (RBI). We used the Statistical Statements Relating to Cooperative Banks in India, brought out by the National Bank for Agriculture and Rural Development (NABARD) and the National Federation of State Co-operative Banks (NAFSCOB), for the information on Primary Agricultural Credit Societies. Various issues of the Census are used to obtain the adult population data (for those aged 14 and above). The data for the panel data regression is compiled from different sources. The self-employment data is taken from Employment Unemployment Survey reports provided by NSSO (GOI, 2000, 2011, 2013; NSSO, 1997, 2006); the data for all other variables are taken from the Reserve Bank of India database. We have included 17 major states in India for our analysis.

3.1 Variables used for the construction of indices

Comprehensive FI indices are constructed for the major states in India, separately for urban and rural areas of the country, keeping in mind the differences in the profile of financial institutions in these two areas. In urban areas, the index comprises indicators (of scheduled commercial banks) measuring demographic outreach, geographic outreach, deposit account penetration, deposit services usage, credit account penetration, and credit services usage. For rural zones, similar bank indicators are used, along with two additional measures: the demographic

outreach of cooperatives (PACSs) and the credit usage of cooperatives credit[3]. The definitions and measurement of these indicators are provided in Table 1.

Table 1: Definition and measurement of indicators

Rural/Urban demographic outreach (SCB)	-Average number of rural/urban bank branches per unit rural/urban population -Calculated as the total rural/urban bank branches divided by the total rural/urban adult population in the state
Rural/urban geographic outreach (SCB)	-Average number of rural/urban bank branches per unit rural/urban area -Calculated as the total number of rural/urban bank branches in a state divided by the total rural/urban geographical area.
Rural/urban deposit account penetration (SCB)	-Average number of rural/urban deposit accounts per unit rural/urban population -Calculated as total number of rural/urban deposit accounts divided by total rural/urban adult population.
Rural/urban deposit services usage (SCB)	-Average amount of rural/urban deposits per unit rural/urban population -Calculated as total rural/urban deposit volume divided by total rural/urban adult population.
Rural/urban bank credit account penetration (SCB)	-Average number of rural/urban credit accounts per unit rural/urban population -Calculated as total number of rural/urban credit accounts divided by total rural/urban adult population.
Rural/urban Credit usage (SCB)	-Average amount of rural/urban credit per unit rural/urban population -Calculated as total rural/urban credit volume divided by total rural/urban adult population
Geographic outreach of cooperatives	-Total number of PACS per unit of the rural population. -Calculated as the total number of PACSs divided by the total rural adult population.
Credit from PACS	-Average amount of rural/urban credit from PACSs per unit population -Calculated as total rural credit (from PACSs) volume divided by the total rural adult population.

3.2 Methodology

3.2.1 Construction of FI Indices

We employ factor analysis to calculate the weights for the indicators, following the method proposed by Nicoletti et al. (1999). For the rural FI index weights are calculated for the following indicators as follows: Rural banks geographic outreach (weight 0.16), Rural banks demographic outreach (weight 0.18), Rural banks deposit account penetration (weight 0.20), Rural banks deposit services usage (weight 0.19), Rural bank credit account penetration (weight-.11), Rural Banks credit usage (weight 0.16), Rural PACS

[3]*Continuous data on urban cooperatives is not available and their contribution to the total urban financial sector is limited. Hence they are not used in the measurement of indicators.*

credit usage (weight 0.53) and Rural PACS demographic outreach (weight 0.38). Similarly, for the urban index, we compute weights for the following indicators as follows: Urban banks geographic outreach (weight 0.13), Urban banks demographic outreach (weight 0.16), Urban banks deposit penetration (weight 0.22), Urban banks deposit services usage (weight 0.21), Urban banks credit penetration (weight 0.11), and Urban banks credit usage (weight 0.17).

Following Nicoletti et al (1999), indicators are statistically grouped into sub-indices and further combined to form the comprehensive index. While constructing the Rural Index, the intermediate indices are the Rural Banks Index (including the indicators related to commercial banks as detailed above) and the Rural Cooperatives Index (including indicators related to cooperatives). The Urban Index is constructed from the commercial bank indicators only. A weighted geometric mean is used to calculate the rural and urban indices individually, and they are finally combined to form the comprehensive FI Index using a simple geometric mean.

Requirements such as the normalisation of indicators were done before the factor analysis to allow meaningful comparison between states and years. We have also carried out Bartlett's (Bartlett, 1950) and Kaiser Meyer Olkin's (Kaiser, 1958) tests for appropriateness (with acceptable values greater than 0.6). Both the tests indicate the presence of unobserved latent variables and, hence, the use of factor analysis can be justified.

3.2.2 Regression Analysis

Fixed-effect model with Driscoll-Kraay (1998) estimator is used to estimate the various factors that affect FI. The choice of this model is due to the presence of cross-sectional dependence in the data. In general, cross-sectional dependence is common in macroeconomic data, where the entities are non-random, as they are likely to experience common disturbances. Ignoring cross-sectional dependence will not result in inconsistent parameter estimation. However, the standard errors will be inconsistent, leading to unreliable statistical inferences (Driscoll & Kraay, 1998). The conventional model choice is to use Feasible Generalised Least Squares (FGLS)(Kmenta, 1986). However, it is accepted that time, T should be substantially higher than the number of entities, N, in the panel, and T/N should be much higher than 3 (Beck and Katz 1995). In our data, T is 24, and N is 17. To overcome the issues related to FGLS, Beck and Katz (1995) suggested using panel corrected standard errors that are robust in the presence of cross-sectional dependence. FGLS model is problematic when N approaches T, and in such cases also, a Driscoll-Kraay estimator is suggested (Hoechle, 2007). The Driscoll-Kraay estimator gives standard errors robust to autocorrelation, heteroscedasticity, spatial, and temporal dependence (Hoechle, 2007). The estimable fixed-effects model is as follows.

$$y_{it} = \beta_k X_{it} + \alpha_i + U_{it}$$

Here Y_{it} denotes the FI index for the i^{th} state for t^{th} period. X_{it} represents the set of independent variables. β_k is the estimated coefficient of the independent variables, α_i is the specific intercept for each state and U_{it} is the error term.

In addition, we conduct the following diagnostic tests and their results are summarised in following Table 2 and Table 3.

The Sargan-Hansen test for over-identifying restrictions suggests a fixed-effect model is appropriate. Tests for stationarity (Levin Lin Chu tests, Pesarans unit root tests) are conducted to examine the stationarity of variables under consideration. Further, the variables are tested for multicollinearity. The average variance

inflation factor (VIF) value is 2.24, indicating that multicollinearity does not pose a problem. The Wald statistic for group-wise heteroscedasticity shows the presence of heteroscedasticity. We also checked for cross-sectional dependence using Pesaran's cross-sectional dependence test, and it indicates the existence of cross-sectional dependence. This justifies the use of a fixed-effect model with the Driscoll-Kraay estimator. Other tests such as Pesaran's unit root test has also been conducted which also indicates overall stationarity.

Table 2: Diagnostic tests and results

Diagnostic tests	Model 1	Model 3	Model 5
Test of overidentifying restrictions: Fixed vs Random effects (Sargan Hansen)	26.64 Chi-sq (7) Pr = 0.0004	64.08 Chi-sq (7) Pr = 0.0000	80.07 Chi-sq (7) Pr = 0.0000
Breusch-Pagan LM test of independence	chi2(136) = 737.27, Pr = 0.0000	chi2(136) = 839.65, Pr = 0.0000	chi2(136) = 637.72, Pr = 0.0000
Pesaran's test of cross-sectional independence	5.43, Pr = 0.0000	4.98, Pr = 0.0000	14.87, Pr = 0.0000
Modified Wald statistic for groupwise heteroskedasticity	chi2 (17) = 30635.40 Prob = 0.0000	chi2 (17) = 1574.43 Prob = 0.0000	chi2 (17) = 863.76 Prob = 0.0000

Table 3: Stationarity test results

Levin Lin Chu (Cross-sectional means removed) H0: Panels contain unit root		
Variable	Adjusted t	p-value
Log of FI	-25.0308	0.0000
Log of deposit volume	-1.8683	0.0309
Log of credit volume	-4.0508	0.0000
Log of per-capita income	-3.5348	0.0002
Agricultural share	-2.9131	0.0018
Rural non-agricultural SE	-3.4102	0.0003
Urban SE	-3.7315	0.0001

4. Analysis and Results

4.1 FI Indices

We begin our analysis by constructing a comprehensive index that incorporates indicators representing the access and usage of both commercial banks and cooperative banks from 1994 to 2017. During this period, India faced several changes such as liberalisation, the 2008 global financial crisis, the introduction of financial drive policies in 2006, and the Jan Dhan Yojana in 2014. Keeping these changes in perspective, we will examine our results.

The Indices for the year 2017 are presented in Table 4. The index values range from 0 to 1. We see that there are large differences in FI across the states. States like Himachal Pradesh, Goa, Karnataka, and Haryana have relatively higher financial inclusion than other states. Of these states, Himachal Pradesh and Goa have

performed well under both the rural and urban indices. Another important inference from this table is the vast disparity between the rural and urban indices for the states. This implies that rural FI has not improved as much as urban FI, despite various efforts by the Government. For instance, Assam has a wide disparity in index values across the rural and urban areas; the urban index value for Assam is .45, while the rural index value is only .01. Other states with wide disparity are Maharashtra, Andhra Pradesh, and Bihar.

We have also looked at the trend of FI from 1994 to 2017 as given in Table 5, Table 6 and Table 7.

Table 4: FI Index by major states of India-2017

State	RI	Rank	State	UI	Rank	States	FI	Rank
High RI states			**High UI states**			**High FI states**		
GA	0.17	1	**HP**	0.75	1	**HP**	0.35	1
HP	0.16	2	**HR**	0.61	2	**GA**	0.31	2
WB	0.12	3	**GA**	0.56	3	**KA**	0.26	3
GJ	0.12	4	**MH**	0.56	4	**HR**	0.25	4
KA	0.12	5	**PB**	0.55	5	**OR**	0.23	5
Medium RI states			**Medium UI states**			**Medium FI states**		
OR	0.12	6	**KA**	0.54	6	**MH**	0.23	6
TN	0.11	7	**AP**	0.52	7	**PB**	0.23	7
HR	0.10	8	**KL**	0.50	8	**AP**	0.21	8
MH	0.10	9	**AS**	0.45	9	**TN**	0.21	9
PB	0.09	10	**OR**	0.45	10	**GJ**	0.20	10
Low RI states			**Low UI states**			**Low FI states**		
AP	0.09	11	**BR**	0.41	11	**WB**	0.19	11
RJ	0.08	12	**TN**	0.38	12	**BR**	0.18	12
UP	0.08	13	**RJ**	0.36	13	**RJ**	0.17	13
BR	0.08	14	**GJ**	0.34	14	**KL**	0.17	14
MP	0.07	15	**UP**	0.31	15	**UP**	0.16	15
KL	0.06	16	**MP**	0.30	16	**MP**	0.15	16
AS	0.01	2	**WB**	0.30	17	**AS**	0.05	17

Note: AS-Assam, BR-Bihar, MP-Madhya Pradesh, WB-West Bengal, OR- Odisha, UP- Uttar Pradesh, RJ- Rajasthan, AP-Andhra Pradesh, PB-Punjab, TN-Tamil Nadu, KA-Karnataka, HP-Himachal Pradesh, HR- Haryana, GJ- Gujarat, MH- Maharashtra, KL- Kerala, GA-Goa RI-Rural Index, UI-Urban Index, FI- Financial inclusion Index

Source: Authors' calculation using RBI data

Table 5: Trend of Urban index across major states of India : 1994-2017

1994			2012			2017		
State	**UI**	**Rank**	**State**	**UI**	**Rank**	**State**	**UI**	**Rank**
KL	0.16	1	**HP**	0.51	1	**HP**	0.75	1
PB	0.11	2	**MH**	0.41	2	**HR**	0.61	2
GA	0.11	3	**GA**	0.41	3	**GA**	0.56	3
HR	0.08	4	**PB**	0.36	4	**MH**	0.56	4
MH	0.07	5	**HR**	0.36	5	**PB**	0.55	5
KA	0.07	6	**KL**	0.34	6	**KA**	0.54	6
HP	0.07	7	**KA**	0.33	7	**AP**	0.52	7
TN	0.06	8	**AP**	0.33	8	**KL**	0.50	8
AS	0.06	9	**OR**	0.26	9	**AS**	0.45	9
WB	0.06	10	**TN**	0.25	10	**OR**	0.45	10
AP	0.05	11	**AS**	0.25	11	**BR**	0.41	11
GJ	0.04	12	**BR**	0.20	12	**TN**	0.38	12
BR	0.04	13	**RJ**	0.20	13	**RJ**	0.36	13
RJ	0.03	14	**UP**	0.19	14	**GJ**	0.34	14
OR	0.02	15	**GJ**	0.19	15	**UP**	0.31	15
MP	0.00	16	**WB**	0.16	16	**MP**	0.30	16
UP	0.00	17	**MP**	0.15	17	**WB**	0.30	17

Note: AS-Assam, BR-Bihar, MP-Madhya Pradesh, WB-West Bengal, OR- Odisha, UP- Uttar Pradesh, RJ- Rajasthan, AP-Andhra Pradesh, PB-Punjab, TN-Tamil Nadu, KA-Karnataka, HP-Himachal Pradesh, HR- Haryana, GJ- Gujarat, MH- Maharashtra, KL- Kerala, GA-Goa

Source: Authors' calculation using RBI data

Table 6: Trend of Rural index across major states of India:1994-2017

1994			2012			2017		
State	**RI**	**Rank**	**State**	**RI**	**Rank**	**State**	**RI**	**Rank**
GA	0.17	1	**GA**	0.18	1	**GA**	0.17	1
HP	0.11	2	**HP**	0.14	2	**HP**	0.16	2
PB	0.11	3	**TN**	0.10	3	**WB**	0.12	3
HR	0.08	4	**KA**	0.09	4	**GJ**	0.12	4
KA	0.06	5	**WB**	0.09	5	**KA**	0.12	5
TN	0.06	6	**PB**	0.09	6	**OR**	0.12	6
GJ	0.05	7	**GJ**	0.09	7	**TN**	0.11	7
UP	0.05	8	**OR**	0.08	8	**HR**	0.10	8
WB	0.05	9	**UP**	0.07	9	**MH**	0.10	9
MH	0.04	10	**HP**	0.07	10	**PB**	0.09	10

1994			2012			2017		
State	**RI**	**Rank**	**State**	**RI**	**Rank**	**State**	**RI**	**Rank**
AP	0.04	11	**MH**	0.07	11	**AP**	0.09	11
BR	0.04	12	**AP**	0.06	12	**RJ**	0.08	12
OR	0.03	13	**BR**	0.06	13	**UP**	0.08	13
RJ	0.03	14	**RJ**	0.05	14	**BR**	0.08	14
MP	0.03	15	**Ker**	0.05	15	**MP**	0.07	15
KL	0.03	16	**MP**	0.05	16	**KL**	0.06	16
AS	0.01	17	**AS**	0.03	17	**AS**	0.01	2

Note: AS-Assam, BR-Bihar, MP-Madhya Pradesh, WB-West Bengal, OR- Odisha, UP- Uttar Pradesh, RJ- Rajasthan, AP-Andhra Pradesh, PB-Punjab, TN-Tamil Nadu, KA-Karnataka, HP-Himachal Pradesh, HR- Haryana, GJ- Gujarat, MH- Maharashtra, KL- Kerala, GA-Goa

Source: Authors' calculation using RBI data

Table 7: Trend of Comprehensive FI index across major states of India:1994-2017

1994			2012			2017		
State	**UI**	**Rank**	**State**	**UI**	**Rank**	**State**	**UI**	**Rank**
GA	0.13	1	**GA**	0.27	1	**HP**	0.35	1
PB	0.11	2	**HP**	0.27	2	**GA**	0.31	2
HP	0.09	3	**PB**	0.18	3	**KA**	0.26	3
HR	0.08	4	**KA**	0.18	4	**HR**	0.25	4
KL	0.07	5	**MH**	0.17	5	**OR**	0.23	5
KA	0.07	6	**TN**	0.16	6	**MH**	0.23	6
TN	0.06	7	**HR**	0.16	7	**PB**	0.23	7
MH	0.06	8	**OR**	0.15	8	**AP**	0.21	8
WB	0.05	9	**AP**	0.14	9	**TN**	0.21	9
GJ	0.05	10	**KL**	0.13	10	**GJ**	0.20	10
AP	0.05	11	**GJ**	0.13	11	**WB**	0.19	11
BR	0.04	12	**WB**	0.12	12	**BR**	0.18	12
RJ	0.03	13	**UP**	0.12	13	**RJ**	0.17	13
AS	0.03	14	**BR**	0.11	14	**KL**	0.17	14
OR	0.03	15	**RJ**	0.10	15	**UP**	0.16	15
MP	0.01	16	**MP**	0.09	16	**MP**	0.15	16
UP	0.00	17	**AS**	0.08	17	**AS**	0.05	17

Note: AS-Assam, BR-Bihar, MP-Madhya Pradesh, WB-West Bengal, OR- Odisha, UP- Uttar Pradesh, RJ- Rajasthan, AP-Andhra Pradesh, PB-Punjab, TN-Tamil Nadu, KA-Karnataka, HP-Himachal Pradesh, HR- Haryana, GJ- Gujarat, MH- Maharashtra, KL- Kerala, GA-Goa

Source: Authors' calculation using RBI data

Although FI has improved for most states from 1994 to 2017, the disparity between rural and urban FI has increased (Saravanabhavan, 2021). For instance, in 1994, for Maharashtra, the rural index value was .04, and the urban index was .07. In 2017, the disparity increased, and we see that for Maharashtra urban index is .56, and the rural index is still at .10. Similar is the case for most other states.

For urban areas, there has been a marked improvement in FI for most states. However, rural FI has not changed much in several states such as Assam, Madhya Pradesh, Uttar Pradesh, and Bihar. These lagging states are some of the lowest-income states in the country. Human development indicators are also poor in these states. Another reason for the poor development in rural areas could be that scheduled commercial banks have focussed on urban areas where it is more profitable for them as there are more wealthy customers. Moreover, many unprofitable branches were closed down in rural areas after the termination of the bank licensing policies of the seventies and eighties.

To further understand rural financial inclusion, we also examined the sub-indices of the rural index (RI) as given in Table 8.

Table 8: Sub-indices of Rural financial inclusion index-2017

States	Cooperatives Index	Rank	States	Rural Banks Index	Rank
PB	0.16	1	**GA**	0.29	1
MH	0.15	2	**HP**	0.14	2
HR	0.12	3	**PB**	0.11	3
GJ	0.11	4	**WB**	0.08	4
TN	0.08	5	**KA**	0.08	5
HP	0.08	6	**UP**	0.08	6
KL	0.07	7	**TN**	0.07	7
KA	0.06	8	**HR**	0.07	8
WB	0.06	9	**OR**	0.06	9
RJ	0.05	10	**BR**	0.06	10
OR	0.05	11	**GJ**	0.05	11
AP	0.04	12	**AP**	0.05	12
MP	0.04	13	**MH**	0.04	13
GA	0.03	14	**AS**	0.03	14
UP	0.02	15	**RJ**	0.03	15
BR	0.01	16	**MP**	0.03	16
AS	0.00	17	**KL**	0.01	17

Note: AS-Assam, BR-Bihar, MP-Madhya Pradesh, WB-West Bengal, OR- Odisha, UP- Uttar Pradesh, RJ- Rajasthan, AP-Andhra Pradesh, PB-Punjab, TN-Tamil Nadu, KA-Karnataka, HP-Himachal Pradesh, HR- Haryana, GJ- Gujarat, MH- Maharashtra, KL- Kerala, GA-Goa

Cooperatives Index -Intermediate index of Rural Index, where only cooperative indicators are used, Rural Banks Index- Intermediate index of Rural Index, where only scheduled commercial banks' indicators are used

Source: Authors calculation using the RBI and NAFSCOB data

States such as Punjab, Maharashtra, Haryana, and Gujarat have performed well under the cooperatives index, while states such as Goa, HP, and Punjab have performed well under the Rural Banks index. It can be inferred that it is primarily the economically developed states that have performed well under the cooperative index. Kerala has performed moderately well under the cooperative index and low under the Rural Bank's Index.

When we examined the component indicators, we observed that Kerala does not do well with regard to bank indicators (in both rural and urban indices). While our results more or less show similar performance vis-à-vis few of the earlier studies, other studies have shown Kerala as one of the better-performing states (Chakravarty & Pal, 2010). We find Kerala's performance satisfactory in terms of urban indices but rural indices do not show a similar achievement. Further, it is also to be noted that these studies are not strictly comparable as the indices are constructed for earlier years. Another difference is that we have taken the usage indicators (deposit volume and credit volume) in terms of population. In contrast, other studies have used it in terms of per capita income (deposit volume per capita income, credit volume per capita income). We argue that to get the true representative indicator which measures the share of each individual we need to divide the deposit/ credit volume by the population.

In the above section, we presented the status of FI across different regions using the comprehensive index, and we see that there are significant regional variations in FI. To explain this differential performance, we now examine important factors that may impact FI by taking up the FI index and some of the important usage indicators as dependent variables for our analysis.

4.2 Determinants of FI

We considered relevant explanatory variables to understand the factors that may have an impact on FI. We have represented the drive period using a binary variable that takes the value of one, if, the year is later than or equal to 2008 and zero otherwise. The recommendations for the FI drive were brought out in 2005 by the Khan committee (Khan, 2005) but impact of the drive policies were noticeable after 2008. Also, in 2008, the Rangarajan committee (RBI, 2008) brought out its recommendations for improving FI, many of which have been diligently put into practice by the Reserve Bank of India from 2008. Further, we have accounted for the changes after the introduction of Jan Dhan Yojana scheme using a binary variable that takes the value of one if the year is equal to or later than 2014.

As mentioned earlier, a sizable percentage of the working population in India is self-employed. In the rural sector, about 80 percent are small and marginal farmer households with fragmented holdings and negligible savings. They require credit on a steady basis to buy seeds, fertilizers, equipment, and other inputs. To estimate how states' dependence on agriculture affects overall FI, the share of agriculture in GDP is included as an explanatory variable. On the other hand, the non-farm sector primarily consists of own account enterprises (around 80%), operating without hired labour. Many of these operate at a subsistence level with very small capital, and most of them face several constraints in accessing formal finance (Rajeev, 2015).

To represent these sectors, we have included the number of non-agricultural self-employed households per 100 households in rural areas as a variable. Correspondingly, we have also considered the number of total self-employed households

per 1000 households in the urban sector. Finally, we have also included per capita income in the regression. Income is an important determinant of FI, especially in developing countries (Demirgüç-Kunt and Klapper 2013; Pal and Pal 2012). It also captures the level of economic activities in a region. The summary statistics of variables used in the estimations are given in Table 9.

Table 9: Summary statistics

Variables	Description	N	Mean	Standard Deviation	Minimum	Maximum
Log FI	Log of FI Index	408	-2.42	0.74	-8.99	-1.06
Log FI	Log of FI Index	408	-2.42	0.74	-8.99	-1.06
Log Deposit usage	Log of deposit volume/Total adult population	408	-1.41	1.14	-3.95	1.62
Log Credit usage	Log of credit volume/Total adult population	408	-2.05	1.30	-4.80	0.78
Drive	=1 if year >=2008	408	0.42		0.00	1.00
Jan Dhan Yojana	=1 if year >=2014	408	0.17		0.00	1.00
Log of per capita income	Log value of per capita income	408	10.86	0.55	9.68	12.64
Agricultural share	Agricultural GDP/Total GDP	408	0.24	0.09	0.04	0.53
Rural non-agri SE	Proportion of rural non-agricultural self-employed households	408	148.04	38.98	63.00	320.00
Urban SE	Proportion of total urban self-employed households	408	347.70	60.90	189.00	533.00
Number of groups		17				

4.3 Econometric analysis and results

To identify the factors that impact the overall FI and usage of important financial services such as deposit and credit, separate regression exercises have been carried out. Table 10 presents the estimation results of six regression models.

In models 1 and 2, we have the FI Index as the dependent variable. Considering the bounded nature of the variable, we have also estimated it using a Tobit model. The likelihood ratio test, however, was insignificant, implying that the Tobit model is not better than the pooled regression.

In Models 3 and 4, 5 and 6, the dependent variables are the usage indicators, namely, deposit usage (commercial banks) and credit usage (commercial banks), respectively. More precisely, the usage indicators are deposit volume per head (log value) and credit volume per head (log value).

From Models 1 and 3 in Table 10, we find that the drive variable is positive and significant with regard to FI Index and deposit usage, which suggests that the policies implemented during the drive period have improved overall FI and formal savings. However, the drive variable is not significant in the case of credit usage (see model 5). This could mainly be because improving credit was not given due importance during the initial years of the FI drive.

Table 10: Determinants of FI and usage indicators- Fixed-effect model (Driscoll-Kraay estimator)

Variables	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)	(Model 6)
	Log FI	Log FI	Log deposit volume	Log deposit volume	Log credit volume	Log credit volume
Drive	0.1730***	-0.0616	0.2040**	0.7735***	0.2228	0.5604***
	(0.039)	(0.312)	(0.083)	(0.197)	(0.132)	(0.183)
Jan Dhan yojana	0.1454***	0.1790***	0.0829**	0.1163***	-0.0502	0.0134
	(0.032)	(0.039)	(0.032)	(0.036)	(0.069)	(0.059)
Log Per capita income	0.8807***	0.8402***	1.5366***	1.3630***	1.8264***	1.8139***
	(0.099)	(0.103)	(0.106)	(0.151)	(0.158)	(0.166)
Agricultural share	-0.1115	0.0257	-4.1790***	-4.6306***	-4.9617***	-5.0376***
	(0.362)	(0.355)	(0.528)	(0.482)	(0.385)	(0.316)
Rural Non- agri SE	0.0030	0.0054***	0.0038**	0.0060***	0.0039**	0.0059***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Urban SE	-0.0022	-0.0031	0.0015	0.0017	0.0010	0.0017
	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Drive * Agri share		0.3008		0.1083		2.1750***
		(0.715)		(0.527)		(0.557)
Drive * Rural Non agri SE		-0.0037***		-0.0031***		-0.0024***
		(0.001)		(0.001)		(0.001)
Drive * Urban SE		0.0022		-0.0003		-0.0012*
		(0.001)		(0.001)		(0.001)
Constant	-11.746***	-11.377***	-18.288***	-16.666***	-21.687***	-22.067***
	(1.452)	(1.455)	(1.257)	(1.721)	(1.688)	(1.743)
Observations	408	408	408	408	408	408
No of groups	17		17		17	
Overall r2	0.625	0.644	0.900	0.900	0.806	0.819

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Dependent variables for models 1and 2, 3 and 4, 5 and 6 are Log of FI index, log of deposit volume per head, and log of credit volume per head respectively. Number of groups=17

Further, the binary variable representing the Jan Dhan Yojana period shows a significant and positive impact on the overall FI index but the effect on credit usage is insignificant. This result is important as it implies that though there has been significant improvement in owning bank accounts, there is no significant effect on improvement in access to credit even in the Jan Dhan Yojana period. Our analysis also includes interaction terms to understand the impact of FI drive policies on the self-employed. The interaction between the drive variable and self-employment (both urban and rural) shows a negative and significant effect. On closer examination of the interaction results, we observe that this negative effect is mainly because the positive effect between credit usage and self-employment is stronger in the pre-drive period compared to the drive period. We see similar results with deposit usage too. Agricultural share during the drive period shows a positive and

significant effect implying that the positive effect between agricultural self-employment and credit usage is stronger in the drive period than in the non-drive period[4]. We also find that the coefficient of per capita income is positive and significant in all the models, indicating that when the income level improves, and as a result, the economic activity in the system gains momentum, overall FI as well as usage improves. Several reasons could be attributed to this. When income increases, people have additional funds to be saved (in a bank). Similarly, when economic activity in a society increases, the need for funds for new investment and, side by side, the need to manage finances formally also rises. Most importantly, this could also mean that even after a massive FI drive in the country, credit often goes to the well-off rather than to the poorer regions, even though the poorer regions require more funds to support their economic activity.

Overall, our results offer two crucial evidences. First, even after the FI drive, the usage of financial services has not improved to the desired level, especially the credit services usage. Second, our results indicate that agricultural credit has improved during the drive period than in pre-drive years.

5. Concluding observations

To our knowledge, existing literature on FI has focused primarily on commercial banking and has overlooked cooperative banks, which are prominent institutions in the rural areas. By constructing a comprehensive index of FI, from 1994 to 2017 that subsumes the indicators of cooperatives banks, a more representative and comprehensive index is presented. While the FI drive has improved overall inclusion in many states, there is evidence of an increasing rural-urban gap. Even after the recent Jan Dhan Yojana, urban FI continues to improve while rural FI did not change much for most states.

Though the Jan Dhan Yojana has improved the general level of FI, there is no significant impact on the usage of financial services. Further, the non-agricultural self-employed individuals (both rural and urban), who are supposedly in regular need of credit, are likely to have less credit during the drive period as compared to the pre-drive period. Lack of awareness about FI programmes, financial literacy-related limitations and constraints resulting from social and economic backwardness could be impeding their access and use of financial services. This area needs special attention in the FI policies as the self-employment sector is increasing in volume (see also Saravanabhavan and Rajeev, 2020), So, necessary efforts need to be made to improve the small-scale self-employment segment through adequate and suitable provision of finance and financial literacy programmes that can help them to earn their livelihood in the absence of proper formal sector jobs.

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[4]*These results have been cross verified by plotting the values as well.*

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WTO Security Exceptions: A Sliding Scale Approach to Protect the Rules-Based System for Global Free Trade

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Abstract

Since the enforcement of the General Agreement on Tariffs and Trade (GATT) in 1947 and subsequently with the establishment of the World Trade Organization, the global community has been moving towards a more secure and rule-based international trade law regime. The cornerstones of the system are predictability and transparency, which ensure that a state, no matter how powerful, cannot undertake a discriminatory trade measure against another going above and beyond the rules. However, the recent instances of unilateral invocation of the security exceptions found in the various trade agreements endanger the very basis of the WTO system. The very first WTO Panel report that directly dealt with this exception was circulated in the 2019 Russia – Traffic in Transit case, closely followed by the 2020 Saudi Arabia – Protection of IPRs case. The standard of burden of proof applied against the invoking nations in these two cases leaves a giant void, rife for exploitation by more and more nations throughout the world. The already increasing trend of invoking these provisions and implementing the strictest possible trade measures for dubious 'emergency' scenarios, as evidenced in the US steel and aluminium tariffs dispute, has the potential of causing a gradual degradation of the rule-based global trade system. Under this backdrop, this paper examines the national security exception provisions, their intent and scope with respect to their negotiating history, their jurisprudential developments in the pre and post WTO era and points out specific gaps in interpretation via the most recent Russia – Traffic in Transit and Saudi Arabia – Protection of IPRs cases. Further, an alternate methodology, a sliding scale system, is proposed for identifying the essentialness of the claimed security interest, to determine the level of burden of proof that may be applied in such disputes to reduce the probability of their abuse. The paper then explains how this methodology would impact on few crucial ongoing disputes involving the security exception provisions. India is a founding-member of WTO and an important beneficiary from the stability of this organisation. The analyses and implications of the WTO security exceptions enforcement, in this paper, are of importance and relevance for the design of India's international trade policies and formulating a comprehensive approach to security concerns.

1. Introduction

Modern world trade law system, comprising of the World Trade Organization (WTO) and the associated multilateral agreements, relies upon the principles of certainty and transparency[3]. With the WTO at the helm, global trade has expanded significantly, benefiting from a secure and predictable free trade system[4]. At present, members of the WTO, including India, account

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All opinions in this article are of the authors and usual disclaimer applies.

[3]*Wesley Cann, Jr., 'Creating Standards and Accountability for the Use of the WTO Security Exception: Reducing the Role of Power-Based Relations and Establishing a New Balance Between Sovereignty and Multilateralism', Yale Journal of International Law, 26, 2001.*

[4]*'WTO | Principles of the Trading System' <https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm> accessed 27 August 2021.*

for approximately 98% of global trade in value, underscoring its enormous significance. Of critical importance is the dispute settlement process, as it ensures the enforcement of the trade agreements or contracts between nations.

While the WTO Dispute Settlement Body (DSB) is primarily concerned with resolving the specific disputes brought before it by the member nations, that is not its only responsibility. Often, WTO decisions cause lasting jurisprudential developments regarding the interpretation of the various provisions of the agreements. These developments are particularly important, as incomplete or unclear interpretations of the provisions in the process of enforcement of the WTO agreements, can undermine the reliability of this rules-based system. This can, once again, lead to a Pareto suboptimal equilibrium or, a self-serving prisoners dilemma situation in global trade, reminiscent of the period between and during the two world wars.

Currently, of specific concern are the security exceptions which, initially included in international agreements such as the General Agreement on Tariffs and Trade (GATT), General Agreement on Trade in Services (GATS), and Trade-Related Aspects of Intellectual Property Rights (TRIPS) as safety-valve measures, to be used only in the direst scenarios, have gone through a period of revitalization. Throughout these three agreements, they are worded in an almost identical manner. Article XXI of GATT and 73 of TRIPS read as:

"Nothing in this Agreement shall be construed

(a) to require any contracting party to furnish any information the disclosure of which it considers contrary to its essential security interests; or

(b) to prevent any contracting party from taking any action which it considers necessary for the protection of its essential security interests

(i) relating to fissionable materials or the materials from which they are derived;

(ii) relating to the traffic in arms, ammunition and implements of war and to such traffic in other goods and materials as is carried on directly or indirectly for the purpose of supplying a military establishment;

(iii) taken in time of war or other emergency in international relations; or

(c) to prevent any contracting party from taking any action in pursuance of its obligations under the United Nations Charter for the maintenance of international peace and security." [5].

Article XIV bis of GATS is nearly identical, except sub-paragraph 1(b)(ii) reads as "relating to fissionable and fusionable materials or the materials from which they are derived"[6], and sub-paragraph 2 provides that "The Council for Trade in Services shall be informed to the fullest extent possible of measures taken under paragraphs 1(b) and (c) and of their termination."[7].

In the seven decades of GATT regime, these provisions were invoked by member nations in rare scenarios, and complaints against such invocations were even rarer. In the five decades of pre-WTO GATT regime, recorded arguments or complaints based on the security exceptions have

[5]*The General Agreement on Tariffs and Trade 1994 (Annex 1A, 1867 UNTS 187, 33 ILM 1153); Agreement on Trade-Related Aspects of Intellectual Property Rights 1995 (Annex 1C).*
[6]*General Agreement on Trade in Services 1994 (Annex 1B, 1869 UNTS 183, 33 ILM 1167).*
[7]*ibid.*

been made before the Contracting Parties only eight times[8]. However, the last four years saw at least as many high-impact documented instances pertaining to the unilateral implementation of measures by the member nations, which they would relate to national security concerns[9]. For example, the recent trade restrictions imposed by US on imported steel and aluminium products were taken under the pretext of a threat to its national security[10]. Similarly, in 2020, India banned hundreds of China-linked mobile applications, by stating they are 'prejudicial to sovereignty and integrity of India, defence of India, security of state and public order'[11]. While there has been no WTO resolution to these instances yet, in 2019, the first ever WTO Disputes Settlement Body (DSB) Panel report directly dealing with the national security exceptions was circulated in the 2019 *Russia – Measures Concerning Traffic in Transit case*[12]. It was soon followed by the 2020 Panel report in the *Saudi Arabia – Measures Concerning the Protection of Intellectual Property Rights case*[13]. Given this recent increased trend of unilateral invocation of the national security exceptions, it becomes crucial to analyse the gap-filling exercise attempted by the DSB in the two latest Panel reports.

Why should a trade platform like the WTO be concerned with an emergency provision that relates to war? Because these provisions allow for member countries to preserve a core aspect of their sovereign function – the need to protect their territory and citizens from external threats, which ranks above their trade interests. If these exceptions were not allowed, GATT and WTO may never have been possible, as the member nations would be unwilling to relinquish their sovereignty completely without having some contingency measures in place[14]. However, the danger lies in the abuse of these provisions for disguised protectionist purposes, which can be facilitated by an excessively broad interpretation (over-inclusion) of the various sub-provisions under this exception. Errors in decisions can also arise from under-inclusion. Both types of errors need to be minimised. The technological advancements witnessed over the last few decades and the significant manner in which it has impacted global trade makes the interpretation of these provisions all the more tricky.

[8]Czechoslovakia's complaint against US, 'General Agreement on Tariffs and Trade: Summary Record of the Twenty Second Meeting' (1949) GATT/CP.3/SR.22, Corr. 1;
Portugal's complaint against Ghana, 'Summary Record of the Twelfth Session' (1961) SR.19/12;
Arab League boycott against Israel, Contracting Parties Twenty Sixth Session, 'Report of the Working Party on Accession of the United Arab Republic' (1970) L/3362;
Sweden's import quota system for footwear, Sweden - Import Restrictions on Certain Footwear [1975];
Restrictions imposed by EEC, its member states, Canada, and Australia on imports from Argentina, 'Minutes of Meeting Held in the Centre William Rappard on 7 May 1982' (1982) C/M/157;
US Trade Embargo against Nicaragua, 'Minutes of Meeting Held in the Centre William Rappard on 29 May 1985' (1985) C/M/188;
US trade embargo on Cuba, 'Minutes of Meeting Held in the Centre William Rappard on 22 May 1986' (1986) C/M/198;
EC trade measures against Yugoslavia, 'Trade Measures Taken by the European Community Against the Socialist Federal Republic of Yugoslavia - Communication from the European Communities' (1991) L/6948.
[9]Geraldo Vidigal, 'WTO Adjudication and the Security Exception: Something Old, Something New, Something Borrowed - Something Blue?' (2019) 46 Legal Issues of Economic Integration.
[10]Administration of Donald J. Trump, 'Memorandum on Steel Imports and Threats to National Security' (2017).
[11]Ministry of Electronics & IT, 'Government Blocks 118 Mobile Apps Which Are Prejudicial to Sovereignty and Integrity of India, Defence of India, Security of State and Public Order' (2020); Ministry of Electronics & IT, 'Government Bans 59 Mobile Apps Which Are Prejudicial to Sovereignty and Integrity of India, Defence of India, Security of State and Public Order' (2020).
[12]Russia - Measures Concerning Traffic in Transit [2019] WTO Panel WT/DS512/R.
[13]Saudi Arabia — Measures concerning the Protection of Intellectual Property Rights [2020] WTO Panel WT/DS567/R.
[14]Raj Bhala, 'National Security and International Trade Law: What the GATT Says, and What the United States Does Symposium on Linkage as Phenomenon: An Interdisciplinary Approach' (1998) 19 University of Pennsylvania Journal of International Law 263.

The primary problem regarding the interpretation of this exception, lies with the subjectivity of various key phrases and the standard of burden of proof applied by the WTO therein. Phrases such as, 'it considers', 'essential security interests' (ESI), 'emergency in international relations', etc., can have a range of interpretations. Recently, the trend seems to be that the invoking nations would have the discretion to interpret these phrases in the widest possible manner, providing them with seemingly unlimited discretion regarding which measures can be implemented under these provisions[15]. Moreover, the approach taken by the WTO DSB in the *Russia – Traffic in Transit and Saudi Arabia – Protection of IPRs cases*, seem to have put an extremely lax burden of proof on the invoking nations at all stages[16].

The existing ambiguities in this exception, combined with the rising global trend of their unilateral invocation, spell significant problems for a WTO regulated world trade order[17]. An excessively flexible burden of proof regarding the clauses can allow protectionist measures, shrouded under the veil of a security concerns, to thrive – causing a significant derogation in the rule-based system that the WTO has established. Smaller economies are likely to be the worst sufferers in this case, being unable to fight against the unjustified trade measures implemented by the powerful nations. In this context, the following analyses shall answer two policy relevant questions: (a) How would the current standard applied by the WTO regarding the invocation of the national security exceptions be detrimental for the rule-based and transparent nature of the WTO regime? (b) What is an alternate framework for the same which can help reduce the potential for abuse?

II. Intent & Scope of the Provision(s)

During the drafting of GATT 1947, it was found that during contingency scenarios threatening the safety and security of the nation, the contracting parties wanted to retain a modicum of control to protect such interests without having to wait for the approval of an external body such as the WTO. Thus, the primary purpose of the security exceptions, included first in GATT 1947 and then in the subsequent multilateral trade agreements under the WTO, was to provide an escape clause to the member nations for situations when global trade interests and national security interests may be at odds with each other[18]. These exceptions allow otherwise WTO-inconsistent measures, if they are considered necessary to protect the 'essential security interests' of the implementing nations[19].

However, while the security exceptions only exist as a safety-valve measure for emergency scenarios, it was recognized in the drafting stage itself that it may be misused by the member nations as a 'virtually unlimited escape clause'[20]. The

[15]*Russia - Measures Concerning Traffic in Transit (n 10); United States - Certain Measures on Steel and Aluminium Products [2019] WTO WT/DS556.*

[16]*United States - Certain Measures on Steel and Aluminium Products (n 14).*

[17]*Ruolin Su and Wensong Shen, 'Is Nationalism Rising in Times of the COVID-19 Pandemic? Individual-Level Evidence from the United States' (2021) 26 Journal of Chinese Political Science 169; Center for Nationalism Studies, Observer Research Foundation, 'Rising Nationalism in Europe and Asia in the Age of COVID19' (ORF) <https://www.orfonline.org/research/rising-nationalism-in-europe-and-asia-in-the-age-of-covid19-72587/> accessed 5 January 2022.*

[18]*Thomas Cottier, Panos Delimatsis and Nicolas Diebold, 'Article XIV GATS: General Exceptions', Max Planck Commentaries on World Trade Law, WTO - Trade in Services (Martinus Nijhoff 2008).*

[19]*The General Agreement on Tariffs and Trade; General Agreement on Trade in Services; Agreement on Trade-Related Aspects of Intellectual Property Rights.*

[20]*Cann, Jr. (n 1); M. J. Hahn, 'Vital Interests and the Law of GATT: An Analysis of GATT's Security Exception' (1991) 12 Michigan Journal of International Law.*

idea behind the security exceptions was always that of balance – between the security interests of one or a few member nations on the one hand, and free global trade and the interests of all other member nations on the other. An extremely strict and narrow provision would defeat the purpose as it may even be out of reach for genuine security concerns. On the other hand, a lax one would allow measures with a disguised trade interest to sneak through[21].

During this stage, it was the hope of the Preparatory Committee that while interpreting and implementing these measures, the member nations would do so in good faith – which would be the primary guarantee against the abuse of these provisions[22]. The good faith requirement was in line with the pacta sunt servanda principle of international law as well, which identifies that, treaties among the nations must be implemented in an honest and reasonable manner[23]. This faith of the Preparatory Committee, until the recent years, on the member nations was not unfounded either, as in the seven decades after GATT 1947 was enacted, till the 2010s, the security exceptions have been rarely used and have never been the subject matter of a dispute before the WTO DSB[24].

Considering the inherent ambiguities that exist in the language of the security exceptions, interpreting the same in a consistent manner can be challenging. The first problematic term in this context is the 'it considers' portion, where the provision states that a nation may take WTO-inconsistent measures "which it considers necessary for the protection of its essential security interests"[25]. This phrase has often been interpreted to mean that the security exception provisions are 'self-judging', or that the implementing nation is the sole judge regarding which measures should be implemented under the same[26]. However, the problem with this interpretation is that if the provisions are considered to be completely self-judging, it eliminates the WTO's jurisdiction. It also provides an unprecedented amount of discretion to the implementing nations, as all other provisions related to unilateral measures under the international trade law regime allows for check and balance systems such as a dedicated procedure for invocation, prior notification, and review by the DSB or the contracting parties[27]. The wording of the provisions seems to suggest that while the nations may not be prevented from taking the necessary actions due to the urgency of the issue in question, an ex-post review by the WTO would not be out of jurisdiction. However, in recent instances, several nations have tried to argue against such an interpretation as well[28].

Other phrases that form the crux of the security exception provisions, remain ambiguous in their scope as well. Currently, the WTO regime does not provide any benchmark regarding the interpretation of various important phrases, such as 'ESI' and 'emergency in international relations'.

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[21]*Economic and Social Council, 'Second Session of the Preparatory Committee of the United Nations Conference on Trade and Employment' (1947) E/PC/T/A/PV/33.*

[22]*ibid.*

[23]*II Lukashuk, 'The Principle Pacta Sunt Servanda and the Nature of Obligation Under International Law' (1989) 83 The American Journal of International Law 513.*

[24]*WTO Analytical Index: Guide to WTO Law and Practice (World Trade Organization).*

[25]*The General Agreement on Tariffs and Trade; General Agreement on Trade in Services; Agreement on Trade-Related Aspects of Intellectual Property Rights.*

[26]*'General Agreement on Tariffs and Trade: Summary Record of the Twenty Second Meeting' (n 6); Bhala (n 12); Russia - Measures Concerning Traffic in Transit (n 10); United States - Certain Measures on Steel and Aluminium Products (n 14).*

[27]*A. Jayagovind, 'Legality of Unilateral Measures in International Trade Law' (2000) 40 Indian Journal of International Law.*

[28]*Russia - Measures Concerning Traffic in Transit (n 10); United States - Certain Measures on Steel and Aluminium Products (n 14).*

The ideas of ESI or emergency are such, that without an objective standard of interpretation, they can be used and abused by the member nations to include 'anything under the Sun'[29]. At the same time, no exhaustive definitions can be provided for them, as it would keep contemporary and evolving emergencies outside the purview of the provisions. Thus, in the current global climate, the idea of an emergency or an ESI seems be more of a continuum, to be accurately decided based on the contexts of the specific dispute.

To understand the enormity of the situation, let us assume that a country X, accuses another country Y of cyber or economic war, i.e., instances which do not involve outright armed conflict, and hence, decides to place an embargo on all trade with the latter. The security exceptions can exempt country X from providing information (Article XXI (a) of GATT and 73 (a) of TRIPS) that may be necessary to validate the claimed emergency, and the concerned Articles also allow country X to take 'any' action that 'it' considers necessary. Going by the current standards employed by the WTO, the burden of proof on X may, therefore, be extremely lax when it comes to deciding if the situation is an 'emergency in international relations' which falls under its 'ESI'. A plain language reading of the provision also seems to indicate that X is free to take 'any' action eliminating even a review of the proportionality of the action. So, under the current standards, a country can have a wide range of issues under which it can claim national emergency and use an equally wide range of measures and instruments to address the situation. While a case involving armed conflict may be easier to interpret as an emergency and whether or not it involves 'essential' security interests, it is the other 'other-emergency-in-international-relations' situations which need careful interpretation.

Ideally, a country negatively impacted by another member nation's unjustified invocation of the national security exceptions would have recourse under the WTO system. The Agreement allows retaliation by the countries which have been negatively impacted by another country's measures, if the violating acts are unjustified and are not repealed. However, it does not provide for compensation of damages already caused. While all other trade remedies such as safeguards or antidumping duties are specific to the product/service involved, the security exceptions have no such specificity – and hence, the scope for damage caused is higher. Also, given the asymmetry in economic might witnessed in the global community, it would be almost impossible for smaller countries to retaliate against larger and more powerful nations. A country that is permitted to retaliate by the WTO, ordinarily seeks to impose higher tariffs on products and services of the offending country. But if it is a small global buyer, it cannot influence the international price of those products or services, i.e., create favourable terms of trade effect. Thus, its act simply translates into higher domestic prices. In effect, the retaliating country suffers a welfare loss in attempting to make the offending nation pay for its excesses. Taking these practical difficulties into account, the WTO system allows for cross retaliation, or retaliation under other agreements[30]. The WTO DSB has allowed cross retaliation in two instances previously – in the *European Communities – Regime for the Importation, Sale and Distribution of Bananas and United States – Measures*

[29]*Economic and Social Council (n 20).*

[30]*Allison L Whiteman, 'Cross Retaliation under the TRIPS Agreement: An Analysis of the Policy Options for Brazil' (2010) 36 North Carolina Journal of International Law and Commercial Regulation.*

[31]*European Communities - Regime for the Importation, Sale and Distribution of Bananas - Recourse to Arbitration by the European Communities Under Article 226 of the DSU [2000]; United States - Measures Affecting the Cross-Border Supply of Gambling and Betting Services [2004] WTO Panel WT/DS285/R.*

Affecting the Cross-Border Supply of Gambling and Betting Services cases[31], and the WTO Arbitration Panel allowed for cross-retaliation in the *United States – Subsidies* for Upland Cotton case as well[32]. However, cross agreement retaliation involving TRIPS faces several barriers related to the estimation of the value involved, and hence, determination of proportionality in retaliation may be fraught with errors. Besides, intellectual property rights may be held by multiple stakeholders of nationalities different from the country which is being retaliated against.

Ordinarily, the rule of proportionality steps in when the DSB permits 'proportionate' retaliation against a respondent country that refuses to revoke violating or non-violating trade acts that undermine the commitments made under the accession agreement of the country concerned. Proportionality of the act ensures that the economic benefit derived by the rule violating country is nullified, and hence, the incentive to continue with the act is eliminated. There is no punitive element involved. But in the use of security exceptions, a country retaliates or imposes trade measures against another without waiting for the DSB's ruling or approval. The intention here is not to balance economic harm and gain but, rather 'punitive' in intent, attempting to coerce a country to change an economic or non-economic policy in order to protect the invoking nation's ESI. In such situations, measures based on security exceptions are inherently stronger than normal retaliations, and hence, there is scope for greater harm. A weak burden of proof combined with a broad interpretation of security exceptions allowing for punitive measures can, therefore, be a recipe for a gradual break down of the rule-based system.

While the first ever decision by the WTO on the security exceptions was made in 2019, the existing literature from before that time highlights that the potential for abuse of these exceptions was still a significant concern. One of the earlier authors to deal with this aspect was Wesley A. Cann Jr (2001), who identifies several existing problems and ambiguities for the security exception provisions. On one hand, the author explains how the benchmark of the current international community and multilateral trading system is cooperation and harmony. On that backdrop, unilateral sanctions imposed by the member nations under the guise of national security would cause unnecessary social and economic hardship to the nations. He highlights how the more powerful nations may misuse the security exceptions for economic and political interests, and with the other nations powerless to stop them, global relationships would be dictated by economic strength of the nations. Moreover, considering the disconnect among the different international organizations such as the United Nations and the WTO, ensuring that the national security exceptions are being implemented in good faith would be even more difficult[33].

Thomas Cottier and Panagiotis Delimatsis (2008) have echoed similar fears in their analysis of the exception provisions as found under GATS. Their discussion of the security exceptions takes into account the Nicaraguan proposal in the Uruguay round, where it was deliberated whether a good faith clause may be added to the provisions. This clause would mandate a bilateral negotiation and the intervention of the UN or other appropriate international organization before any unilateral imposition of measures could take place. The authors have described the concerned provisions as a 'virtually unlimited escape clause', and went on to describe that in absence of a balance being achieved between the relevant security interests of the member nations and their rights and

[32]*United States – Subsidies on Upland Cotton [2004].*

[33]*Cann, Jr. (n 1).*

obligations under the various trade agreements, the threat of misuse would be severe. Thus, including the above-mentioned clause would ensure that the good faith requirement that is inherent in all provisions of WTO agreements, could be enforced in a more practicable manner. They have also warned that these exceptions should only be used in extreme contingencies, as applying them in a hasty and unwarranted manner might lead to a slippery slope scenario with respect to economic sanctions[34].

Sophocles Kithardis (2014) goes one step further to describe the national security exceptions as a 'significant weakness' to the otherwise rule-based and predictable international trade law system. On one hand, he acknowledges that the provisions in question need to be broad to ensure that concerns of national security can be mitigated by the nations in a timely fashion. At the same time, providing such broad discretion to the nations and binding them to an abstract 'good faith' standard would ensure that it would be misused for political concerns as well. The author highlights the fact that not only are the security exceptions ambiguous in their wording, but this factor also makes it difficult for an affected nation to contest an invocation of this provision. Particularly considering that the transparency requirements related to this exception are also rather low, it makes it difficult for the other member nations to even know about the existence of such measures, let alone contest them before the DSB. Thus, the author argues, that while a provision under international trade agreements cannot be completely self-judging, in practice, the security exceptions are being applied in such a manner[35].

More recent literary works, particularly in the aftermath of the Russia – *Traffic in Transit case*, seem to be more urgent in their plea of achieving balance and clarity while interpreting the national security exceptions. Murrill (2018) advocates for a narrower approach in interpretation, as the current interpretation of the security exceptions can result in nullifying other provisions of the Agreement, if the nations are allowed to bypass them under the pretext of national security. As the author also points out, this would corrode the basis of security and predictability of the global trade system[36]. Similarly, Bossche and Akpofure (2019) have analysed the approach taken by the WTO DSB in the recent *Russia – Traffic in Transit and Saudi Arabia – Protection* of IPRs disputes, and dubbed the trend of unilateral and rampant invocation of the national security exceptions as an alarming one. The authors point out that the self-restraint system adopted by the member nations in the past few decades have eroded, and in this backdrop, they call for an alternative methodology for interpretation and just enforcement of the security exception provisions[37].

Authors Lester and Zhu (2019) take into account the ongoing dispute of the steel and aluminium tariffs imposed by the US under the national security exceptions, and discuss whether these measures can be justified under the system. Answering this question in the negative, they point out how the powerful nations such as the US have been bypassing the system for years. They criticize US' actions as taken in bad faith, and consider this scenario a challenge to the WTO system

[34] *Cottier, Delimatsis and Diebold (n 17)*

[35] *Sophocles Kitharidis, 'The Unknown Territories of the National Security Exception: The Importance and Interpretation of Art XXI of the GATT' (2014) 21 Australian International Law Journal 79.*

[36] *Brandon J. Murrill, 'The "National Security Exception" and the World Trade Organization' (Congressional Research Service 2018).*

[37] *Sarah Akpofure and Peter Van den Bossche, 'The Use and Abuse of the National Security Exception under Article XXI(b)(iii) of the GATT 1994' (WTI 2020) WTI Working Paper No. 03/2020.*

[38] *Simon Lester and Huan Zhu, 'Closing Pandora's Box: The Growing Abuse of the National Security Rationale for Restricting Trade' (2019) 874 Policy Analysis: Cato Institute.*

overall[38]. In a similar please, Voon (2019) has urged that in such cases, it is up to the WTO DSB to keep a check on the invoking nations and maintain the delicate balance of trade and national security, a task in which it has been drastically failing for the past decade[39]. Regarding India's ban of China-linked mobile applications, as Warrier (2021) has pointed out, India may have a recourse under the security exceptions in WTO law, if the dispute is ever actually brought before the WTO. However, even after issuing numerous notifications, China has been reluctant to initiate the same before the DSB. As the author highlights, considering the standards adhered to in the previous two panel reports, China may be hesitant to bring the case before the WTO due to the existing ambiguities in interpretation[40].

Essentially, the security exception provisions were meant to work as an escape clause, allowing the nations to defend themselves in times of grave emergency. It is true that in such scenarios, an ex-ante jurisdiction or approval process of the WTO would defeat the purpose as it would undermine the urgency of the matter besides corroding sovereign decision making. However, not having an ex-post jurisdiction at all poses the risk of nations being able to get away with anything, ultimately causing cracks in the whole WTO system. In the recent times, the two cases of *Russia – Traffic in Transit and Saudi Arabia – Protection* of IPRs have clarified the WTO DSB's interpretation of the national security exceptions and the jurisdiction question to an extent. But the problem remains as to how far they have been successful in mitigating the threat of abuse of the relevant provisions. Most of the literature, both pre and post the *Russia – Traffic in Transit* decision, has already acknowledged that the growing trend of abuse of these provisions is a problem. However, there is little information available in the existing literature on what would be the way out of this problem. Several authors have stressed upon the need of achieving a balance between trade and security, yet provide no solution as to how such balance would be achieved. In this context, this paper suggests a solution in the form of a sliding scale system, which can be implemented for efficient yet reasonably flexible interpretation of the security exceptions – thereby reducing the scope for abuse while protecting sovereign use.

III. Jurisprudential Evolution of the National Security Exception

While the 2019 Russia – Traffic in Transit case was the first ever decided case on security exceptions by the WTO DSB, in the pre-WTO era, Article XXI of GATT has been invoked a few times as well. In particular, there were six instances when a dispute involved the security exceptions. In the 1949 United States v Czechoslovakia dispute, trade restrictions were implemented by the United States under Article XXI of GATT for goods coming from Czechoslovakia. In defending its stance, United States had argued before the Contracting Parties that the implementing nation would be the sole determinant of the measures that would be necessary to protect its national security. However, no resolution was reached for the problem as the complaint was rejected by a roll-call vote[41]. Similarly, in the 1961 Ghana v. Portugal case, trade restrictions were imposed by Ghana against certain Portuguese products – and it was argued by Ghana that it was the 'sole judge' of the measures that it sought to implement under Article XXI[42]. Subsequently, the issue was turned

[39] *Tania Voon, 'The Security Exception in WTO Law: Entering a New Era' (2019) 113 AJIL Unbound 45.*

[40] *Aditi Warrier, 'The Essential Security Interest Conundrum for India' (2021) 53 New York University Journal of International Law & Politics.*

[41] *'General Agreement on Tariffs and Trade: Summary Record of the Twenty Second Meeting' (n 6).*

[42] *'Summary Record of the Twelfth Session' (n 6).*

irrelevant as Ghana invoked Article XXXV against Portugal, which explains specific scenarios where the Agreement may not apply between particular contracting parties[43].

The next instance where Article XXI was invoked, was the 1975 Sweden Footwear case, where a quota was implemented on certain footwear by Sweden, by invoking the 'spirit of Article XXI'. Sweden felt the need to ensure domestic production of footwear that would be essential in times of war[44]. It was not taken favourably by the Contracting Parties, as the connection between national security and footwear was found to be abysmal and reeked of protectionism. Ultimately, the measures were revoked by Sweden after 18 months . However, the review by the Contracting Parties of the measure in question solidifies the position further, that Article XXI allows for ex-post review of the measures[45].

Again in 1982, the security exceptions again came into focus via the European Community, Australia, and Canada v Argentina case, where imports from Argentina were banned by the EEC, its member nations, Australia, and Canada, based on non-economic reasons. The implementing nations, to justify their actions, claimed that they had the 'inherent rights' to do so under Article XXI. This gave rise to a debate as to whether invoking such unspecified 'inherent rights' was justified and whether the Contracting Parties were the right forum to decide the same[46]. Finally, the question of security exceptions found culmination in the 1985 United States v Nicaragua case, where US suspended all trade relations with Nicaragua. While a Panel of the GATT Council reflected upon the issue, it could not provide any decision on the same, due to the invocation of Article XXI, which was considered to be outside of the scope of the Panel[47].

In many of these pre-WTO cases, the implementing nations tried to argue that the measures or their intention behind the same could not be questioned or reviewed, such an approach was shot down by the Contracting Parties every time. Nowhere was it accepted by the other member nations that a country implementing measures under the national security exceptions would be completely outside the power of review of the Contracting Parties. Thus, having ex-post jurisdiction of review related to the measures implemented under national security exceptions could be said to always have been inherent under the Agreement.

In the WTO era, the first ever dispute to be decided by the WTO DSB on this matter was the Russia – Measures Concerning Traffic in Transit case in 2019. In this dispute between Russia and Ukraine, Russia had imposed certain trade restrictions on goods being transported from Ukraine through the territory of Russia. These restrictions were justified by Russia under Article XXI of GATT, citing the tumultuous relationship between Russia and Ukraine since 2014 as an 'emergency in international relations'. This dispute between Russia and Ukraine was a direct result of the close relationship between Ukraine and EU, facilitated by the 2014 EU-Ukraine Association Agreement, and the occupation of the Crimean territory by Russia. When the dispute was referred to the UN General Assembly by Ukraine, it condemned the Russian actions, while referring to the dispute as a war or armed conflict[48].

[43] *Negotiating Group on GATT Articles, 'Article XXI Note by the Secretariat' (Multilateral Trade Negotiations - The Uruguay Round 1987) MTN.GNG/NG7/W/16.*

[44] *Sweden - Import Restrictions on Certain Footwear (n 6).*

[45] *ibid.*

[46] *'Minutes of Meeting Held in the Centre William Rappard on 29-30 June 1982' (1982) C/M/159.*

[47] *United States - Trade Measures Affecting Nicaragua [1986] WTO Panel L/6053.*

[48] *Russia - Measures Concerning Traffic in Transit (n 7), p. 30-31.*

At the outset, it was claimed by Russia that due to the self-judging nature of this exception, a review of the same would be outside the WTO's jurisdiction. In analyzing this issue, the Panel looked into the negotiating history of this provision, where it was highlighted that at least some aspects of the security exceptions would be subject to review by the appropriate authority, as the scope of misuse was severe in this context. The Contracting Parties had recognized that by keeping the security exceptions completely subject to the discretion of the invoking nations, the spirit of the Agreement itself would be undermined[49]. The third-party arguments of a number of member nations in this case as well mostly show a consensus among the member nations that the phrasing of the provisions does not exclude the DSB's jurisdiction, but rather, identifies the specific aspects that can be reviewed by the WTO. However, US and China, both powerful economies, take the opposite road, and argue that the Panel lacks jurisdiction to make a determination in this case[50]. This approach of US and China as third parties is particularly interesting, considering both of them are currently associated with security exception disputes of their own, in the US steel and aluminium tariffs and the banning of Chinese apps by India respectively. Overall, taking the negotiating history and facts of the case into account, Russia's argument related to its lack of jurisdiction was rejected by the Panel. In such rejection, the Panel also referred to the *EC – Bananas III case*, where the interpretation of the phrase 'if that party considers' of Article 22 of DSU still involved a scope for review[51].

In many disputes, including the *Russia – Traffic in Transit,* it was seen that there were back-and-forth instances of sanctions and retaliations among the two states, before the issue was brought before the WTO DSB. Thus, while the Panel deemed that Russia was free to undertake any 'necessary' measures to protect its national security interests, if it should still be allowed to do that as an aggressor and instigator to the issue, is a political question more within the domain of an organisation like the UN and, rightly not considered by the DSB.

The next area that the Panel analyzed, was whether the measures in question were "taken in time of war or other emergency in international relations", as per Article XXI(b)(iii) of GATT. The Panel identified that an 'emergency' may not be in the nature of an armed conflict, and even a deterioration of relations, as was found between Russia and Ukraine, could be considered as such. Regarding the idea of ESI, the Panel concluded that while the member nations had some discretion to identify such interests, it could not bring in any potential concern under the same – but rather, it was under the obligation to interpret the phrase with a good faith principle, which is inherent in all international law treaties. Thus, a wide interpretation and low burden of proof was put by the WTO while interpreting 'emergency'. While in this case, the scenario was closer to an armed conflict, as described by the UN as well, this spells out a dangerous jurisprudential trend.

Next, the Panel identified the idea of 'ESI' to be narrower than the 'security interests'. While the 'security interests' may be covered by other provisions of GATT including the general exceptions under Article XX, the 'ESI' would involve the protection of its territory, citizens, or law and order[52]. Moreover, it applied a plausibility test in the context of the measures, as in, the

[49]*ibid, p. 45-50.*

[50]*ibid, p. 33-38.*

[51]*European Communities - Regime for the Importation, Sale and Distribution of Bananas - Recourse to Arbitration by the European Communities Under Article 22.6 of the DSU (n 30).*

[52]*Russia - Measures Concerning Traffic in Transit (n 10).*

measures must not be so unrelated or remote to the security interest that it is not plausible to protect the interests with the concerned measures[53]. In the end, the Panel concurred with Russia's arguments in the case, in as much that the measures in questions were taken 'during an emergency in international relations' for the protection of the nation's 'ESI'[54].

Overall, it can be seen that the Panel applied a very narrow standard of analysis or low burden of proof on Russia at every stage. The plausibility test put only the bare minimum burden of proof on Russia, to signify that there is some thread of connection between the measures and their objective. Regarding the proportionality of the measures compared to the ESI in question, no arguments or interpretations were provided in this case.

Immediately after the *Russia – Traffic in Transit* case, in 2020, the security exceptions came into focus again via another WTO dispute – *the Saudi Arabia – Measures concerning the Protection of Intellectual Property Rights* case. In this case, Saudi Arabia, UAE, and other nations in the Middle East and North Africa (MENA) region had imposed restrictions on intellectual property from Qatar, by invoking Article 73 of TRIPS. Citing its ESI that were being curbed by the ambience of war, terrorism, and instability in the region directly attributable to Qatar, Saudi Arabia refused to directly or indirectly interact with Qatar regarding the dispute[55]. It also imposed anti-sympathy measures on Qatar, which provided that anyone helping or even showing sympathy with Qatari citizens, whether in practical contexts or virtually, will be subject to imprisonment and/or fine. Since the implementation of these measures by Saudi Arabia and UAE, Qatar faced severe damage due to rampant piracy. While previously the Qatari broadcasting group beIN had the exclusive rights to broadcast premier sporting competitions such as Major League Baseball, FIFA World Cup, UEFA Champions League, etc., its operations were now thwarted with the emergence of beoutQ, a channel which illegally streamed pirated sporting content taken from beIN in Saudi Arabia and other nations. Moreover, they were unable to legally counter these IPR violations, due to the anti-sympathy measures in place in Saudi Arabia[56] .

In this case, regarding WTO's jurisdiction on the matter, the Panel established its jurisdiction in the same lines as *Russia – Traffic* in Transit, and it was not contested by the parties. Next, Saudi Arabia argued that the ambience of political unrest in the region among the different nations and in the border region of Saudi Arabia is an 'emergency in international relations', and the concerned measures were undertaken to protect its ESI and improve the scenario[57]. While Saudi Arabia claimed that the existing emergency was already recognized by the international community, the third parties argued and the Panel agreed that in line with the previous *Russia – Traffic* in Transit decision, the existence of such an emergency would be objectively reviewable by the DSB.

Regarding the questions of whether the measures were necessary for the protection of its ESI, the Panel applied a similar standard of burden of proof to that of the Russia – Traffic in Transit case. It provided that the scope of ESI was narrower than 'security interests', and would

[53]*ibid, p. 56-58.*
[54]*ibid.*
[55]*Saudi Arabia — Measures concerning the Protection of Intellectual Property Rights (n 11).*
[56]*Saudi Arabia — Measures Relating to Trade in Goods and Services, and Trade-Related Aspects of Intellectual Property Rights [2017] WTO Panel DS528, p. 25-32.*
[57]*ibid.*

involve scenarios causing a direct external or internal threat to the invoking nation[58]. Moreover, the Panel contended that the obligation of good faith applied not only to identifying the ESI, but also to the connection between them and the measures in question. This meant that the plausibility test from the Russia – Traffic in Transit case was applied here as well, as in, the measures could not be so remote from the interests that they were incapable of achieving the intended objectives[59]. However, considering that Saudi Arabia only needed to prove that the measures in question "meet a minimum requirement of plausibility in relation to the proffered ESI, i.e. that they are not implausible as measures protective of these interests"[60], they were able to establish the connection of plausibility and bring the measures in conformity of Article 73 quite easily. However, as that the measures in question were implemented not on goods or services but on IPR, which can cause significant damages, it is questionable whether the actions taken by Saudi Arabia were justified in connection to the ESI that it was trying to protect. Resolving this issue would require a proportionality test, something that was missing in this case as well. Even if the sanctions were considered to be 'punitive', their proportionality must be reviewable under a test, albeit with more leeway[61].

From these two decided cases, it seems that the first issue that needs to be resolved within any dispute related to the national security exceptions, is whether the WTO DSB has the jurisdiction to review the same. Both the *Russia – Traffic in Transit and Saudi Arabia – Protection of IPRs* cases seem to have established a trend that while the member nations have the discretion to implement the measures that they see fit under the provisions, the WTO has complete jurisdiction to conduct an ex-post review of the same[62]. Moreover, a similar approach is undertaken for security exception clauses in Bilateral Investment Treaties and other international law instruments as well, as the nation invoking an exception can never be the sole authority to determine its justiciability[63]. Once jurisdiction is established, the burden of proof for a successful invocation of the security exceptions should rest in three stages – i) there must be a war or other emergency in existence, ii) the measures in question must have some plausible connection to the interest in question, i.e., they must pass the plausibility test, and iii) the measures must be proportionate to the threat. To ensure that the national security exception provisions are serving their intended purpose while the scope for abuse is minimized, the burden of proof applied in these three stages must be a mix of strict and flexible in nature. Table 1 briefly illustrates how the WTO Panel analysed these three stages of invocation and what standard of burden of proof it had applied for them:

[58]*Saudi Arabia — Measures concerning the Protection of Intellectual Property Rights (n 8), p. 119-123.*
[59]*ibid, p. 106-124.*
[60]*Russia - Measures Concerning Traffic in Transit (n 7), p. 108.*
[61]*Thomas Cottier and others, 'The Principle of Proportionality in International Law' [2012] NCCR Trade Regulation, Working Paper No 2012/38.*
[62]*Russia - Measures Concerning Traffic in Transit (n 10); Saudi Arabia — Measures Relating to Trade in Goods and Services, and Trade-Related Aspects of Intellectual Property Rights (n 55).*
[63]*AK Bjorklund, 'Emergency Exceptions: States of Necessity and Force Majeure', The Oxford Handbook of International Investment Law (2015).*

Table 1: WTO Panel Analysis of National Security Disputes: A Brief Summary

Issue	Russia – Traffic in Transit Case	Saudi Arabia – Protection of IPRs Case
Existence of War/ Emergency	The deterioration of relationships between Ukraine and Russia arose to a matter of international concern, constituting an emergency in international relations. Taking into account the invasion of Crimean territory by Russia, the UN had referred to it as a war or war-like scenario as well.	There was a continuous deterioration of relationship between Saudi Arabia and Qatar, due to allegations against Qatar of facilitating war, terrorism, and instability in the MENA region. The severance of diplomatic, consular, and economic relationship between Saudi Arabia and Qatar can be described as an emergency in international relations due to it being an exceptional act.
Plausibility of Measure(s)	Measures could not be extremely remote or unrelated to the emergency, to the extent of making them implausible to serve the objective. As the measures can be connected to the 2014 deterioration of relationship between the countries, they cannot be described as extremely remote.	There must be a plausible cause-effect relationship between the measures and their objectives. The measures in question were a part of anti-sympathy measures implemented to Qatar, thus retaining a plausible connection between them and the objective of preventing terrorism.
Proportionality of Measure(s)	No discussions on proportionality of measures, allowing Russia to make a solo call on proportionality.	No discussions on proportionality of measures, leaving the question of proportionality to Saudi Arabia.

Source: Authors (Based on Panel Reports in Russia – Traffic in Transit and Saudi Arabia – Protection of IPRs disputes)

The standard that is applied at these two cases, seems to show that the Panel is favouring an extremely flexible burden of proof at the first two stages, while it did not consider a proportionality requirement at all. While an 'emergency' would need to be decided on a case-to-case basis, the Panel did not provide any guidance for the future, as to which scenarios would be considered as an emergency, probably exercising judicial economy. However, this begs the question - do emergencies other than armed conflicts, such as environmental, economic, digital, or health emergencies also come under the scope of the national security exceptions, and can all of them be treated on par? While in the *Russia – Traffic in Transit* case, the situation was dubbed as an armed conflict by the UN, the situation was rather grey for *Saudi Arabia – Protection of IPRs*, as the threat in question existed outside of its borders. Moreover, the WTO also mentioned that it would only objectively determine the existence of an emergency, and not enter the debate of which nation initiated or caused the same[64]. This would mean that the more powerful nations could intentionally cause a degradation of relationship, and then implement trade sanctions, on the smaller nations.

At the second stage of the DSB's analysis, the plausibility test that was employed, however, the invoking nations only needed to prove that there was some modicum of connection between the measures and their intended objectives, no matter

[64]*Saudi Arabia — Measures concerning the Protection of Intellectual Property Rights (n 11).*

how tenuous. On the other hand, there has been no discussion related to the proportionality of the measures in question at all, which means that once the existence of an emergency and a connection of the measures with the threat is proved, the invoking nations would be free to take the most severe measures without any consequences. This is a trend that would be even more dangerous if it is considered that it is not only trade agreements that are being impacted by the same, but it would also have far-reaching impacts in other international law instruments such as Bilateral Investment Treaties. A number of powerful nations have started incorporating similar vaguely worded national security exception clauses in all or most of their BITs[65]. For example, various US BITs include a clause that domestic legislations may restrict international investment to protect national security. Similarly, German BITs clarify that if a measure is taken to protect public security, it would not be considered as discriminatory treatment[66]. All of such provisions ensure that the implementing nation has almost unlimited discretion to restrict international investment, without any significant burden of proof.

Thus, these measures, if implemented indiscriminately, would further exacerbate the existing power imbalance in the global community. If these measures are implemented by a smaller nation on a larger one, they would not make a dent on the economy of the larger nation. However, in a vice versa scenario, they would be devastating for the smaller nation. The Russia – Traffic in Transit and Saudi Arabia – Protection of IPRs disputes would support such a trend as well, as evidenced from the size of economy and trading relationship of the disputing nations in Table 2[67].

Table 2: Comparison of Economic Size of Disputant Countries by Dispute Cases

Cases	Size of Economy (2020 GDP in US$)	Relationship as Trading Partners (2020)
Russia – Traffic in Transit	Russia: $1.48T (trillion) Ukraine: $155.5B (billion)	Ukraine is Russia's 14th largest trading partner, receiving $6.31 billion in exports. The amount of export in 2013, just before the dispute, was $25.1 billion. Russia is Ukraine's 3rd largest trading partner, receiving $2.97B in exports. The amount of export in 2013, just before the dispute, was $15.1B.
Saudi Arabia – Protection of IPRs	Saudi Arabia: $700.12B Qatar: $144.41B	Qatar is Saudi Arabia's 49th largest trading partner, receiving $52.5k (thousand) in exports. The amount of export in 2015, just before the dispute, was $1.64B. Saudi Arabia is Qatar's 120th largest trading partner, receiving $7.97k in exports. The amount of export in 2015, just before the dispute, was $762M (million).

Source: Authors' Compilation of OECD Data

[65] *OECD, International Investment Perspectives: Freedom of Investment in a Changing World (2007).*

[66] *Sebastián Mantilla Blanco and Alexander Pehl, National Security Exceptions in International Trade and Investment Agreements (Springer 2020).*

[67] *'The Observatory of Economic Complexity | OEC - The Observatory of Economic Complexity' <https://oec.world/en/home-a>.*

In both the cases, the trends seem to be highly similar: i) the stronger and more powerful nation unilaterally implements a measure against a smaller and weaker nation and ii) in the aftermath of the dispute, trade flow between the two nations is severely hampered. However, such a scenario is likely to be more detrimental for the smaller economies than the larger ones. For example, Russia's loss of Ukraine as a $25.1 billion trading partner is inconsequential, considering its GDP of $1.48 trillion. On the other hand, for Ukraine's $155.5 billion economy to lose Russia as a $15.1 billion trading partner, is indeed a blow. Similarly, for Qatar, a $144.41 billion economy, to lose Saudi Arabia as a $762 million trading partner is a much bigger deal than it is for Saudi Arabia, a $700.12 billion economy, to lose Qatar as a $1.64 billion trading partner. In the latter case, Saudi Arabia deliberately allowed violation of Qatar's IPR's as a mechanism of hurting the latter due to the limited possibility of inflicting any harm through tariffs given their low levels of trade.

The determination of these standards should be done with great urgency, as on a global level, multiple cases of invocation of the national security exception provisions are arising, none of which have seen any appropriate resolution yet. One of the more prominent ones is the United States – Certain Measures on Steel and Aluminium Products case, where in 2018, tariffs on steel and aluminium products were raised by the US[68]. It was done by referring to Section 232 of the Trade Expansion Act of 1962, which deals with national security concerns. However, it has been claimed that these tariffs are protectionist in nature, a view that can be confirmed by the public communication circulated by the then US President, Donald Trump[69]. These tariffs were not taken kindly by the international community, as there were several instances of retaliation and threat of retaliation against them[70]. Going against the previously established Russia – Traffic in Transit and Saudi Arabia – Protection of IPRs cases, the US, while invoking Article XXI(b) of GATT, has claimed that it is completely self-judging, and thus, the WTO would not have any jurisdiction to review the measures[71].

Another instance, operating closer to home, is India's ban on China-linked mobile applications. Following the skirmish at the India-China border where a number of Indian soldiers lost their lives, the trade and diplomatic relationship between India and China took an immediate hit. Via three notifications circulated in June, September, and November of 2020, India has now banned more than two hundred China originated or linked from operating within the territory of India. While India has not formally sought recourse to the security exceptions, the government notifications mention that the applications are 'prejudicial to sovereignty and integrity of India, defence of India, security of state and public order'[72]. Chinese officials have already identified that such a blanket ban is a gross violation of India's obligations under GATS[73]. However, even after almost two years have passed since the first instance of such ban, China has not brought the dispute before the WTO.

[68]*United States - Certain Measures on Steel and Aluminium Products (n 14).*

[69]*Jen Kirby, 'Trump Called Himself "Tariff Man." The Internet Did the Rest.' Vox (4 December 2018).*

[70]*Kate Gibson, 'Canada, Mexico, EU Retaliate against U.S. Steel and Aluminum Tariffs' CBS News (31 May 2018); 'India Announces Retaliatory Trade Tariffs against the US' BBC News (15 June 2019).*

[71]*United States - Certain Measures on Steel and Aluminium Products (n 14).*

[72]*Ministry of Electronics & IT, 'Government Bans 59 Mobile Apps Which Are Prejudicial to Sovereignty and Integrity of India, Defence of India, Security of State and Public Order' (n 9); Ministry of Electronics & IT, 'Government Blocks 118 Mobile Apps Which Are Prejudicial to Sovereignty and Integrity of India, Defence of India, Security of State and Public Order' (n 9); Ministry of Electronics & IT, 'Government of India Blocks 43 Mobile Apps from Accessing by Users in India' (2020).*

[73]*Rezaul H Laskar, 'China Says India's Latest App Ban Order Violates WTO Rules' Hindustan Times (25 November 2020); PTI, 'India's Decision to Ban 43 Apps in Violation of WTO Rules, Says Chinese Foreign Ministry' The Print (25 November 2020).*

As these recent disputes show, the burden of proof that the DSB is currently placing on the nations invoking the security exceptions, is extremely light. As the global arena is not a level playing field, this may lead to the powerful nations implementing more and more such protectionist measures under the pretext of security issues. Considering that such unilateral security measures by the member nations do not have a concrete transparency requirement either[74], the recent jurisprudential trend is perfectly conducive towards a steady degradation of the rule-based WTO system. Thus, the question rises as to what would be the ideal methodology to determine the burden of proof for the nations invoking the national security exceptions.

IV. Towards a Sliding Scale Framework

So far, what has quite clearly emerged, is that the national security exception clauses are justiciable. Although a positive development this justiciability may become infructuous if the interpretations given are so wide as to allow any 'emergency' or any 'action' or fail to incorporate new threats that can constitute 'essential' security interests. If the interpretation is too wide justiciability becomes de facto toothless. Further rules also need to be flexible to incorporate global changes else they become error prone. In this section, we propose a framework that can aid in reducing the probability of errors in the interpretation of the exceptions and thereby sending appropriate signals to countries that seek to misuse them.

ESI is defined as a function of the emergencies specified in the various sub clauses to A XXI (b) in GATT and similar articles in other agreements. The panel in *Russia – Traffic in Transit* clearly interpreted that the nature of the emergency must typically be caused by an external threat which results in an armed conflict, threat of the same or 'heightened tensions' or instability around the country or an internal law and order breakdown[75]. This specifically rules out the use of ordinary 'political' differences or other trade related situations but at the same time may also be too narrow failing to capture threats that arise from attacks that are not arms based. Cyber-attacks or unconventional warfare such as sponsoring of separatists or terrorism by another nation may also be considered as necessitating action in ESI. What we therefore, propose is to recognise there can be claims of ESI which have varying degrees of 'essentialness' arising out of the differing degrees of emergency. The actions of the other nation(s) can have varying degrees of impact on the country concerned depending on – a) immediate or not so immediate and ; b) high impact or low impact. What could qualify as immediate? Any change in international relations that has already impacted a country or threatens to do so in the short run, by way of armed conflict or an internal law and order development that has already attracted domestic measures can be categorised as high emergency? A 'high impact' instance would include those situations where there is a direct impact on a country's own territory, safety of its people and internal law and order and when required accompanied by suitable internal responses. Situations which pose an indirect threat to its territory etc would fall into the low impact category. The distinction is not made on the basis of the 'magnitude' of the impact i.e., on the extent of the territory, economy , or number of people compromised. Any minimal impact can be construed as a high impact situation. This allows for complete sovereignty over decision making and no external body sits in judgement over the need for a de minimus harm or threat to

[74] *A. Jayagovind (n 26).*

[75] *Jen Kirby, 'Trump Called Himself "Tariff Man." The Internet Did the Rest.' Vox (4 December 2018).*

qualify it as leading to an ESI. The standard of proof for plausibility and proportionality in action can vary according to these possibilities. The strength of this approach is that it does not take away the sovereign right of a nation to respond to a true threat. All it requires is a plausibility test and proportionality that is inversely related to the degree of 'essentialness'.

We present this combination of possibilities and the resultant plausibility test and proportionality requirement in the figure below.

Figure 1 : Categorisation of emergencies under A XXI and the associated plausibility evidence and proportionality required

	Immediate impact	Delayed impact
High impact	A) Prima facie evidence, low plausibility and no proportionality	B) Stronger evidence, low plausibility and no proportionality
Low impact	C) Stronger evidence, low degree of plausibility and high proportionality	D) Stronger evidence , higher degree of plausibility and proportionality

Source: Authors

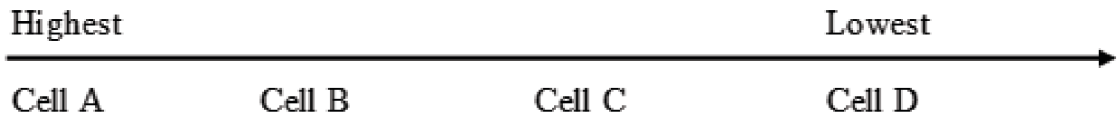
Depending upon the position of the dispute in this matrix, the burden of proof and degree of plausibility and proportionality of measures may be decided accordingly. In other words the decision cannot be based on a binary standard i.e., essential or non-essential security interest, with uniform weak standards for the former but rather to be treated as a continuum of differing degrees of 'essentialness' with appropriate standards of evidence to be applied while not abrogating the sovereign right of a nation.

How does this methodology reduce the possibility of errors of over or under inclusion? A situation where a country is facing an armed attack or immediate threat of the same would fall in cell A. This would demand a low standard of proof and given the gravity of the situation a country can use all possible trade instruments (low plausibility and no proportionality) as its security interests require to deter further escalation. Cell B which reflects high potential impact requires a higher standard of proof but low plausibility and degree of proportionality. The reasoning behind this is that the probability of the event yet to take places decreases with time hence a comparatively higher standard of proof to establish linkage between the current situation and future impact would be justified. The very economic logic behind the legal enforcement of a contract is to provide certainty to delayed transactions which have a lower probability of performance over time, due to favourable or unfavourable occurrences that can cause a breach, as compared to immediate transactions. Similarly events which are to take place even over a short run horizon have a probability, whether high or low. But a low plausibility and a still deterrent degree of action via no requirement of proportionality can allow a country to induce deterrence and function with sovereignty intact. Cell C and D both require comparatively higher standards of evidence given the lower impact (non-territorial among others) but vary in the specificity of plausibility and proportionality based on the compounding of factors. Cell D has both low and delayed impact and hence requires higher standards on all counts.

The probability of establishing an ESI will be a function of the standard of proof required.

As the standard of proof requirement increases the probability of establishing an ESI decreases and hence the scope for over inclusiveness reduces. Further as the requirement of the twin P's (plausibility and proportionality) increases the specificity of the action increases the magnitude of the action reduces and therefore the expected social cost of an erroneous decision is reduced. The expected social cost is essentially the sum total of the cost of enforcement and the error cost in decision making. The degree of essentialness and its associated expected value of trade acts a country can engage when desirous of using A XXI can be represented as below:

Figure 2 : Degree of 'Essentialness' and associated expected size of trade actions



This approach lays down a clear guidance for member countries. The list of events that fall into the different cells can be populated over time and it is not the intention of the authors to provide an exhaustive list but rather a framework for analysis. The benefit of such an approach can be seen when applied to the two cases decided by the DSB so far. The Russia – traffic in transit case would find itself in cell A by virtue of it involving an armed conflict and western sanctions that impacted it directly. Although the aggressive posturing was mostly by Russia, with minimal 'immediate' armed threat to its own territory, the panel despite its definition of an emergency also took into consideration 'economic sanctions' imposed by other countries in deciding that it was a situation that fit the description of an ESI. This approach by the panel inherently creates scope for other member countries, subject to external sanctions, to invoke A XXI and hence the need for a sliding scale. The Saudi – IPR case would be placed in cell D given that there was no immediate or high impact situation. The situation could qualify as an ESI but will require higher standard of evidence and greater degree of proportionality.

How does this methodology place other recent instances of trade actions claimed under security exceptions and yet to be contested in the WTO or to be decided by the DSB? The US steel and aluminium tariffs is unlikely to fall in any cell of the matrix for the reason that its emergency does not connect to any event involving an emergency that relates to the possibility of a war/armed conflict or threat of the same. Nor does it face any sanctions from other member nations. The justification for these tariffs was that the US steel and aluminium industry is critical for the defence industry, besides the economy itself [76]. It is a clear case of protectionist reaction to global competition and macroeconomic conditions which led to a glut in steel probably used with the hope that it would be treated as outside the scope of the DSB. While the crisis in its domestic steel and aluminium industry may be categorized as an emergency of economic nature, it cannot be deemed as essential for protection of its security. It can resort to alternate instruments such as the emergency provisions in the Agreement on Safeguards. Of course use of this would have meant that it would have to compensate affected member nations.

[76] *Administration of Donald J. Trump (n 8); Five Things to Know About Trump's Steel and Aluminum Tariff Plan, WSJ, March 8, 2022 https://www.wsj.com/articles/five-things-to-know-about-trumps-steel-and-aluminum-tariffs-1520530325*

The India-China skirmish, the armed conflict in the Indo-China border would place its situation in cell A with both high impact and immediate impact[77]. Its fits the panel definition of an emergency. Further our methodology would place a low level of plausibility and proportionality in its trade actions against China. It is no surprise that China has not challenged India's actions in the WTO, particularly given the two recent panel decisions.

V. Conclusion

The WTO was established as trade regulator, to provide a rule-based world trade order for the collective benefit of member nations. In the recent decade, a clear rising trend of invocation of security exceptions, mostly by the powerful nations has cast a new challenge to this order. Unchecked it could result in a prisoner's dilemma situation with various players encouraged to act in a self-interested manner unless stopped in their tracks by the DSB[78] However, the two panel decisions so far have placed an extremely low burden of proof and weak plausibility resulting in the danger of countries abusing their good faith when faced with an international political contingency. Instability in surrounding regions and sanctions now have legitimate claim to the use of security exceptions. Could India use the security exceptions if China were to build a dam across the Yarlung Tsangpo (Brahmaputra in India) which could either cut the water flow during the dry season or flood Assam during the wet season?[79] The shortfall in the current panel approach is that it treats claims under the security exceptions in a binary manner. Instead if such actions were approached using a sliding scale methodology, member countries would have better clarity regarding the potential outcomes of them invoking the national security exceptions and the chances of misuse could be minimized as the probability of success and the scale of trade action get scaled down. This will not eliminate all opportunistic uses and neither have we seen this happening in the context of other rules, but it is certainly a positive step forward. In the context of India's international trade policies, as well as other countries, such an approach would provide it scope to employ strong trade measures before it finds it compelling to resort to armed measures.

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Tax Policies Towards Multinationals and its Impact on Transfer Pricing in India and Selected Countries

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Abstract

The paper explores the effects of changes in tax policies towards multinational corporations and their impacts on transfer prices in India. For this purpose, the study considers the five largest importers of mineral products viz., Australia, Chile, Indonesia, South Africa, United Arab Emirates (UAE). The main objective of the paper is to show that with an increase in the taxes of the foreign subsidiary's country, multinational corporations try to increase the inflow of tax income to their home country by increasing and manipulating transfer prices in the host country. To check the product tariff and corporate tax influence on the reported transfer prices of MNCs in India, a basic empirical model is constructed with reported transfer price as the dependent variable and Transfer Price index (TPI) and GDP per capita as the independent variables. The study uses both country-specific OLS and overall Panel data regression for analysis and finds that when the coefficient of the TPI is significant and positive for a country, the MNCs increase the reported transfer prices to increase the inflow of tax income to the home country and when the coefficient of TPI is negative but significant, MNCs reduce the reported transfer prices to reduce the inflow of tax income in the home country of the MNC.

1. Introduction

Theoretical and empirical literature shows that taxation can alter the business operations of Multinational Corporations (MNCs) from one country to another because MNCs organize their operations according to the taxation policies and alter where they set up their businesses. For instance, MNCs invest in low-taxed jurisdictions to attain greater profits. This implies that corporations can reduce tax burdens by altering their location and character of incomes across various jurisdictions. Many countries' multinational tax rules are very similar to each other due to the OECD model tax treaty.

Multinationals have gained opportunities for tax adjustments after globalization and the rise of intangible capital. The concept of Base Erosion and Profit Shifting (BEPS) is one of the strategies used by MNCs to shift profits from high tax jurisdictions to low tax jurisdictions. At least 40% of the profits are transferred to tax havens every year and this has mostly led to a loss for the United States by 15 percent of the nation's corporate tax income. The BEPS mainly took place through transfer pricing. Transfer Pricing is an act of transferring internal prices for goods and services that are sold between subsidiaries or companies of the same entity. This is a usual practice that has been a part of the business since the beginning of the firm (Coase 1937). There are practical difficulties in monitoring and taxing such transactions as they do not take place in an open market. A commercial transaction between two independent companies in a competitive market should reflect the best option for both companies and two affiliated companies are more likely to make transactions in the best interest of their global parent corporation. It can be in the interest of the global corporation to make higher profits

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in lower-taxed jurisdictions and lower profits in higher-taxed ones, as a means of reducing its overall tax bill.

The expansion of transnational corporations abroad imposes the transfer of goods and services between parent corporations and their foreign associates. One problem that arises in this context is how to find prices for these cross-border transfers. Transfer pricing frameworks can promote sensible tax revenues for the countries involved in foreign trade and at the same time, it can establish a fair tax liability on corporations. For these motives, transfer pricing matters important for host and home governments, as well as for MNCs, as transfer pricing impact the amount of profit described in host countries by corporations, which in turn affects the tax revenues of both host and home countries (UNCTAD: 2015).

In contemporary international business, transfer pricing is also one of the factors which determine the price of goods and services of enterprises or companies that are traded across national frontiers. The method of transfer pricing allows enhancements in pricing and profits of enterprises involved in foreign trade and strategizing business operations in foreign trade. It also helps for capacity utilization and working capital management but is not a smooth adjustment for risk. For instance, the base erosion and profit shifting risks in the mining sector are very high. According to the ongoing work on BEPS and the Intergovernmental Forum on Mining (OECD: 2018), regulations for source nations on transfer pricing in the mining sector have been released. The transfer pricing and tax avoidance problems are identified mainly in some areas like undervaluation of mineral exports, abusive transfer pricing, excessive deductions in the interest rates, harmful tax incentives and metal streaming.

Recently, many developing countries use tax incentives to attract and facilitate the inflow of domestic and foreign investment. Their effectiveness has often been uncertain because they are location-specific or cannot be relocated. Tax incentives are also expensive as countries forgo vital public revenues. Nonetheless, governments may benefit from introducing tax incentives because changing tax arrangements may appear easier to deliver than other investment-promoting actions such as infrastructure. In such cases, tax incentives need to be carefully planned to be effective and competent in the policy-making processes.

India has been one of the high tax countries relative to the safe havens where MNCs shift profits to their home country through transfer pricing. In recent years, however, India is trying to attract more foreign investors and reduce base erosion. Apart from the negative impact on government revenue, the individuals have to bear a greater tax burden which otherwise would have been less burdening and the domestic firms face a competitive disadvantage as they pay disproportionately high taxes. India's corporate tax revenues also come from MNCs and the loss of this revenue affects public expenditure. India (2018) has also increased the taxation by 15% on the multinationals due to advertisement, marketing and sales promotion.

Thus, the problem of transfer pricing needs corrective policy interventions in developing countries. This raises a few important research questions: Does a corporate tax cut help MNCs in India? Is the financial scope expanded concerning the Finance Act of 2018 that focuses on taxing non-residents for Significant Economic Presence (SEP) beneficial for India? Will changes in profit apportionment lead to double taxation and profit attribution or fractional apportionment lead to mismatched profit allocation on cross-border operations? This paper addresses these questions and issues related to the base erosion through

transfer pricing via minerals trade, because of its relevance and significance in the context of transfer pricing.

The major objective of this paper is to identify the appropriate transfer price methods and tax policies for MNCs. In addition, this paper examines the changes in the tax reforms of India, analyzes whether the new idea of fractional apportionment is beneficial for India rather than the standard formulary policies suggested by the OECD (2018) and suggests suitable policies to (a) resolve the problem of transfer pricing and base tax erosion in India and (b) shifting of profits by the MNCs from the country to safe havens which are the low tax jurisdictions.

2. Related literature

Transfer pricing adjustment reduces the total quantum of an organization's tax liability by shifting accounting profits from high tax to low tax jurisdictions. It changes the relative tax burden of the multinational firms in different countries of their operations and reduces worldwide tax payments of the firm (Gupta 2012). Cristea and Nguyen (2016), found a relationship between transfer prices for goods and corporate tax rates that is consistent with tax minimization by multinational corporations. Many empirical studies found the incentive to set transfer prices in a way that minimizes total tax liability (Horst 1971, Clausing 2003, Swenson 2001).

Dawson and Miller (2000) observed how the MNCs respond to changes in the international corporate tax rates and establish that profit-maximizing MNCs use transfer prices to shift profit to the relatively lower-tax country to maximize their profit. This literature comprises other studies including Grubert 2003, Heckemeyer & Overesch 2017. Srivatsan (2004) examined economic facets like Value Added Tax (VAT) in transfer pricing; bridging of fiscal vs economic tax base, and the multiplier effect of transfer pricing. The study specified that by implementing tax/ profit shifts from higher tax jurisdictions to lower tax jurisdictions, the firm can go on building the profits and the multiplier concept would hold for transfer pricing.

UNCTAD (2015) evaluated tax revenue losses owed to tax avoidance schemes that exploit a direct investment relationship based on the lower reported rate of return for investment from offshore hubs also termed as tax heavens. OECD (2015) estimates revenue losses due to both profit shifting related to tax rate differentials and differences in average effective tax rates for large affiliates of MNEs and domestic companies.

Freinschreiber (2007) examines the rapid development of transfer pricing in India using case law, audit techniques, and other regulations for business. This study has observed that the Indian government is imposing severe transfer pricing penalties compared to other developing countries. These penalties included an adjustment of transfer prices to a minimum of 100 percent and a maximum of 300 percent. India's stringent penalties include the documentation penalty which is imposed on the taxpayers above the transfer penalty when the taxpayers failed to maintain India's submitted documentation which is 2 percent of the taxpayer's transactions. For the protection of the tax base, Indian tax authorities have pursued potential permanent establishment claims against MNCs. Gupta (2012) explores the impact of product tariffs and corporate tax on the transfer pricing of MNCs in India. The study has applied the Swenson model using custom values of imports originating from countries like Germany, Italy, Switzerland, China, Japan, France, Singapore, UK and USA into India. It shows that an opportunity for the MNCs is created due to the transfer pricing incentives that are created by tariffs and corporate taxes. The opportunity that the MNCs get is that they can now maximize

profits by manipulating transfer prices and can also reduce tax liabilities. Swenson (2001) analyses that transfer price manipulation has changed the relative tax burdens faced by MNCs in their various countries of operation. This kind of manipulation also brings about changes in tariffs that are levied on intracompany imports. Due to this reason, the manipulation of transfer prices varies substantially across products when tax rate changes take place in various countries. The study uses product level variation in tariff duties to identify transfer pricing changes in products imported to the U.S. The results indicate the variations in the reported customs values of the U.S. imports from the U.K, Japan, Canada, Germany, and France with the transfer pricing incentives created by taxes and tariffs. The results suggest that even though transfer pricing manipulation of inter-firm trade can potentially suggest income shifting, the evidence from trade transaction prices suggests that manipulation of product transfer prices is not responsible for movements in large incomes. Liu et al (2017) employ unique data on corporate tax returns and export transactions of UK multinationals. The findings suggest that the prices are manipulated by the firms to shift profits to low tax jurisdictions. Mansori et al (2001) analysed the US transfer pricing regulations. Recently, the regulations with regard the transfer pricing have been tightened. These regulations have been created to limit multinationals' profit-shifting activities. The new regulations have been formulated due to the concern of inadequate tax revenues contribution from the foreign companies. Kari and Yla-Liedenpohja (2005) analysed the effects of equalization tax on the decision of a multinational company. An equalization tax is an extra corporation tax on dividend distributions to ensure that the underlying profit of a dividend has borne a tax in the corporate sector equal to the imputation credit given to the shareholder. An equalization tax is shown to increase incentives for home-country's real and financial investments and for transfer pricing to shift taxable income even from low-tax countries to high-tax home countries of parent companies. The current EU process of exchanging imputation systems and equalization tax for classical systems may thus have adverse tax revenue effects in the countries concerned.

Clausing (2016) used the survey data from the Bureau of Economic Analysis for the period 1983 to 2012. The data the MNCs in U.S. were collected to test the profit shifting effects on corporate tax base erosion in the U.S. To estimate the impacts of profit shifting activities on the government revenue of the U.S. tax rates and affiliate profits are analyzed. The findings suggest a substantial increase in the revenue losses and the cost borne by the U.S. government for profit shifting lies between $77 and $111 billion in corporate tax revenue by 2012.

This paper addresses the issue of transfer pricing, fractional apportionment and cuts in corporate taxes in India's digital economy. India has not yet been able to comply with the OECD FAR analysis. However, the new hybrid method adopted by India is a mix between FAR analysis and fractional apportionment.

3. Empirical framework

To estimate the product tariff and corporate tax influence on the reported transfer pricing of MNCs in India, a simple empirical model is used. The testing of the model is done with the use of both time series data and panel data. The regression technique is adopted and estimated through GLS (Generalized Least Squares) method. There are challenges to measure the effects of tax and tariffs on the reported transfer prices, because the changes in the reported transfer prices may be due to different macroeconomic reasons which are not only affected by tax or tariff. By reporting an artificial increase in the prices, MNCs can easily shift income back to their home countries, to

their foreign parent companies and out of India. The overall tax payment of the MNC across the globe may reduce if the corporate tax rates in India are low and the prices are artificially increased by transferring the taxable income from India to the MNC's parent country which is a low tax country. However, the MNCs have to pay the additional amount of tariff due to increments in the transfer prices. This assumes that the parent company sends or ships some of the parts to the foreign subsidiaries to assemble and sell. If the firms choose to use arm's length transfer prices, the firm's real returns would constitute the taxable income on which it pays taxes at home and abroad. However, manipulation of transfer prices may lead to an alteration in the firm's taxable income at home and abroad. Even though the firms may practice understatement of transfer prices, the firm chooses the reported transfer price that is less than or equal to zero. Due to higher transfer prices, the taxable income of the subsidiary reduces and the taxable income of the parent firm increases by the same amount which is only done by the firms when the tax rates in the home country are lower than tax rates of the foreign subsidiary's country. The increase in transfer prices however increases the tariff payments by the subsidiary in the foreign country thereby resulting in a decline in the taxable income of the firm in the foreign country by the amount equivalent to the tariff payments.

The firm's decision to understate or overstate transfer prices depends on the tax and tariff differentials across the countries. The firm then makes a comparison between shifting income out of the host country and weighing the benefits. This decision is made by taking the difference between the tax rates of both countries and the after-tax cost of tariffs. The after-tax cost of tariffs is the price of shifting the income from the host to the home country. The firms overstate the transfer prices when the after-tax cost tariffs are lower than the benefit from the tax difference in relocating the income. This may be called Transfer Pricing Incentive (TPI) which is taken as one of the independent variables in the regression. If TPI is positive, the firm can overstate the transfer price by one rupee, and the total income increases by a positive percentage of one rupee. The transfer pricing hypothesis is simple to quantify the importance of this method of income shifting in firm activities. To test this hypothesis, the following general model is formulated.

$$Y_t = \alpha + \beta_1 PI_t + \beta_2 GDP/cap_t + u_t$$

Yt is Reported Transfer Price, PI_t is Transfer Pricing Incentive and GDP/cap is GDP per capita. α is assumed to be a constant and u_t is the random error term. The reported transfer price is equals to [(tf – th) – tf (1-tf)] = [(tax in foreign country – tax in home country) – tariff in foreign country (1-tax in foreign country)]. GDP per capita is used as a proxy for the gross domestic product of the country which is included to control measurable cross-country quality differences.

The data for the study is collected through secondary data for a period of fifteen crucial years from 2003 to 2017 when significant changes took place in the Indian tax system. Other study countries are Australia, Chile, Indonesia, South Africa and United Arab Emirates (UAE). The two largest traded goods by India are mineral fuels and gold. We focus on trade in minerals products. These countries chosen are the five largest trading partners of India in the mineral industry. The secondary data for analysis is collected from the Export-Import Data Bank of the Department of Commerce, Ministry of Commerce and Industry, Government of India and Directorate General of Commercial Intelligence and Statistics (DGCI&S). The data for minerals' import product share is sourced from WITS (World Integrated Trade Solution). The corporate tax rate data for different countries are collected from KPMG's Corporate and Indirect Tax Rate survey. The data set is formulated by one commodity and

five countries. The commodity i.e. minerals is the most traded commodity for India and the five selected countries are the largest trade partners of the country. The transfer prices artificially raised based on Indian tariff rates leads to a different cost of shifting income out of India. The MNC can shift income to its foreign parent country and out of India by reporting artificially increased prices. If the Indian tax rate is more than that of the MNC's parent country, then artificially increased transfer price reduces tax payments for India globally as the taxes shift from India to the low tax parent country. Thus, the MNCs need to pay India's increased tariff payments due to the additional increase in the transfer price. If the firm chooses transfer prices based on the arm's length principle, (known globally as the price agreed in a transaction between two parties must be the same) then the firm's real income includes the taxable income on which it pays taxes at home and abroad. In other words, changing or altering the transfer prices from the arm's length standard by manipulation of the prices leads to a deviation of the transfer price from arm's length which then results in the firm altering its tax income at home and abroad. It is also assumed that the subsidiary's income is sufficient enough to avail of the tax benefit from transfer price manipulation.

The method includes the calculation of transfer pricing margin which is the difference between the actual and manipulated transfer price. The transfer pricing margin represents the per unit overstatement of the price. Thus, the taxable income of the home country of the parent company increases whereas the taxable income of the subsidiary reduces by an equal amount due to the higher transfer prices. A higher price leads to an increase in tariff payments by the subsidiary in the foreign country and results in a decline in the taxable income of the subsidiary in the foreign country by an equal amount as that of the tariff payment.

Other variables taken into consideration are import tariffs as they affect trade and can therefore affect the degree of transfer pricing adjustment in the home country's tax rate, foreign country's tax rate, and tariff rate in the foreign host country.

4. Empirical analysis and findings

An analysis of tax policies toward MNCs and their impacts on the Indian economy through transfer pricing techniques is estimated in two ways. Firstly, the panel estimation of the general least square (Panel EGLS) using the transfer pricing techniques of Australia, Chile, Indonesia, South Africa and the United Arab Emirates. Second, nation-specific regression analysis using the standard OLS method.

Table 1: Determinants of reported transfer price: Estimates of Panel EGLS

Dependent Variable: Reported Transfer Price (PR) Method: Panel EGLS Sample: 2003 – 2017 Periods Included: 15 years Cross-sections included: 5 countries Total panel observations (Balanced): 75 Linear estimation after one-step weighting matrix			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**
C	733891.3	53185.90	13.79861
TPI	-1033.481	196.8461	-5.250198
GDP/cap	17494.91	7549.546	2.317346

Weighted Statistics			
Root MSE	0.938381	R-squared	0.343317
Mean dependent var	1.410851	Adjusted R-squared	0.325076
S.D dependent var	1.524933	S.E. of regression	0.957731
Sum squared resid	66.04192	F-statistic	18.82098
Durbin-Watson stat	1.175106	Prob(F-statistic)	0.000000
Unweighted Statistics			
R-squared	0.128943	Mean dependent var	685656.5
Sum squared resid	2.728613	Durbin-Watson stat	0.364635

Source: Author

The result in Table 1 indicates that the TPI coefficient is negative and the p-value for TPI and GDP/cap is less than 0.05. This implies that all the countries like Australia, Chile, Indonesia, South Africa and UAE (United Arab Emirates) based MNCs may reduce their home country's taxable income through reducing the reported prices and removing taxable income from India to increase the reported prices. With a five percent increase in the corporate taxes in the home country, the reported prices of MNCs reduce by 1033 units in their home countries. The coefficient of TPI is significant and negative implying that the MNCs reduce taxable income in their home countries by reducing their reported transfer prices.

Next, the regression results using OLS (Ordinary Least Square) of the time series data for specific countries i.e. Australia, Chile, Indonesia, South Africa and UAE are presented in Table 2.

Table 2: Determinants of reported transfer price: Estimates of OLS for individual countries

Country: AUSTRALIA			**Country: CHILE**		
Dependent: Reported Import Price			**Dependent: Reported Import Price**		
Independent Variables	**Coefficient**	**p-value**	**Independent Variables**	**Coefficient**	**p-value**
Transfer Pricing Incentive	-10283.57	0.0034	Transfer Pricing Incentive	-9042.973	0.0423
GDP Per Capita	280084.6	0.1125	GDP Per Capita	39264.65	0.6631
Prob (F-Statistic)	0.009162		Prob (F-Statistic)	0.111819	
C	1662232	0.0000	C	2357512.00	0.0004
Durbin Watson	1.411181		Durbin Watson	0.944209	
R-Squared	0.542562		R-Squared	0.305905	

Country: INDONESIA			**Country: SOUTH AFRICA**		
Dependent: Reported Import Price			**Dependent: Reported Import Price**		
Independent Variables	**Coefficient**	**p-value**	**Independent Variables**	**Coefficient**	**p-value**
Transfer Pricing Incentive	-2742.695	0.0270	Transfer Pricing Incentive	-747.7799	0.0499
GDP Per Capita	67636.53	0.5803	GDP Per Capita	-48894.22	0.0581
Prob (F-Statistic)	0.067785		Prob (F-Statistic)	0.010387	
C	576610.6	0.2770	C	478398.6	0.0000
Durbin Watson	2.859355		Durbin Watson	1.738123	
R-Squared	0.361458		R-Squared	0.532891	

Country: UNITED ARAB EMIRATES		
Dependent: Reported Import Price		
Independent Variables	**Coefficient**	**p – value**
Transfer Pricing Incentive	-305.0293	0.0009
GDP Per Capita	11149.52	0.0020
Prob (F-Statistic)	0.000337	
C	306406.7	0.0000
Durbin Watson	1.883729	
R-Squared	0.736161	

Source: Author

Table 2 shows that the coefficient of transfer pricing incentive (TPI) is negative for Australia which implies that a reduction in reported transfer prices of MNCs situated in Australia reduces the taxable income. Further, the regression results in Table 2 reveal that the coefficient value for transfer pricing is observed negative and significant for Chile, Indonesia and South Africa. The level of significance is observed through the low value of the f-statistic and low p-value, which indicates a 5 percent level of significance. This implies that the MNCs headquartered in Chile, Indonesia and South Africa seek to remove taxable income from India through decreasing their reported transfer price by 9042 units, 20742 units and 747 units when the home corporate tax rate fall by one unit.

The coefficient of determination (R2) for the transfer pricing incentive of the United Arab Emirates and Australia are 0.736 and 0.543 respectively which is very high, indicating that the model has been specified correctly. Moreover, the low F-statistic value and the p-value of 0.0009 and 0.003 for UAE and Australia implies the transfer pricing incentive is significant at a 1 percent level. It is also observed that the MNCs headquartered in UAE and Australia may remove taxable income from India by increasing its reported transfer price by 305 units and 10283 units when home country corporate tax rates fall by one unit. Compared to Chile, Indonesia and South Africa, the results show a higher level of significance and transfer pricing incentive effect for UAE and Australia.

5. Conclusion

This paper has analysed the reported transfer prices for the import of minerals to India. Shifting of income from high tax jurisdiction to low tax jurisdiction between various MNCs and their subsidiaries takes place because of transfer pricing manipulation by such MNCs which are in turn incentivized by different corporate tax rates across countries and due to the difference in import tariffs or customs duties across products. The paper includes the concept of TPI i.e. transfer pricing incentives which is the difference between the corporate tax differential and import tariffs. The estimates of the results of the study suggest that reported transfer prices increase when the TPI is positive and significant. When the transfer pricing incentive is negative and significant then reported transfer pricing decreases. The coefficient of the transfer pricing incentives shows that when the coefficient is negative and significant, then an increase in the home country's tax will lead to a decrease in the reported transfer price. Thus, it can be concluded that the change in transfer pricing incentives changes the reported transfer pricing, thereby providing opportunities to the MNCs to maximize profits by manipulating transfer prices.

Based on the findings of the study, there are a few implications on the transfer pricing policy for India for reduction of tax evasion that takes place due to transfer price manipulation. First, compliance with transfer pricing issues must be focused on rather than relying on the penalty policy. This helps in saving resources and time used up in adjustments and audits that take place due to the penalty policy. Second, the tax authorities can increase the tax base by reduction of tariffs and corporate tax so that India is at a similar level to countries across the world for minimizing the shift of taxable income from India to the home countries of the MNCs with lower tax rates. This may help in the increase of tax revenue for India. Finally, the information exchange involvement of the regulatory authorities may take place with competent authorities of other countries that can correctly assess the tax liabilities of the MNCs.

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Economic Analysis of Energy-Smart Agri-Food Value Chains in India: Lessons from Global and National Experiences and Implications for State Level Promotional Policy Interventions

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Abstract

This paper is a policy analysis of economic aspects of energy efficient interventions in agri-food value chain. Based on global and national level experiences, this paper recognises that energy plays a vital role in the expansion of agri-food markets and trade by contributing to increased and diversified crop production as well as powering allied sectors across the value chain from land preparation, transportation and processing to consumption of agri-food products. This implies that decoupling fossil fuel dependence in the agri-food value chain and adoption of cost effective alternative energy saving systems that use energy efficiently without compromising on product quality are paramount. These analyses are useful to improve the design and implementation of policy initiatives for state-specific and commodity-specific policies for strengthening agri-food value chains including agri-tech start-ups.

1. Introduction

The amount of energy required for food production, processing and consumption at global level has been rising with the increase in population resulting in adverse impacts on climate and natural resources. It is estimated that the global food supply and consumption accounts for one-third of the total annual end-use energy and approximately one-fifth of the total Greenhouse Gases (GHG) as illustrated in the Figure (1) on major components of GHGs emitted to the total GHGs.

In particular, high value in horticulture crops require high thermal energy to fulfil value chain processes in order to obtain quality products, especially during different seasons and time intervals of production, processing and transportation. For instance, about 20 percent of the world fruit and vegetable production is subjected to drying, more than 50 percent consumed as fresh, 20 percent as frozen, 5 percent as canned, and 5 percent as pickled (Grabowski et al., 2003).

Thus, a move towards a sustainable agri-food value chain and resource consumption optimisation is essential with focus on the use of new innovative technologies with renewable energy and improved energy efficiency measures. These energy solutions are helpful when applied at the industrial level in 'compound industries'[4] that share sub-processes in the agri-food value chains. Further, energy efficient technologies and the use of renewables that

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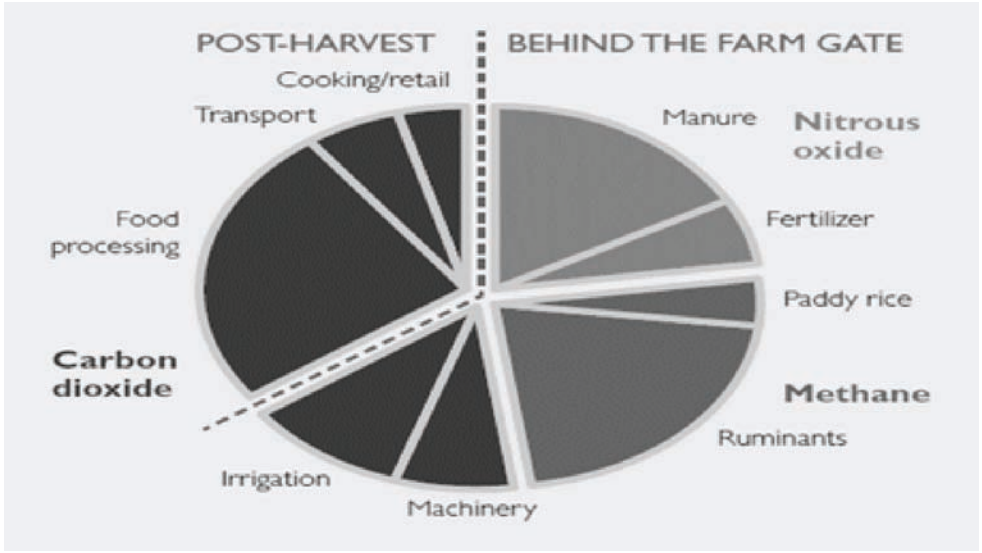
All opinions in this article are of the authors and usual disclaimer applies.

[4]*Common industries that share the same building capacity supported the introduction of the concept of "compound industries"*

decouples fossil fuels in the value chain can help to increase productivity as well as reduce GHGs. The additional benefits from efficient energy solutions in the value chain include cost savings, access to modern energy systems, treatment of organic wastes, improved time and water savings, improved soil quality, local employment opportunities and better livelihoods among others. Although there exists a substantial body of research that has already highlighted the potential of making alterations in production, distribution and consumption of food in reducing energy consumption, this paper focuses on India and state specific initiatives of energy solutions regarding agri-food value chains to draw policy implications for promotion of energy efficient green economy.

Figure 1. Major components of GHGs emitted by the global agri-value chain in billion tonnes of carbon dioxide (GtCO2)-Equivalent (2010)



Source: Sims et al (2015)

2. Energy use in the agri-food value chain

A life cycle assessment reveals the generic pattern in energy consumption of primarily fossil fuel-based inputs in the form of fuel, electricity and agrichemicals in the agri-food value chain viz., raw ingredient production, product manufacture and distribution, and consumption. At the stage of raw ingredient production, they may also differ based on some characteristics of the ingredients such as vegetable versus animal origin, open field versus glasshouse and domestic versus import. The production manufacturing stage includes activities such as mixing and blending operations that require substantial energy. Following which, packaging of finished products is based on the packaging materials to safeguard food integrity and security followed by waste treatment energy requirements. The next step related to consumption and food preparation requires the use of energy (gas and electricity) for storage, cooking/re-heating processed food and ultimately waste generation. In this context, the challenge is to meet growing energy demands with low-carbon energy systems and to use energy efficiently throughout the production, transport, processing, storage and distribution of food that takes into account the diversity of food production conditions. In summary, the direct and indirect energy inputs in agri-food value chain are listed in Table 1.

Table 1: Direct and indirect energy inputs

Direct	Indirect
Petroleum fuels for tractors, harvesters, trucks and irrigation plants	Manufacture and delivery of fertilizers and agri-chemicals
Electricity for motor drives, lighting, refrigeration, water pumping	Embedded in farm buildings and processing factories
Natural gas for water heating	Machinery and equipment
Steam raising, and process heat	Transportation
	Food retailing
	Cooking
	Waste disposal

Source: Compiled from Sims et al, 2015

3. Avenues in the agri-food value chain for efficient energy use

Renewables can replace fossil fuels at every stage of the value chain starting with conservation agricultural practices and precision agriculture techniques that are considered a positive approach towards efficient energy use. Such organic farming practices can contribute significantly towards saving non-renewable energy as it uses fewer inputs that depend on non-renewable energy used in conventional farming practices (Alonso et al, 2010). These practices include the following:

- Water pumping for irrigation and food processing consumes a large extent of energy and this can be minimised with solar and wind-powered pumps that have become popular in rural areas. Energy demand for irrigation can be reduced with the use of gravity supply, efficient design of electric motors and pumps based on crop's actual requirements, regular pump maintenance, low-head distribution sprinklers, drip irrigation in row crops, regulation control systems for irrigation based on soil moisture content, suitable drought resistant crop varieties and application of water based on weather forecasts.

- Well-maintained agriculture machinery and hydraulic systems can be utilised to produce fuel based energy outputs where the operator is skilled in optimizing performance including use compaction and wheel-slip to reduce soil damage.

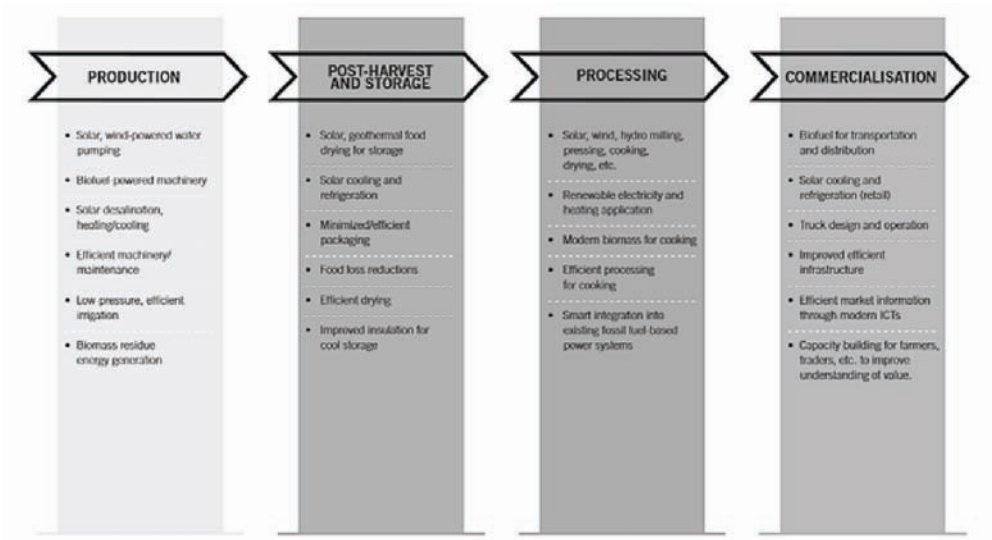
- Embedded energy used in manufacturing fertilizers and other agrochemical inputs can be reduced with improved manufacturing efficiencies and accurate application. Some suggestions for reducing the energy inputs in fertilizers include; growing nitrogen-fixing legume crops, NPK proportions based on soil and leaf analysis, liquid fertilizers through injection or mixed into irrigation water, organic alternatives in addition to use of effluents from food processing or sludge from biogas plants.

- Heat is another essential energy component used for pasteurized milk, warm greenhouses, dried fruits and vegetables, canned food, and for other food processes. To use it more efficiently and reduce heat losses within the system, heat exchangers may be adopted and its generation from renewables or modern bioenergy plants or efficient designs for heat pumps.

- Aggarwal (2018) found that solar drier with thermal storage system and temperature regulator should be integrated so that drier may be used for various crops throughout the year. This will also improve the quality of packed food and increase the income of farmers.

- Cooling and Cold Storage is necessary to maintain quality along the value chain and apart from a reliable source of electricity supply system, refrigeration with solar absorption chillers and other renewables based on the scale of operation can help to reduce energy demand. In terms of cold storages, this is possible with increased insulation and minimize the heat load post-processing in a cold chain
- Air freight of off-season fresh food demands the highest energy compared to local market. As such, transportation in bulk as well as under controlled refrigeration can relatively reduce carbon-footprint.
- In the 'beyond the farm gate' operation requires energy audits by trained specialists to identify cost-effective opportunities to efficiently use energy.
- Anaerobic digestion plants can be installed to produce biogas from organic wastes produced both in farms and processing plants. Towards improving local sources of energy, Dr. Mandavgane in a special lecture at JNU on Waste to Wealth, discussed the potential of Agro Wastes (AW), like straw and fruit waste that are abundantly generated and contribute to 50 percent of cereal plant and 15-35 percent of fruit yield respectively. Agro wastes open avenues for the production of bio-fuels, bioactive compounds, nutraceuticals, and dietary fibres among many other products. Instead of using it for a single product application, it would be beneficial to develop an integrated approach for manufacturing multiple products in sequential manner. This integrated approach may be summed up as "bio-refinery" which is analogous to petroleum refinery. However, the immediately implementable energy use efficiency measures according to Mossie (2016) are replacement of failed electric motors with energy-efficient or premium-efficient electric motors; scheduled and proper greasing of electric motor bearings, reducing electric motor system friction losses, properly sizing electric motors to the load; testing questionable equipment before and after repair, improving lighting systems among others. Figure-2 illustrates the general clean energy options from production to commercialisation through post-harvest and storage and processing stages.

Figure 2: Clean energy options in agri-food value chain



Source: REEEP[5], 2015

[5]*https://www.reeep.org/sites/default/files/REEEP_PAVC_doublepages_web.pdf accessed on 17-04-2020*

Table 2 presents the clean energy options at every stage of agri-food value chain by with special reference to vegetables value chain and by distinguishing the options between energy efficiency options and clean energy options.

Table 2: Clean energy options in the vegetable value chain

Main energy demands		Energy Efficiency Options	Clean energy Options	
PRODUCTION				
	Tractor performance operation of machinery	Regular maintenance Educating operators	Biodiesel fuels powered machinery	Training operators saves 10% of fuel and time
	Integrated Pest Management (IPM)			Reduces use of agrichemicals and number of applications
	Precision irrigation		Solar water pumps Low pressure efficient irrigation	
Greenhouses (Unheated)	Hydroponic production	Advanced air circulation fan designs	Carbon dioxide enrichment using bioenergy heaters	Reduces artificial fertilizer use Optimum use of floor area for plants by using gantries
Greenhouses (Heated)	Combined heat and power (CHP). Heat recovery Heat pumps		Heat generated from solar, geothermal or bioenergy greenhouses	Replaces coal/gas with renewables
PROCESSING				
	Hydrothermal treatment		Wet residues for anaerobic digestion.	
	Reuse of by-products	Heat and water recovery	Process wastes for biogas for cogeneration, heating and transportation	By-products suitable for bioenergy use compete with use as animal feeds, compost.
	Recycle water	Save water pumping		Use for other cleaning cycles, irrigation, cleaning work areas
	Cooling/refrigeration	Evaporative cooling Liquid air refrigeration Precooling methods	Evaporative coolers use solar PV panels.Solar chillers	Smart integration into existing fossil fuel-based power systems
Heat	Water Heating		Solar water heating. Bioenergy as pellet boilers Geothermal heating	Limited area availability of geothermal steam, ground source heat pumps available
Drying	Recirculation of air in dryer. Pulsed fluid-bed drying		Solar cabinet dryer with forced circulation. Geothermal drying	Same as above
Freezing	Hydro-cooling before freezing			

Packaging	Minimise efficient packaging	Use bio-based resources, for alternative packaging eco-designs		Avoid plastics with 'green chemistry'
	Food loss reductions			
COMMERCIALISATION				
Biofuel for transportation and distribution Retail solar cooling and refrigeration Truck design and operation Improved efficient infrastructure Efficient market information through modern ICTs Capacity building for farmers, traders, other stakeholders in the value chain				

Source: Sims et al, 2015

4. Energy initiatives in the agri-food value chains: Select global experiences

Given the energy inputs necessary across the value chain, a glimpse of the avenues available for infusing energy solutions are highlighted below with nine ventures in different countries where energy interventions have had a positive impact using the information from the REEEP's 2015-2017 Powering Agri-food Value Chains portfolio[6].

- Solar powered irrigation systems in Kenya: A proprietary solar powered irrigation pump, combined with an end-user finance programme is able to reach very low-income farmers with less than one acre of land – which constitute the majority of the agricultural sector in Kenya. It is also complemented with additional elements of market access and technical knowledge to help farmers to leverage improved productivity into improved incomes and quality of life.
- Solar powered multi-use cold storage in Uganda: An innovative concept for a solar-powered cold room that would provide refrigeration and freezing for fresh products of any type in isolated areas. It is used by agricultural cooperatives, fishermen associations, sanitary usages (conservation of vaccines) or for ensuring cold chain integrity in food processing and distribution.
- Biogas powered Agri-cultural processing in Cambodia: REEEP and NexusC4D, with their experience in the renewable energy Small and Medium-sized Enterprises (SME) sector, set up a revolving fund to provide affordable loans to rice mills to switch from diesel electricity generation to rice husk gasification through bio-gasification processes.
- Pico Hydro powered mills in Nepal: The new Improved Water Mills (IWM) replace traditional water mills and displaces diesel generators. Compared to diesel, REEEP estimates that Nepal could avoid up to 60,000 tCO2 annually, and drastically improve livelihoods of local farmers. A major aspect of the venture is the simultaneous provision of credit to potential operators, marketing and capacity-building on how to economically utilise the IWMs benefits for smallholder and subsistence farmers.
- Solar powered dairy refrigeration in Bangladesh: The venture retrofits existing diesel-powered cooling units with solar PV units, and build new collection centres incorporating renewable energy. It provides a critical service to smallholder farmers and directly impacts dairy supply – and thus food security and related health and well-being outcomes in the country.

[6]*https://www.reeep.org/powering_agrifood accessed on 03-04-2019*

- Solar powered agri food processing in Tanzania: Project by Redavia is a pioneer in multipurpose solar-diesel hybrid farms, standalone high-output solar PV systems that can be employed in a variety of end uses in frontier markets, and paid for through an innovative 'Pay As You Go' model. Its innovative business model will replace unreliable fossil fuel-based power from the electricity grid, resulting in 20 to 50 percent reductions in energy costs for agricultural processors, while expanding access to nearby communities via mini-grids. Redavia will be focusing initially on coffee, tea, oilseeds and cashew processing firms, which suffer from frequent power outages and high costs of back-up-generator power.
- Renewable energy farming solutions in Nicaragua: Project by Tecnosol aims at tapping latent demand for multi-purpose energy solutions that fulfil a range of needs of small farmers in off-grid areas, including manure-based bio-gasification, solar powered electric fencing units, solar water pumps and standalone solar PV units. Tecnosol is partnering with major micro-lender KIVA to meet demand for financing for these productivity-improving products.
- Efficient irrigation in Nicaragua: 'iDEal Tecnologías' provides a combination of specialised drip irrigation system to lower overall cost, a strategy to cultivate a retailer network of technicians who can both sell and conduct after-sales service, and a marketing plan focusing on opening doors for longer term agricultural practice transformation.

In addition, the findings from the FAO Investing in Energy Sustainable Technologies in the Agri-food Sector (INVESTA) project (Flammini et al, 2018) that supports new and sustainable approaches to accelerate the development of clean energy solutions in agri-business in developing countries, found the following impacts from the application of six energy interventions (biogas for power generation, biogas powered domestic milk chiller, solar cold storage for vegetables, solar water pumping, rice husk gasification, solar-powered rice processing) in milk, vegetables and rice value chains.

- Small scale applications are more likely to achieve diversified co-benefits.
- Net economic benefits are higher than financial benefits, even though occasionally the investment in energy interventions may be financially unattractive.
- Local taxes, markets, energy prices and subsidies significantly influence the economic performance of these interventions.
- Reduces food losses and improves food quality with clean energy technology which has a multiplier effect in the value chain.
- Interventions have an impact on gender equality but differ on a case-by-case basis.
- Synergies between energy needs for food and other village-level necessities should be considered when designing solutions that can meet diverse energy needs and maximize sustainable development impacts (e.g., a micro-grid with irrigation pumps and agro-processing equipment as anchor loads).
- Helps to achieve SDGs having linkages with energy interventions.

5. Emerging technologies for efficient energy use

Technological innovations[7] address the use of energy in the production, marketing and processing of agricultural and horticultural crops. The prototypes of technologies proposed to be tested for horticultural products include the followings.

[7] *https://horticulture.ucdavis.edu/sites/g/files/dgvnsk1816/files/extension_material_files/Reid%20Innovative%20Energy%20Solutions.pdf accessed on 03-04-2019*

(a) D.C. air conditioner/CoolBot for a solar-powered cool room
(b) In-village solar panel construction to reduce the cost of photovoltaic supply
(c) Inexpensive photovoltaic pumping based on R.V. water pumps
(d) Adsorption refrigeration using Zeolite beads
(e) High intensity LEDS for a solar-powered germination cabinet
(f) Vacuum-sealed straw bales for building inexpensive insulated rooms
(g) Aerogel panels for high-quality insulation
(h) Peltier-effect cooling for small-scale transport
(i) Low-cost air suspension for small-scale transport
(j) Simple solar dryer for fruits, vegetables, and grains
(k) Facilitated solarisation for weed and soil-borne disease control

A low-cost solution for storage is evaporative cooling also known as a ZECC (Zero Emission Cold Chamber). Evaporative cooling extends the shelf life of horticulture products, and avoids spoilage by keeping food at lower-than-room temperatures without having to use electricity under smallholder farming systems (Noise et al, 2018). Alternatively, WAKATI, is another evaporative cooling solution powered by solar energy. For large scale open markets in developing countries like Nigeria, there is the ColdHubs system, a solar-powered cooling facility near markets centrally operated by the 'ColdHubs' Company. Other alternatives also include hybrid solar dryers that use biomass for auxiliary heating to prolong drying continually into the night (Tomar et al, 2017). In Rwanda, the Dutch Horticultural Trade Board designed medium and low-tech greenhouses adaptable to local climatic and economic conditions called SMART (Smart Adaptive Sustainable Horticulture)[8]. The project helped small farmers growing tomato to have access to innovative horticultural technologies.

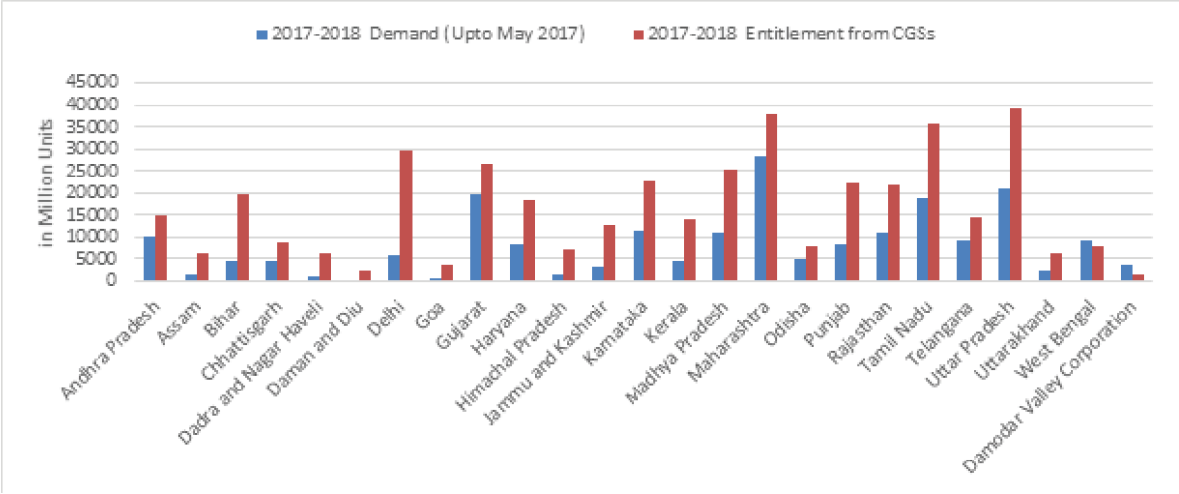
6. Energy in the Indian agri-food value chain

Given the rapid advances in technological and economic expansion, India is expected to be the second largest contributor to the increase in the global energy demand by 2035, accounting for 18 percent of rise in global energy consumption. According to the International Energy Agency's global energy and CO2 status report in 2019, India witnessed primary energy demand increase by 4 percent or over 35 million tonne of oil equivalent. This accounts for 11 percent of global demand growth. India's share of total global primary energy demand is set to roughly double to nearly 11 percent by 2040[9]. The state-wise energy demand and entitlements from Central Generating Stations (CGS) for the period 2017-18 reveals that except for West Bengal, most states' demand is lower than the CGS entitlements (Figure 3).

Jha et al (2012) concludes that the structure of energy consumption in Indian agriculture has changed and the consumption patterns of both direct and indirect energy inputs show that the energy consumption per hectare of net as well as gross cropped area has increased over time. The output per unit of energy-use has declined underscoring the fact that Indian agriculture has become more energy-intensive. The energy-related foresight exercise by Jha (2013) suggests that the energy requirement in Indian agriculture might double the present consumption level (22 million tonnes of oil equivalent) for achieving 280 Mt of food grains production by 2020.

[8] *https://data.rvo.nl/subsidies-regelingen/projecten/smash-smart-adaptive-sustainable-horticulture*
[9] *BP Energy Outlook, 2019*

Figure 3: State-wise energy demand and entitlements from Central Generating Stations: 2017-18



Source: Annual & LGBR Report of Central Electricity Authority

Keeping with India's Intended Nationally Determined Contribution (NDC)[10] at the UN Paris Climate Agreement in 2015 to reduce emission intensity of its GDP by 33 to 35 percent by 2030 compared to 2005 levels, the country intends on meeting 40 percent of its energy demand with renewables by 2022. As such, it is estimated that from an overall 175 GW of renewable energy generation, 57 percent will be from solar, 34 percent from wind, 6 percent from biomass and 3 percent from hydro power. Given the extent of total emission contributed by agriculture in the country, India has identified agriculture and its allied sectors as priority for emissions reduction in its NDC.

7. Government of India's initiatives for promotion of energy efficiency

Keeping in mind India's NDC and to move towards a sustainable growth trajectory, the Union Government has operationalized several direct, enabling and integrating policies and missions. With particular focus on the energy sector, some key initiatives have been the National Solar Mission (NSM), National Mission for Enhanced Energy Efficiency (NMEEE) that includes standards and labelling by the Bureau of Energy Efficiency (BEE), National Mission for Sustainable Agriculture (NMSA). The MNRE has sanctioned a scheme 'Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM)' consisting of three components; (a) 10,000 MW of decentralized ground mounted grid connected renewable power plants of individual plant size up to 2 MW (b) installation of 17.50 lakh standalone solar powered agriculture pumps of individual pump capacity up to 7.5 HP, and (c) solarisation of 10 lakh grid-connected agriculture pumps of individual capacity up to 7.5 HP as of March 2019[11]. In another programme, this ministry promotes setting up of projects for recovery of energy in the form of Biogas/BioCNG/ Enriched Biogas/Power from urban, industrial and agricultural wastes through biomethanation as well as captive power and thermal use through combustion, gasification, pyrolysis or

[10] *India's NDC to UNFCCC, http://www.moef.nic.in/climate-change-docs-and-publications*

[11] *https://mnre.gov.in/sites/default/files/schemes/900.pdf accessed on 04-03-2019*

a combination thereof or any new technology as approved by MNRE[12]. In addition, the New National Biogas and Organic Manure Programme (NBMMP) also meets the 'lifeline energy' needs for cooking as envisaged in the Integrated Energy Policy of NITI Aayog[13]. The Pradhan Mantri Krishi Sinchai Yojana (PMKSY) also provides end-to end solutions in irrigation supply chain, viz. water sources, distribution network and farm level applications. PMKSY not only focuses on creating sources for assured irrigation, but also creating protective irrigation by harnessing rain water at micro level through 'Jal Sanchay' and 'Jal Sinchan'. Micro irrigation is popularised to ensure 'Per drop-More crop'.

8. Specific State Energy related Programmes

In **Karnataka**, the prominent schemes include Karnataka Solar Policy 2014-2021, Draft Karnataka Renewable Energy Development Policy, Biogas power and cogeneration programme, Niranthara Jyothi Yojana, Ganga Kalyana Scheme, and Surya Raitha Scheme for using energy efficiently and promoting renewables in the agri-food value chain.

Maharasthra, under the Mukhya Mantri Saur Krishi Vahini Scheme, has approved one lakh solar agriculture pumps and aims to provide uninterrupted power supply to farmers even during day time. The scheme aims to generate 2,500-megawatt solar power through a High Voltage Distribution System (HVDS) wherein a large number of farmers gets power from a single transformer.

Andhra Pradesh has implemented the National Energy Efficient Agriculture Pumps Programme that focuses on replacing energy guzzling agricultural pumps with new-age energy efficient agricultural pumps, with a 5-star rating. These pumps, enabled with smart control panel and a SIM card, give farmers the flexibility to switch-on and switch-off the pumps from their mobile phones. All new agricultural connections in the State shall use the Grid connected Solar BLDC Pump sets. In addition, scaling up Zero Budget Natural Farming (ZBNF) in the state in the next six to eight years through farmer outreach programmes is planned. Further, the State has partnered with Sustainable India Finance Facility (SIFF), a collaborative initiative of United Nations (UN) Environment, World Agroforestry Centre, and BNP Paribas for scaling up natural farming[14].

In **Himachal Pradesh**, the Dr. Y. S. Parmar Kisan Swarozgar Yojna includes construction of location specific models of poly houses with micro irrigation facility. In addition, the centrally sponsored scheme - Biogas development programme as well as the PMKSY has been operationalized in the state. The state has proposed the 'Himachal Pradesh Subtropical Horticulture, Irrigation and Value addition (SHIVA) Project with a total cost of Rs.1688 crores, approved by the Government of India for funding from Asian Development Bank with an area of 20,000 ha under sub-tropical fruits. The 'Saur Sinchayee Yojana' programme is expected to provide 5,850 agricultural solar pumping sets to farmers in the hilly state.

Similarly, Gujarat government has also announced a similar programme called Suryashakti Kisan Yojana (SKY), through which it would provide farmers with solar panels to generate solar power on their lands.

[12] *https://mnre.gov.in/sites/default/files/schemes/programme_energy-urban-industrial-agriculture-wastes-2017-2020_0.pdf accessed on 04-03-2019*

[13] *https://mnre.gov.in/sites/default/files/schemes/New-National-Biogas-Organic-Manure-Programme%28NNBOMP%29-upto-2020-1.pdf accessed on 04-03-2019*

[14] *https://economictimes.indiatimes.com/news/economy/agriculture/andhra-pradesh-plans-to-scale-up-zero-budget-farming-with-un-backed-siff/articleshow/62654595.cms accessed on 04-04-2019*

9. Select crop-specific energy measures

9.1 Potato

Potato is the world's fourth important food crop after wheat, rice and maize, and is cultivated in more than 100 countries of the world. About 40 to 50 percent post-harvest loss is reported for potatoes under tropical and sub-tropical conditions. These losses necessitate significant augmentation of storage facilities in remote locations, powered by alternative energy sources. Basu and Ganguly (2016) provided a conceptual design and analysis of the powering system of a potato cold storage using the climate data of Kolkata. The power system of the cold storage comprised of a grid-interactive SPV/thermal-powered cold storage. This integrated power system (photovoltaic and thermal combined) can provide a net annual energy surplus of about 36.062 MWh. The overall energy efficiency of the designed system was also found to be reasonable and economically viable with a payback within 4 years.

Potato is also widely used in food-processing industries in India, Prakash et al (2017) studied potato drying under sunlight and a modified greenhouse dryer, which operates in active and passive modes. It was found that the dryer in an active mode was more efficient for potato chips drying as compared to passive-mode and open-sun drying. In addition, potato chips dried in the dryers possessed superior nutrient content as compared to open-sun dried product.

At Potato chips manufacturing units, bioenergy production from potato processing residues such as potato peels is one such intervention that can bring benefits to the SMEs and small holders by converting potato processing residues to electricity or biodiesel as highlighted by an FAO study in Rwanda[15]. This has also been studied from a bio-refinery perspective (Pathak et al, 2017).

The above energy efficient solutions in the potato value chain can be applied on a large scale in India because the country produces 513.10 lakh MT on a total area of 21.42 lakh ha in 2017-18 with Uttar Pradesh and West Bengal being the leading producers in the country.

9.2 Tomato

The total area under tomato cultivation in India was 8.82 lakh ha with a production of 187.36 lakh MT having a productivity of 25 MT/ha during 2013-14. Andhra Pradesh, Madhya Pradesh and Karnataka are the top three producing states in the country. A study on Karnataka's tomato value chain by Ramappa and Manjunatha (2016), revealed high cost for groundwater irrigation due to depleting water table and a high rate of well failures. As such, financial support is needed for low cost water harvesting and water saving technologies so that input costs may be reduced. In addition, majority of the intermediaries along the value chain indicated the need for finance to create infrastructure facilities (cold storages, transportation facilities, etc.) to enhance their business opportunities.

Keeping this in mind, suggestions for energy optimisation in the tomato value chain may be energy efficient greenhouses (operating as a solar thermal collector) and post-harvest processes consisting of model-based solar drying systems. The latter differs with intrinsic temporal and geographical factors matched with specific solar energy irradiation. Such methods have also shown to reduce water as well as carbon footprints (Ramírez et al, 2015).

[15] *https://eeas.europa.eu/sites/eeas/files/options_to_promote_the_use_of_sustainable_energy_in_potato_chip_manufacturing_in_rwanda.pdf accessed on 09-04-2019*

India also has a large potential for processed tomatoes. Drying and processing options include low-cost solar dryer or larger hot air dryer. The latter is a solution for large farmers, aggregators and cooperatives. In addition, the use of solar drying next to the growing site thereby coupling processing sites generates savings in energy consumption per transport, which reduces GHG emissions. Processing includes canning, smoking, pureeing, sterilizing, canning and based on size, solutions range from simple household juicing machines to entire factories. In terms of packaging, non-plastics alternatives such as glass bottles or jars or tin cans can be used.

9.3 Apple

Apples are the most widely grown temperate fruit crop in the Indian Himalayan region. The area under apple production in India was 3.01 lakh ha in 2017-18 and increased to 3.07 lakh ha in the advanced estimates for 2018-19. India produced 23.27 lakh MT having a productivity of 7.7 MT/ha in 2017-18. A major share of the production was from the States of Himachal Pradesh, and Jammu and Kashmir. The Technical Standards Committee on Technical Standards and Protocol for Cold Chain in India by the National Horticulture Board provided controlled atmosphere storage practices that need made accessible and widely circulated for awareness creation among apple growers in India[16].

On field, Dyjakon (2018) found that the yearly harvested pruned biomass from apple orchards may be considered a good energy source for local heating systems given its positive net energy balance. During processing, an experimental investigation of an indirect solar dryer integrated with phase change material (Paraffin RT-42) situated in Solan, Himachal Pradesh for drying a medicinal herb showed that drying time reduced by 37.50 percent and 64.29 percent when compared to heat pump drying and shade drying and the quality of the herb was superior to the latter methods of drying (Bhardwaj et al, 2017). This method could be replicated for processing of other horticultural products in the region, including apples.

In addition, cold chain infrastructure and processing facilities is a major issue faced by apple orchards in India. Modern preservation practices that use ICT can help alleviate the shelf life as refrigerated storage can preserve apples up to six months and such a controlled atmosphere can keep apples for almost a year. Muller et al (2017) found that most farmers in Himachal Pradesh require awareness and coordination to help them utilise such facilities. For this purpose, the Muller et al (2017) developed an android mobile application and informational poster/pamphlet to make these technologies more accessible to farmers and improve communication between farmers and cold storage facilities.

10. Illustrations of Energy related Indian Start-ups in the Agri-Food Value Chain

Aibono is an agritech firm that provides farm-related intelligence, technology, expertise and gadgets to farmers based on precision agriculture. It helps farmers to apply appropriate quantity of inputs to maximise yields. Nearly 140 farmers have been covered within the Nilgiri hills in Tamil Nadu[17].

Avanijal Agri Automation Pvt. Ltd. has developed an automated system - termed 'Nikash' - that leverages IoT and wireless technology to control irrigation motors and valves in the field. Using this precision

[16] *http://nhb.gov.in/documents/cs3.pdf accessed on 09-04-2019*

[17] *https://inc42.com/features/watchlist-agritech-startups-2018/ accessed on 03-04-2019*

irrigation system app, farmers can ensure that the field is irrigated on time and constantly monitor the condition of the field without being physically present[18].

Tessol by Thermal Energy Service Solutions Pvt. Ltd explores technology for thermal energy storage. It is a heat exchange unit (called PlugnChill/PCM) that can be charged at any power outlet in approximately six hours and provides 60 percent cost saving. Once charged, the unit will keep the refrigerator on the reefer truck within the optimal temperature for a full-day's operation. This has eliminated the use of fossil fuel for cold chain transport systems. This company's technology is widely used across poultry, horticulture, dairy and frozen food sectors including Godrej Tyson, Abad Fisheries, Mother Dairy, Chitale and Fortis hospitals. The firm has already customised 200 cold chain vehicles with modular TES units for bakeries, fruit and vegetable vendors, dairy and ice cream manufacturers and e-commerce, food processing, poultry and seafood companies.

Similarly, **Inficold India Pvt. Ltd** provides thermal energy storage systems. It is a low-cost, retrofittable solution that is an alternative energy storage instead of batteries and diesel generators for refrigeration/Air conditioning systems to provide cooling at a later period. It is primarily used for milk cooling at collection sites, refrigerated transportation, walk-in cold rooms and air conditioners – anywhere space conditioning is desired. Inficold is closely working with National Dairy Development Board (NDDB) to understand the viability of thermal storage and solar integrated solution for milk cooling application. A system was jointly installed at one of the Amul's milk collection centre.

Indian Institute of Science under the Govt. of India, Technology Development Mission and Rinac India Limited, Bangalore has developed a mobile and a stationary precoolers using indigenous technology to suit Indian conditions. It is used for cooling of horticultural products at the farm level[19].

Urban Kisaan is a company that helps people grow their own safe, fresh, high quality vegetables and fruits sustainably at home, in the office, or commercially at restaurants to have these products on-demand and year-round leveraging on hydroponic techniques[20].

11. Policy discussion and implications

With the slow industrialisation of agriculture, the energy inputs in the agri-food value chain and their associated industries have become increasingly intensive. Adoption of sustainable energy interventions via the aforementioned renewable energy technologies and energy efficiency measures are necessary to promote the transition towards a renewable energy based agri-food value chain. While doing so, the complex and context specific likely synergies and trade-offs of climate-smart agriculture and energy-smart agri-food chains need to be considered given India's NDCs, Solar Mission and the Sustainable Development Goals[21]. In addition, in terms of behavioural change, Winkler et al (2018) found that small farmers were motivated to produce and use renewable energy and favoured integrated food and energy systems that combine solar-PV for irrigation and vermicomposting of organic residues/wastes for fertilizer production.

[18] *https://economictimes.indiatimes.com/small-biz/startups/features/smart-farming-this-startup-has-a-new-irrigation-method-one-that-uses-just-an-app-avanijal-agritech/articleshow/62248946.cms?from=mdr accessed on 03-04-2019*

[19] *http://indiaagronet.com/New%20Product/contents/rinac_precoolers.htm accessed on 03-04-2019*

[20] *http://www.urbankisaan.com/AboutUs.html accessed on 03-04-2019*

[21] *http://www.fao.org/climate-smart-agriculture-sourcebook/production-resources/module-b9-energy/chapter-b9-4/en/ accessed on 03-04-2019*

Practically, a cost-benefit of competing technologies may be compared in common terms, such as kWh/ MT (kilowatt hour per metric ton) of irrigated, transported, cooled, or packed produce. Some of the trade-offs may be higher costs for the purchase of relatively high-technology equipment versus lower purchase and energy costs and higher labour costs for a lower-technology version, taking into account their relative effectiveness. Also, low-energy post-harvest cooling methods may result in higher losses than mechanical refrigeration, but those losses may be offset by energy savings. Rising fuel prices may also push the energy/labour trade off towards lower-technology, more labour-intensive activities.

Sustainable technology transfer would depend on the availability of the necessary equipment, replacement parts, servicing know-how, and fuels that are easily accessible and affordable to agri-food producers. Keeping this in mind, the design of supporting policies and related programmes could encourage utilisation of local natural resources effectively with target measures that meet the scale of operation unlike industrial corporate farming systems. For the improvement of energy utilisation in the food value chain, as Dutilh and Kramer (2000) wrote, the energy requirements based on the functional and emotional value of food products is necessary and the inclusion of the latter will help identify improvement options. Taking this into consideration will also help differentiate home-made over industrial produced food towards a better informed consumer.

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Saving, Investment and Economic Growth in India: An Empirical Analysis

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Abstract

This paper aims at empirical determination of long-run relationship among saving, capital formation and economic growth, using time series data from 1960 to 2019 and time-series methods. The results show unidirectional causality between saving, capital formation and economic growth. It is found that investment has a positive and significant impact on economic growth and a negative and insignificant impact of gross domestic saving on economic growth in India. This indicates the need for strengthening India's financial sector to mobilise the savings for economic growth. In addition, the structural break of Indian economy in 1979 is shown to have a significant impact on economic growth.

1. Introduction

A sound financial system is necessary for a sound economy. It interlinks saving, capital formation, investment, and economic growth. Diversified evidence on the relationship between saving, capital formation, and economic growth is available in the literature.

Theoretically, Romer (1986) and Lucas (1988) argued that savings lead to an increase in investment and, hence, economic growth. Solow (1956), Harrod, and Domar (1939 and 1946) also said that with savings and capital formation comes economic growth. As per the neoclassical Solow (1956) and Swan growth theory (1956), savings are essential source of investment giving rise to economic growth. Several empirical studies support for the positive impact of saving on economic growth. For example, Jappelli and Pagano (1994) showed that saving leads to increased investment and GDP growth in short run. Ang (2007) found a cointegrating long-run relationship between domestic savings and investment rates from 1965 to 2003 in Malaysia. Attanasio et al. (2000) found that investment rates Granger-cause growth rates by using a panel of 123 countries for a period of 33 years. Jangili (2011) analyzed the relationship between savings, investment, and economic growth in India and identified a cointegrating relationship for which the causality is unidirectional from higher savings to investment and growth. In addition, Khundrapam and Ranjan (2010), Patra et al. (2017), and Singh (2010) found comparable results on positive impact of savings on economic growth in Indian context.

Existing literature also includes studies which show the direction of relationship between savings and economic growth. For instance, Keynesian theory argued that savings are a leakage dependent on the level of income or its growth (Tang and Tan 2014). Carroll and Weil (1994) asserted that the effect of savings on growth may be overstated. Carroll et al. (2000) argued that savings and

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growth are strongly and positively correlated across countries because high growth leads to high savings, not the other way around. In the same way, Sinha and Sinha (1998), Gavin et al. (1997), Sahoo et al. (2001), and Abu (2010) found the causality running from economic growth to savings. Few studies also found a negative relationship between domestic savings and economic growth. For instance, Verma (2007), Bist and Bista (2018), and Joshi et al. (2019) observed a negative and statistically significant impact of savings on economic growth.

Mixed evidence on savings and economic growth are offered in few studies. Sinha (1996) investigated the relationship between the GDS annual growth rates and GDP (economic growth) and found no causality between them in either way. Muhleisen (1997) showed significant causation from growth to saving but rejected causality from GDS to growth for all types of saving. Odhiambo (2009) found bi-directional causality between savings and economic growth while Sothan (2014) identified no causal relationship between savings and economic growth in Cambodia.

The main objective of this paper is to offer recent empirical evidence on the macroeconomic relationship between savings, capital formation, and growth in India from 1960 to 2019 and to draw useful macro economic policy implications for India with special reference to role of savings.

2. Empirical analysis

2.1. Data

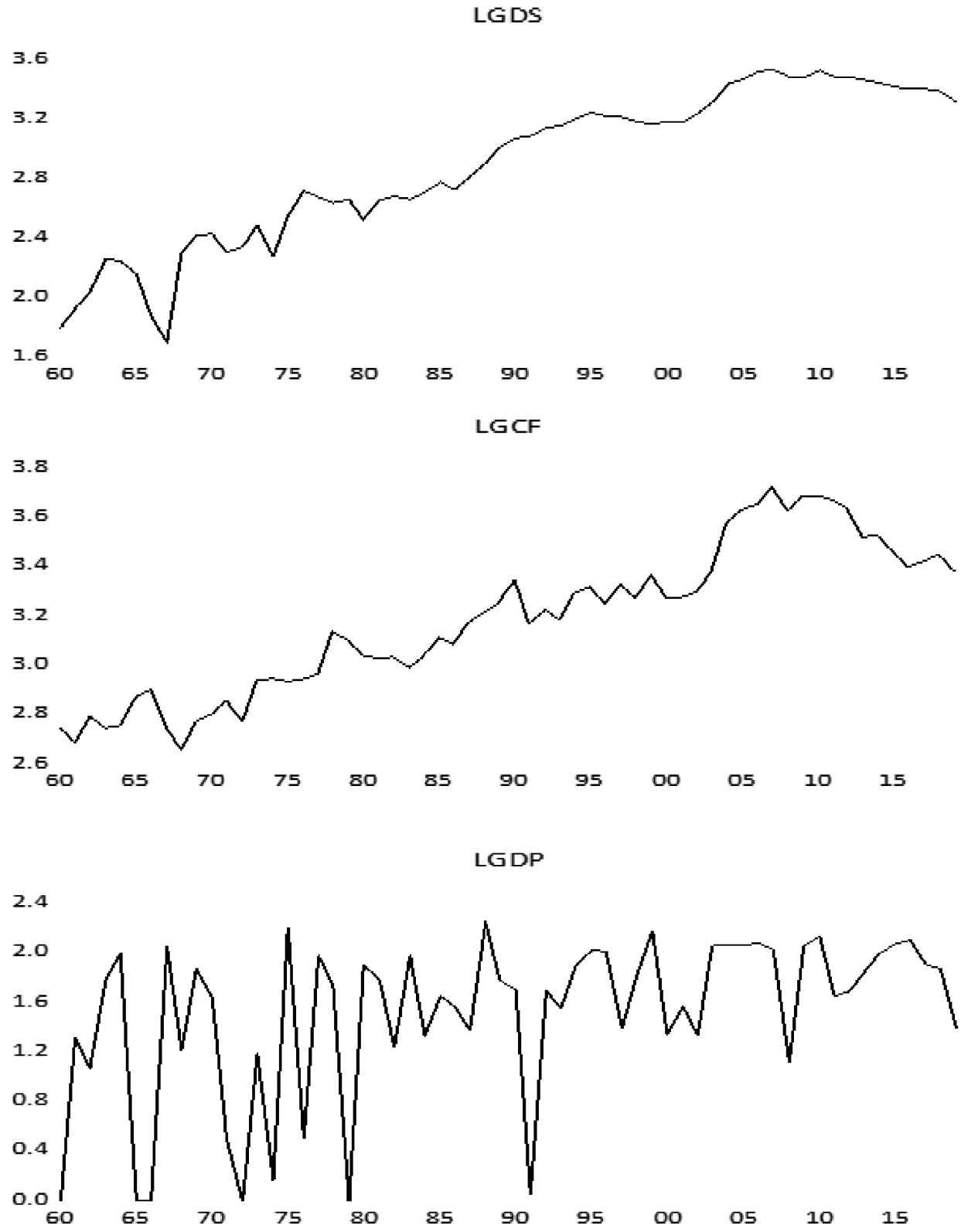
Using the annual time-series data from the World Bank open data, for the period 1960 to 2019, empirical relationship between economic growth and domestic savings and investment are estimated, employing both descriptive statistics and time-series econometric methods. Descriptive statistics include percentage and ratio analysis to show the trend. GDP annual growth rate is used as a proxy for measuring economic growth. For the saving component, Gross Domestic Saving as a percent of GDP is used while for investment, Gross capital formation as a percent of GDP is used for measurement.

2.2. Diagnostic tests

All of the variables are found trending upward, as shown in the Figure-1. As a result, it is important to test for the stationarity of the variables before applying any econometric tools to estimate the relationship between savings, investment, and economic growth. To determine the order of integration among the variables, Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests, which endogenously correct for one structural break, are used.

The results of the ADF and PP unit root tests are presented in Table 1. All variables are first-difference stationary. As the period of data is 59 years i.e., from 1960 to 2019, the test for stationarity is needed. To determine whether a systematic trend existed or not, the first step is to find out the trend of variables over the study period. Figure 1 shows the existence of a trend in GDS, GCF and GDP in log form. Test for stationarity is based on the Augmented Dicky Fuller test. Dickey Fuller's H_0 tests for presence of unit root, and the results show that the null hypothesis is not rejected for all other variables by taking P-value except the GDP annual growth rate. This implies that other variables are non-stationary. If the plot reveals that most of these variables are moving over time, differencing with the trend variable and a constant term is likely to convert the non-stationary series to a stationary one. Table 1 shows that after the first difference, all variables are stationary at varying lag lengths and levels of significance.

Figure 1: Trends in LGDS, LGCF and LGDP



Source: Authors' calculations

Table 1: Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests

	Variables Level		First difference	
	ADF	PP	ADF	*PP*
LGDP	-7.2501*	-9.8128*	-6.6845*	*-13.123**
LGDS	-2.7706	-6.6382	-7.4477*	*-16.8310**
LGCF	*-2.2292*	*-2.2391*	*-8.7915**	*-8.8510**

*Significant at the 1% level

Table 2: ADF test for unit roots with break

Variables	T stat.	Year of break	Result
GDP	-0.9466	1979	Unit root
GDS	-3.9283	2003	Unit root
GCF	−5.7191	2003	Unit root

Note: The lag order is determined by the Schwarz information criterion (SIC). GDP, GDS, and GCF stand for real GDP per capita, gross domestic savings, and investment, respectively. The null hypotheses of the ADF and PP tests refer to the existence of a unit root.

As we are dealing with a time series data set spanning over 59 years, the structural break test is essential as it enables us to detect when a given time series abruptly changes at a point in time. Table 2 shows the structural break in GDP annual growth rate in the year 1979 and in Gross Domestic Saving in 2003. During the same year, i.e., 2003 there is a structural break in the trend of Gross Capital Formation.

2.3. Cointegration and Long-run relationship

Given the variables at I (1) and the structural break, we applied cointegration techniques such as Johansen cointegration and Auto-regressive distributed Lag model to establish the long term relationships. Table 3 gives the results of Johannsen cointegration. Based on the trace and maximum eigenvalue tests, two cointegrating vectors are significant at a 5% level of significance. This result shows a long-run cointegrating relationship among GDP annual growth rate, GDS, and GCF when GDP annual growth rate is taken as the dependent variable in the structural break of 1979.

Table 3: Johansen cointegration test:

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value	P-value
None*	0.4400	33.6316	21.1316	0.0005
At most 1*	0.2333	15.4096	14.2646	0.0328
At most 2	0.0460	2.7369	3.8414	0.0981

Note: * Denotes rejection of hypothesis at 0.05 level. At most 1 and at most 2 mean the rejection of null hypothesis (i.e. Number of cointegrating equations being at least 1 or at least 2 respectively) at 5 per cent level of significance. However, we accept the presence of at least 2 cointegrating equations.

As the Johansen cointegration test is sensitive to the sample size, owing to the lower power and other series problems, the ARDL bounds testing approach for cointegration is applied to analyze the long-run and short-run dynamics among saving, investment, and economic growth. The estimable ARDL equations are specified as follows

$$\Delta LGDP_t = \delta + \sum_{i=0}^{p} \alpha_{1i}\ \Delta LGDP_{t-i} + \sum_{j=0}^{q} \alpha_{2j}\ \Delta LGDS_{t-j} + \sum_{k=0}^{r} \alpha_{3k} \Delta LGCF_{t-k} + \beta_1 LGDP_{t-1} +$$

$$\beta_2 LGDS_{t-1} + \beta_3\ LGCF_{t-1} + \beta_4\ D1979 + e_1 \quad \text{..... (i)}$$

$$\Delta LGDS_t = \delta + \sum_{i=0}^{p} \alpha_{1i}\ \Delta LGDS_{t-i} + \sum_{j=0}^{q} \alpha_{2j}\ \Delta LGDP_{t-j} + \sum_{k=0}^{r} \alpha_{3k} \Delta LGCF_{t-k} + \beta_1 LGDS_{t-1} +$$

$$\beta_2 LGDP_{t-1} + \beta_3\ LGCF_{t-1} + \beta_4\ D2003 + e_2 \quad \text{.....(ii)}$$

$$\Delta LGCF_t = \delta + \sum_{i=0}^{p} \alpha_{1i}\ \Delta LGCF_{t-i} + \sum_{j=0}^{q} \alpha_{2j}\ \Delta LGDP_{t-j} + \sum_{k=0}^{r} \alpha_{3k} \Delta LGDS_{t-k} + \beta_1 LGCF_{t-1} +$$

$$\beta_2 LGDP_{t-1} + \beta_3\ LGDS_{t-1} + \beta_4\ D2003 + e_3 \quad \text{.....(iii)}$$

Where Δ signifies the difference operator and GDP denotes Gross Domestic Product annual growth rate. As the ADF test for the structural break shows that the regressand (GDP annual growth rate) undergoes a structural break in 1979, dummy variable D1979 is taken in equation (i) to explain structural break. The dummy variable D1979 denotes 0 until 1978 and 1 thereafter. Similarly, dummy variable D2003 is introduced in equation (ii) to explain the structural break in 2003 in the Gross Domestic Saving. It takes value 0 until 2002 and 1 from 2003. In the same way, D2003 in equation (iii) is included to control for structural break in 2003 for Gross Capital Formation.

The coefficient (α_1- α_3) represents the short-term dynamics of the model and (β_1- β_3) captures the long-term dynamics. The values (p,q,r) are selected number of lags for the cointegrating equation base on SIC. The bound testing is incorporated to test for the existence of the long-run relationship among variables and F-test signifies joint significance of the coefficients of the lagged levels of the variables. The Wald test of coefficient restriction is used to test for the level effect with the null hypothesis of no level effect which is: H_0: $\beta_1=\beta_2=\beta_3=0$

In short, the usual Wald or F-test is to determine the combined significance of the lagged level variables. The null hypothesis of no cointegration can be rejected if the estimated F-statistic is greater than the upper bound critical values I (1) established by Pesaran et al. (2001). The null hypothesis of no cointegration cannot be rejected if the estimated F-statistic is less than the lower bound critical values I (0). The cointegration inference is indecisive if the estimated F-statistic falls between the lower and upper bound critical values.

The following Error Correction Model (ECM) is used to obtain the ARDL specification of the short-run dynamics.

$$\Delta LGDP_t = \delta + \sum_{i=0}^{p} \alpha_{1i} \Delta LGDP_{t-i} + \sum_{j=0}^{q} \alpha_{2j} \Delta LGDS_{t-j} + \sum_{k=0}^{r} \alpha_{3k} \Delta LGCF_{t-k} + \beta_6 ECM_{t-1} + e_t$$

.....(iv)

$$\Delta LGDS_t = \delta + \sum_{i=0}^{p} \alpha_{1i} \Delta LGDS_{t-i} + \sum_{j=0}^{q} \alpha_{2j} \Delta LGDP_{t-j} + \sum_{k=0}^{r} \alpha_{3k} \Delta LGCF_{t-k} + \beta_6 ECM_{t-1} + e_t$$

.....(v)

$$\Delta LGCF_t = \delta + \sum_{i=0}^{p} \alpha_{1i} \Delta LGCF_{t-i} + \sum_{j=0}^{q} \alpha_{2j} \Delta LGDP_{t-j} + \sum_{k=0}^{r} \alpha_{3k} \Delta LGDS_{t-k} + \beta_6 ECM_{t-1} + e_t$$

.....(vi)

Table 4: Bound testing for existence of a level relationship

Equation	F-value	Break (Year)	Lag order	Critical Value-Upper bound (1%)	
				I (1)	I (0)
F (ln GDP/ln GDS, ln GCF)	7.4547*	1979	(4,4,4,)	4.66	3.65
F (ln GDS/ln GDP, ln GCF)	0.7112	2003	(1, 3, 4)	4.66	3.65
F (ln GCF/ln GDP, ln GDS)	3.3981	2003	(1,0,4)	4.66	3.65

Note: The values between parentheses are the selected number of lags based on the Schwarz information criterion (SIC). GDP, GDS, and GCF stand for the GDP annual growth rate, gross domestic savings, and gross capital formation respectively.

Table 4 shows that when real GDP per capita is used as the dependent variable, the calculated F-statistics (7.4547) is higher than the upper bound critical value of 4.66 at the 1% level of significance. This implies that savings, growth, and investment are all cointegrating together. When saving and investment are included as dependent variables, however, the results show no evidence for cointegration or a long-run relationship. As a result, the long-run causality from savings and investment to economic growth in India can be said to be unidirectional. These results, however, contradict the Carroll–Weil hypothesis (Carroll and Weil 1994) that economic growth leads to savings.

Given the cointegrating variables, Table 5 gives the long-run estimates based on the ADRL model.

Table 5 shows that domestic saving has a negative impact on economic growth. Other thing remaining constant, a one percent increase in saving leads to decline in 2.069% in GDP annual growth rate in India in the long-run. Thus, savings do not positively impact economic growth. However, the result is not statistically significant. On the other hand, investment (or Gross Capital Formation) has a positive and significant impact on economic growth in India. In long-run, other thing remaining same, 1 % increase in investment will lead to increase in economic growth by 0.9864 percent. This signifies that in long-run, investment accelerates economic growth in India.

Table 5: Results for long run relationships based on ARDL model

Dependent variable: ln GDP **Explanatory variables**	**Coefficient**	**P-values**
ln GDS	-0.2069	0.5422
ln GCF	0.9864**	0.0632
D1979	0.3164*	0.0293
Intercept	-1.2369	0.1386
Diagnostic test statistics		
	Test stats	*P-value*
LM	1.1074	0.3403
JB	0.9862	0.4520

Note: GDP, GDS, and GCF stand for the real GDP annual growth rate, gross domestic savings, and Gross capital formation respectively. LM and JB denote the test statistics for serial correlation and normality of errors respectively. * Significant at 5% level and** significant at 10%level.

In the framework of equations (iv) to (vi), the estimates of the ECM are presented in Table 6.[3]

Table 6: Short term dynamics of relationships: Estimates of ECM

Dependent variable: ΔGDP **Explanatory variables**	**Coefficient**	**Prob.**
$\Delta \ln GDP_{-1}$	0.6153*	0.0188
$\Delta \ln GDP_{-2}$	0.3989**	0.0412
$\Delta \ln GDP_{-3}$	0.3372*	0.0053
Δln GDS	1.0189	0.1525
Δln GCF	1.9870**	0.0211
$\Delta \ln GCF_{-1}$	-1.5482	0.1101
$\Delta \ln GCF_{-2}$	-0.3188	0.7090
$\Delta \ln GCF_{-3}$	-2.6258*	0.0041
D1979	-0.4962	0.3513
ECM_{-1}	-1.8094*	0.000
Diagnostic test statistics		
R_squared	76.48	
F-value	7.4547	
DW-statistic	2.2373	

*-Denotes significant at 0.01 level and ** denotes significant at 0.05 level.

[3]*We conducted the diagnostic tests for both the serial correlation and normality. The results showed that the error term is normally distributed according to Jarque-Bera test and serially independent as per the LM test.*

Results of ECM in Table 6 shows that the estimated coefficients of lag GDP annual growth rate are positive and significant at 5%. This indicates that economic growth is sustaining with pace within the study period in India. Similarly, in short run, lag investment in terms of gross capital formation has positive and significant impact on economic growth in India. But domestic saving has insignificant and positive impact on economic growth. Overall, the results of ECM have the predicted signs and about 180 percent of the disequilibrium in the GDP annual growth rate from the previous year shock adjusts back to the long run in the current year. In general, the signs of ECM lies between 0 to -1. In few cases, as explained by Loayza and Ranciere (2005) the existence of a long run relationship (dynamic stability) requires the coefficient of the error correction term to be negative and not lower than -2. This implies that if the ECM lies between -1 and -2, then the lagged error correction term produces dampened fluctuations in dependent variable about the equilibrium path (Narayan and Smyth, 2006). The ECM value given in Table-6 implies that instead of monotonically converging to the equilibrium path directly, the error correction process fluctuates around the long run value in a dampening manner. However, once this process is complete, convergence to the equilibrium path is rapid.

3. Conclusion

This paper has examined the empirical relationship between saving, investment in terms of capital formation, and economic growth in India for the period 1960-2019, using Johansen cointegration and ARDL approach. The empirical results indicate that a stable long run relation exists between saving, investment and economic growth in presence of structural break, when economic growth is taken as dependent variable. That implies a long run relationship is from saving and investment to economic growth in India. This finding supports the view of Solow that saving leads to economic growth.

In the long-run, estimates of the ARDL model shows that investment has a positive and significant impact on economic growth. However, there is a negative and insignificant impact of gross domestic saving on economic growth in India. This indicates the weakness of Indian financial sector in mobilising the saving which should encourage economic growth. The long-run effect of the GDP's structural break in 1979 is found to have significant impact on economic growth, mainly because the Indian economy in that year had faced double severe problems of drought and supply disruption.

In order to attain the goals and targets of UN-SDGs in 2030, policymakers may pay attention to the current interrelationship between savings, investment, and growth. This emphasises the importance of developing strategies to improve the efficient mobilisation of savings in productive sectors. As a result of such measures, investment may rise, resulting in economic growth.

This paper has focused on aggregate analysis of savings. In future, role of savings may be disaggregated by public savings and private (household and corporate) savings. In the same way, role of investment can be distinguished between public and private sectors. Further, the study period of this paper ends at the year 2019. Subsequently, Covid-19 pandemic has impacted on India's economy in terms of growth, investment and savings. An extension of this paper into pandemic years may offer new insights into the relationships between economic growth and investment and savings in India.

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Current Status of Women in Karnataka with Special Reference to Effects of Covid-19 Pandemic: Need for Improvement Through Select Policy Interventions

Uma Mahadevan [1]

Abstract

This paper aims at policy analysis of the current status of women in Karnataka with special reference to effects of Covid-19 pandemic on women. The current status analysis is supported by the findings for Karnataka in the latest round of National Family Health Survey (2019-20). Further, need for improvement of current status of women is emphasized and select policy interventions for improvement of current status of women in Karnataka are suggested.

1. Introduction

Across the world, as a result of the Covid-19 pandemic, women have been forced to leave or 'drop out' of the workforce. In India, too, women's presence in the workforce has fallen sharply. Between 2005 and 2020, Indian women's workforce participation had already dropped from 32 percent to 19 percent[2]. With the advent of the pandemic, CMIE estimates suggest that female workforce participation in India came down even further.[3] In contrast, labour force participation of women in Bangladesh was over 35 percent in 2021[4].

In general, when women leave the workforce, they are less likely to return. The pandemic has made it even harder for women to return to the workforce. Job losses due to Covid restrictions, as well as additional domestic responsibilities, care work, and especially the added burden of childcare due to anganwadi / preschool and school closures, have not only led to women being forced out of the workforce, but also severely limited their abilities to return to work.

In addition, the pandemic saw a rise in child marriages and also 'simple' marriages during Covid containment restrictions. These curtailed young women's options to pursue secondary and post-secondary education and seek gainful employment before marriage.

The pandemic also saw an increase in cases of domestic violence. One of the first calls to the Karnataka state Covid-19 response team working with non-governmental and civil society organisations came through a Kerala response team, from the sister of a Kerala software engineer based in Bengaluru. She was reporting a case of domestic violence in her sister's family. Over the months of the pandemic, there was an increase in the number of cases of domestic violence reported.

Increasing women's participation in the workforce in Karnataka, and closing the gender gaps, will not only add to economic growth, but also empower the women in the state.

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All opinions in this article are of the author and usual disclaimer applies.
[2]*World Bank https://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS?locations=IN*
[3]*CMIE https://www.cmie.com/kommon/bin/sr.php?kall=warticle&dt=20220505124252&msec=676*
[4]*World Bank https://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS?locations=IN-BD*

This paper aims at policy analysis of the current status of women in Karnataka with special reference to effects of Covid-19 pandemic on women. The current status analysis is supported by the findings for Karnataka in the latest round of National Family Health Survey (2019-20). Further, need for improvement of current status of women is emphasized and select policy interventions for improvement of current status of women in Karnataka are suggested.

2. Current status of women in Karnataka

The fifth round of the National Family Health Survey (NFHS-5) for Karnataka, conducted in 2019, offers much useful information for policymakers in terms of gains made and challenges that remain in terms of the status of women in the state[5]. To identify systematic areas of focus for policy interventions, it is a good place to start.

While there have been gains in literacy and education, considerable gaps exist, especially in internet access. As per NFHS-5, over 73 percent, or nearly 3 out of 4 of surveyed women were literate, though there was a marked rural-urban gap: literacy was only 67.7 percent among rural women, and 81.9 percent among urban women. There was also a considerable gender gap. Over 85 percent of surveyed men were literate, that is, around 12 percent more than women. Further, the rural-urban gap for men was much less: more than 83 percent were literate among rural men, just a bit behind urban men's literacy which was 87 percent.

The percentage of women with more than 10 years of schooling had gone up to 50 percent from 45.5 percent in NFHS-4 (2015-16). However, the percentage of women who have ever used the internet was low, at 35 percent, with a considerable rural-urban gap: among urban women 50 percent had used the internet at least once, which was twice the percentage among rural women where it was only about 25 percent. For men the comparable percentages were higher: over 62 percent of men had ever used the internet, of which the percentage in rural areas was 55 percent, and in urban areas it was over 70 percent.

Virtually, no reduction was seen in child marriage even before the Covid pandemic. Over 21 percent of surveyed women aged 20-24 years had been married before 18, similar to the findings of NFHS-4. This percentage was slightly less in urban areas at 16 percent, while in rural areas it was nearly 25 percent.

On domestic violence, Karnataka ranked highest among states with 44% of women reporting that they had faced domestic violence, over twice the level of 20.6% in NFHS-4. One in ten young women aged 18 to 29 also reported having experienced sexual violence.

Adolescent pregnancy, too, needs policy attention. Over 5.4 percent of surveyed women aged 15-19 years were already mothers at the time of survey. This is a reduction from nearly 8 percent in NFHS-4 but still a matter of considerable concern.

Total fertility rate (TFR) was down to 1.7 in NFHS-5 from 1.8 in NFHS-4. Access of pregnant women to an ANC in first trimester has increased to 71 percent, over 66 percent in NFHS-4. Postnatal checkup coverage has also increased. Nearly 94 percent of pregnant women have had their anti-tetanus injection as compared to 88 percent in NFHS-4.

[5]*All details of NFHS-5 (2019-20) are given in State Report and State and District Fact sheets for key indicators and available at: http://rchiips.org/nfhs/districtfactsheet_NFHS-5.shtml (accessed on 15th June 2022).*

However, the percentage of women who have had 4 Ante Natal Care (ANC) during pregnancy has remained static at just over 70 percent. Further, consumption of iron and folic acid tablets has come down, which is of concern, as anemia among women has increased.

On child malnutrition, NFHS-5 findings show that Karnataka has made gains in reducing child wasting, severe wasting, underweight, and stunting, thereby reducing the extent of malnutrition among young children.

In addition to NFHS-5, other data also points to gains made in reducing malnutrition in recent years through systematic policy interventions for child and maternal nutrition. An independent evaluation by the Public Health Foundation of India (PHFI)[6] of Karnataka's Mathrupoorna Scheme, a One Full Meal (OFM) programme intervention for pregnant women and breastfeeding mothers, found that the scheme had significant impact as it had led to improvements in gestational weight gain of pregnant women and birth weight of babies, reduction in anemia among pregnant women, and improvement in mental health among pregnant women. This is also because the hot meal is not an end in itself, but the first step in a series of layered interventions including calcium, iron and folic acid provision, deworming, and nutrition education.

Further, maternal mortality ratio in the state has come down by around 20 percent to 83 per lakh live births from over 100 in just a few years. This is a considerable reduction by any yardstick. As Karnataka continues to have the highest maternal mortality ratio among the southern states, it is essential to continue these impactful programmes.

It is also critical to look deeper, beyond state-level data. Karnataka has sharp regional imbalances in human development, including imbalances in the status of women. There are district-level and taluk-level imbalances. Over the years, continuing efforts have been made to redress these; a constitutional amendment has also been passed, giving special status to a section of north eastern Karnataka[7]. Nevertheless, redressing the impact of decades of deprivation will take time. As the Covid-19 pandemic has exacerbated inequalities across the world[8], it is likely that it has exacerbated regional imbalances within the state too. A quick state-level post-pandemic survey would be very useful to plan policy interventions.

3. Need for and suggested policy areas of improvement of current status of women

One of the first and most important areas of focus should be to increase women's workforce participation. Encouraging such an increase would require multiple steps. These include: universal childcare in urban and rural areas; making public transport accessible and affordable; enhancing public safety; and providing last-mile access to secondary education and skill development for girls and women.

To do this, it is essential to retain girls in school until they complete secondary education. The prevalence of child marriage is unacceptably high and one in four girls is still forced into marriage before she is 18. Supporting girls to access secondary education, retaining them, and preventing their marriage in childhood will not only help girls to obtain education, but also reduce the risk of early pregnancy and the prevalence of

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[6]*Evaluating effect of one full meal a day in pregnant and lactating women. The Public Health Foundation of India, New Delhi: 2020.*

[7]*This refers to insertion of Article 371-J in the Constitution by the 98th Constitutional Amendment Act of 2012 to provide for special provisions for Hyderabad-Karnataka Region in Karnataka State.*

[8]*For instance, Covid-19 effects on global inequalities (with special reference to health inequalities) is best articulated by Professor Joseph Stiglitz, recipient of the Nobel Memorial Prize in Economic Sciences, in: "Conquering the Great Divide", Finance and Development, September 2020:*

low birth weight among newborns. Rules must be drafted, and awareness disseminated, about Karnataka's important amendment making child marriage void ab initio.

It is also necessary to communicate options to poor families about how girls can continue to pursue secondary education. High school students should also be given information about how to seek protection by appealing to the Child Welfare Committee (CWC) and the state in case parents or guardians are forcing them into child marriage. Other important interventions that should be considered include providing hot school meals with eggs for protein upto pre-university, and access to residential schools and hostels for girls from disadvantaged homes.

For girls to be supported to remain in secondary education, a decentralized microplanning approach is needed, including better planning of routes for public transport to and from high school; admission in hostels or residential schools/ pre-university colleges; or, in the absence of an in-kind option, through vouchers. Girls should also be given support for menstrual hygiene at least upto the completion of secondary education. There are many obstacles to girls attending high school, and a cash transfer at secondary level should be thought of for the poorest girls in educationally backward taluks.

Poor mothers require additional support from the anganwadi and school education sector in the form of full working hours. Anganwadi working hours are already six and a half hours a day, thereby functioning as partial daycare. If anganwadis and schools can function for eight hours a day, serving nutritious food including milk and eggs, this will permit women to go out to work full eight-hour days. Further, in schools, there should be a focus on ensuring that there is no exclusion of the poorest children, especially those from migrant worker families, or nomadic and semi-nomadic communities, or children with disabilities.

For livelihood support, there is a need for more outreach and enrolment of rural women with the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) job cards. Equally, all eligible women should be enrolled in Self Help Groups (SHGs). Building SHG worksheds – a permitted activity under the MGNREGA – should be prioritized, as women need this "room of their own", in the words of Virginia Woolf [9], to facilitate SHG meetings, training, and productive activities. SHG women members should be given effective training in financial and digital literacy. To promote financial inclusion, banks should recruit and train women banking correspondents from among SHG members. These women banking correspondents can be given office space in gram panchayats for their regular weekly operations.

Karnataka has a tremendous opportunity in its Stree Shakti SHG network which is already twenty years old. Well over one lakh women's Stree Shakti groups have been developed and are functioning, with regular meetings and revolving funds to help members tide over everyday needs for money, like school fees. Apart from their activities, Stree Shakti groups now have their own identity and culture of working. In recent years, the NRLM (national rural livelihood mission) programme has been introduced in the state. To ensure that the gains of the Stree Shakti programme are not lost, an imaginative and nuanced integration of the two programmes is required that goes beyond the mere replacement of one programme with the other.

While implementing SHG programmes, it is critical to recognize that a narrow focus on

[9] *Woolf, Virginia. (1931). A Room of One's Own. London: Published by Leonard and Virginia Woolf at the Hogarth Press (London)*

[10] *Details of information of Mahila Samakhya Programme in Karnataka is available at: https://www.karnatakamahilasamakhya.org/ (Accessed on 15 June 2022).*

economic empowerment is not sufficient. There is also a need for strong gender conscientization, along with information about legal remedies and available support systems especially in cases of violence against women, if women's SHGs in the state are to become a greater force for empowerment. Karnataka's strong Mahila Samakhya programme should be used to focus on this hitherto neglected area of women's social empowerment[10]. Mahila Samakhya is already working in nine districts and its work should be expanded to the entire state.

A good network of affordable public transport for women is an important part of promoting livelihood opportunities as well as public safety for women. Well-planned routes and timings will help women working in sectors such as the garment industry. Further, to promote safe workplaces, there is a need for proactive gender training for organisations, including Prevention of Sexual Harassment (POSH) training, posters in prominent places, the regular constitution and training of anti-harassment committees, and regular reviews of their functioning.

Emerging areas of paid work such as solid waste management in rural and urban areas should be made a focus for women's participation. Through a contract between the rural local bodies and gram panchayat-level federations of women's self-help groups, women's SHGs have already started taking up the end-to-end management of solid waste in rural areas. This should eventually include all activities, right from driving the waste collection vehicles and planning the optimal routes, to behaviour change communication and door to door collections, and thereafter further processing of the collected waste up to its recycling / sale. Women's SHGs will thus become entrepreneurs, and rural areas will manage their waste in a more planned and sustainable way.

But an exclusive focus on women's livelihoods without childcare support will not suffice. If women are to be supported to perform remunerative work and stay in the workforce, an important part of the puzzle is childcare. Both urban and rural creches are required in order to help women go out for paid work. Anganwadis already function as partial daycare for children between 3 and 6 years. However, they function only for six and a half hours a day, and their timings should be extended to eight hours daily.

Additionally, creches for under-3 year old children need to be set up. Creches not only provide childcare allowing women to return to the workforce, they also provide livelihood opportunities to women as childcare workers. Moreover, such creches for under-3 year old children will provide the valuable nutrition and stimulation that will help to overcome the continuing challenge of child stunting.

NFHS-5 findings indicate that only 11.3 percent of children below 2 years received an adequate diet. This is partly because infants and toddlers under 3 years of age do not come to anganwadis for their supplementary nutrition. Their families are instead provided with Take Home Rations (THR) as a packaged mix. This mix is often of uneven quality, not palatable, and sometimes used as animal feed instead of being consumed by children. Poor mothers of children under 3 years nevertheless need to engage in paid work. Their children under 3 years are either taken to the worksite, where they nibble at chips while their mothers perform physical work; or they are left behind with a grandmother or elderly neighbour. However, as most elderly women in rural areas also go to work, either in MGNREGA or performing other agricultural labour, the care of under-3 children is a challenge that requires urgent attention.

A practical and cost-effective creche arrangement for these children is required, where they can be provided with early stimulation as well as supplementary nutrition while their mothers go out to earn a livelihood. This can be done through creches at the gram panchayats. The gram panchayat can engage a local women's self-help group to run the creche, selecting them through the panchayat-level federation of SHGs. Creche workers chosen by the SHG from among its members can be given appropriate training by the Women and Child Development Department. The MGNREGA programme already envisages the setting up of a creche at any worksite with five or more children below the age of 6 years, with one of the workers being designated as the caregiver. With a modification in the guidelines, funding to run the creche can come from MGNREGA, as MGNREGA workers will leave their children in its care; the creche building can be included as a permissible asset creation activity under MGNREGA; and space for the building can be provided by the gram panchayat. Supplementary nutrition can be provided from the Integrated Child Development Services (ICDS) programme with the Gram Panchayat taking care of local implementation. Cooking arrangements can be shared with the anganwadi.

For urban creches for under-3 year old children, women child care workers can be trained from among urban women's self-help groups, and the urban livelihood programme can focus on the opening of such creches. Urban local bodies, slum development authorities, and the Labour Department can partner with the construction industry and civil society organisations, to identify spaces and train women's SHGs to start and run such creches.

In urban areas, such creches should be set up with support from the construction industry, in a clustered manner rather than a creche in every worksite. Urban women's SHGs can manage these creches, and ICDS can provide the nutrition component. Caregivers can be paid from the welfare funds collected in the Karnataka Building and Other Construction Workers' Welfare Board.

Creches have already been started in all Zilla Panchayat offices. On similar lines, government offices at taluk and district level, court complexes, district and taluk hospitals, should all have attached creches with trained creche workers, guidelines, and standard operating procedures. A timebound mission-mode programme should be taken up to ensure the provision of creches in plantations, industries, the hospitality and retail sectors, and garment factories.

The practical details can be worked out locally. Under-3 creches will serve many purposes: they will also promote livelihoods for SHG creche workers; they will lead to greater engagement of rural and urban local bodies in basic childcare services; and they will provide an opportunity for quality feeding and appropriate early stimulation for children under the age of 3. Most importantly, without compromising the safety and well-being of our youngest children, they will lead to improved women's labour force participation.

The above policy suggestions for improving the status of women in Karnataka are of general relevance and applicability for other states in India. Further, they may also have positive implications for strengthening the child development as well as gender development through the budget allocation to relevant programmes and schemes in the child budget and gender budget of Karnataka.

BOOK REVIEW

M.H. Bala Subrahmanya, and H.S. Krishna. (2021). **TECHNOLOGY BUSINESS INCUBATORS IN INDIA: STRUCTURE, ROLE AND PERFORMANCE.** Walter de Gruyter GmBH (Berlin/ Boston): ISBN 978-3-11-070505-8; E-ISBN (PDF) 978-3-11-070519-5; E-ISBN (EPUB) 978-3-11-070530-0; ISSN 2698-4806

This book is all about Technology Business Incubators (TBIs), a support system and a major component of entrepreneurial ecosystem for technology-enabled start-ups. Broadly, this support system comprises accelerators, incubators and co-working spaces. TBIs offer technological support and services which are aimed at (a) bridging knowledge gaps, (b) providing resource base, (c) promoting innovation and technology commercialization, and (d) providing infrastructure and business networking for start-ups to develop their own viable businesses and grow by self-sustaining and thriving companies. TBIs are mainly promoted/sponsored by economic development agencies, government and academic institutions with non-profit motives. Goals and objectives of TBIs include national and sub-national economic growth and development by ways of employment, income and output generations and export promotion, promotion of innovation, commercialization, development and transfer of technology, and facilitate University-industry interactions. Way back in 2020, 606 TBIs were in India and, among the states, Karnataka State had the highest number (66). Public promotional policies are initiated at the national level (Start-up India Policy in 2016) and state level (e.g. Karnataka Startup Policy 2015-20). Thus, TBIs have a special economic policy significance for Karnataka State, often called Start-ups Capital of India.

The book is well organized into 7 chapters. Chapter 1 and Chapter 2 are introductory. Chapter 1 is focused on explanation of the concepts, characteristics and importance of TBIs at global level and a description of origin and growth and current policy status for promotion of TBIs in India. Chapter 2 explains the types by not-for-profit and for profit TBIs, classification of TBIs by promoters (public and private), location, functions and services of TBIs for business incubation, and performance indicators of TBIs in terms of outcomes and achievements. Chapter 2 also include theoretical perspectives of TBIs, such as, Real Options Theory, Social Network Theory, and Resource-based View Theory. Dynamism of TBIs is distinguished by supply and demand side factors in three stages: Pre-incubation (Selection), Incubation Process (Start-up formation) and Post Incubation (Start-up graduation and exit).

As a basis for scientific analysis of TBIs, research questions and methods are developed in Chapter 3. Data are newly and completely collected from 65 TBIs, dispersed in Bangalore (31), Chennai (15) and Hyderabad (19). From each location, varying samples comprised Incubators, Accelerators and Co-working Spaces except Chennai which had no sample of Accelerators. This data is nearly classified and described by characteristics of TBIs, such as, types, age, location, public-private sponsors, sectors focus, prior industry/start-up experience, stage focus, objectives, infrastructure and support offered to incubates, staff patterns (administrative, in-house experts and external networks), size of physical space and number of seats for incubation and forms of promotional activities. Using these data, the determinants and performance of TBIs are explained in Chapter 4 through Chapter 6. All data descriptions are based on locations. All estimations are based on pooled sample of all locations for lack of enough degrees of freedom.

Chapter 4 explains the determinants of TBIs by structure and characteristics. First, determinants of public sponsorship of TBIs. Second, determinants of early stage TBIs. Using standard Logistic Regression technique and stepwise estimation procedure, the key determinants of these TBIs are distinguished. For instance, firms' age, education background of CEOs, and stage of growth are significant variables influencing public sponsorship of TBIs. Estimated determinants of early stage TBIs include nature of objectives, sponsors, and sector focus. These results show that each characteristic of TBIs has unique determinants.

Chapter 5 extends the estimation of determinants by role of TBI in terms of incubatee selection, incubation and start-up graduation, using the Stepwise Multiple Linear Regression Technique. For instance, incubatee selection is measured by number of prospective start-up applications and 6 determinants are estimated (such as, number of in-house experts employed, and education background of CEOs). In general, estimated determinants are unique for each role of TBIs.

Chapter 6 focuses on measurement of performance indicators, and estimation of their determinants for TBIs using Stepwise Multiple Linear Regression Technique. Three important performance indicators are distinguished as they are related to Research and Development (R&D): Cumulative R&D investment expenditure, R&D personnel, and R&D output contribution (measured by number of new products/ services, patent applications submitted, revenue generation and sales revenue from new products and services). Estimated determinants vary across the performance indicators. For instance, age of TBI, number of cumulative admissions, presence of external networks and number of successful exists are significant variables which influence new products/services from TBIs.

The technical approach and analyses of the entire book is best summarized in Chapter 7. This chapter also includes specific policy recommendations and scope for extensions of the current research. Annexures to the book include the questionnaires used for collection of primary data from sample TBIs. Consolidated reference at the end adds research value to this book.

Overall, this book analyses the TBIs from the global to national and state level perspectives in India with a simple and elegant of presentation of intricate technical concepts, analytical approaches, research methodology, business practices and policy experiences. Thus, the book is relevant and useful as a scientific reference for a broad readership comprising academic researchers, students and teachers in industrial economics, policy makers, and corporate promoters of TBIs, especially for promoting growth of start-ups. A strong research orientation in approach, empirical orientation in data collection and analyses with application of plausible methodologies, and generation of evidence-based policy conclusions and recommendations are the hallmarks of this book's contributions to an emerging area of research and policy in industrial economics and management in India. Subject to the comparability of economic and business structures of TBIs, the methods in this book may be replicated in other developing countries to generate either supportive or confronting evidence for the hypotheses tested for India. Supportive evidence shall be useful to generalize the results and conclusions to countries elsewhere in the developing world of Asia, Africa and Latin America.

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The preferred size of manuscript (including references, tables, figures and annexures) is 4000 to 6000 words.

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(BUDGET)

FOR THE YEAR 1974-75

(As presented to the Legislature in March 1974)

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