Agricultural marketing reforms to enhance business freedom and efficiency in the agricultural sector- An Empirical Analysis

RAJNI KAPOOR*
Department of Economics, Janki Devi Memorial College,
University of Delhi, New Delhi, INDIA

NIMAI DAS
Faculty of Environment and Developmental Economics,
Indian Institute of Forest Management Bhopal
Deemed University, Bhopal, INDIA

*Corresponding author

Abstract: - This research attempts to evaluate business freedom in the agricultural sector as a whole, which is weighted through agricultural marketing reforms, contract farming, market access, food security and liberal trade policies. Business freedom in agriculture is a comprehensive set of agribusiness ideas, options and opportunities opening for the farming community. It encompasses various aspects of the production, processing, and marketing of agricultural products. Freedom to agribusiness involves the management of the entire value chain, from farm to fork. The resolution of trade and transaction-related concerns related to agricultural products through business freedom and opportunities improves farms' efficiency. A developed nation, however, has the option and opportunity to invest in better farm technology and research, while an emerging nation that relies heavily on agriculture needs to expand its technical and marketing structure. Highlighting the significance of Farm Bills, 2020 in the Indian context, that were introduced as marketing reforms in the agricultural sector, the study provides insight to introduce agribusiness freedom and opportunities for small and marginal farmers, merchants, traders, and mills. A primary survey was conducted in one of the agricultural leading states of India. The study has estimated business freedom index using principal component analysis and has investigated how it affects farm-level technical efficiency. Output-oriented efficiency is measured using a data envelopment analysis. The results reveal that the degree of agribusiness freedom and farm size have been found to be positively correlated, while its's indicators' extent varies throughout farms. According to technical efficiency estimates, marginal farms are considered to be less efficient than small and medium-sized farms. As per results, the ability to adapt efficient technology is positively and strongly correlated with agribusiness freedoms. The study proposes that in order to improve farm-level efficiency in technology, governments should implement these farm-specific business freedom measures. Therefore, the study has raised knowledge and responsiveness among farming community to embrace for sector expansion and accessibility through innovative farming techniques.

Key-Words: - Marketing, business freedom, efficiency, trade, India

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1 Introduction

Business freedom in agriculture is a comprehensive set of agribusiness ideas, options and opportunities opening for the farming community. It encompasses various aspects of the production, processing, and marketing of agricultural products. Freedom to agribusiness involves the management of the entire value chain, from farm to fork. Previous group of literature examined the provisions of agribusiness, which is contingent to market infrastructure, and lawful improvements [1]. Market access and marketing issues related to farm produce have been reported by several studies [2]. The policy reforms related to trade and protections are emphasized to improve marketing, scale and technical efficiency of farming [3]. In short, the business freedom in the agricultural sector has a significant role in the supply chain process of the farm products.

The paper identifies marketing policy reforms as the first component of business freedom in agriculture which is required to resolve trade and transactional aspects of a farm product [4]. The marketing reforms promote the big landlords, traders, merchants and new agri startups facilitating trade without any license, cess or fee to transact inter-state or intra-state [5]. Marketing policy reform enable significant advancements in agriculture, which led to the rise of agribusiness. Thus, these reforms have paved the way for the growth of agribusiness.

In the same way, market access expands opportunities for farmers to reach regional and local markets through investing in cold storage and transportation. Subsequently, agribusiness freedom can be increased by building transaction capabilities of the buyers and sellers while trading the products in an open market and shifting from one state to another for better price options [6]. Only then regulated markets will become more competitive and cooperative for the traders to obtain the benefits of mandi infrastructure [7]. Thus, business freedom explores a good trading environment.

Similarly, liberal trade policies are required to improve the competency level of products and their flow across nations [8]. Tariffs, customs, and non-tariff barriers are reduced, resulting in an increased demand for the product [9]. As well, agribusiness freedom and opportunities expand to set protection policy goals for achieving food self-sufficiency and security by providing region-specific policy changes in tariff and non-tariff barriers [10]. The protection covers the choices of ceiling tariff rates or bound tariffs ensuing special safeguards for products related to food security and self-sufficiency whose non-tariff limits are changed to tariffs in a special emergency package [11]. Following this way, developing countries need not to cut tariffs on their farm products. Therefore, these mechanisms of business freedom are crucial to enhancing efficiency at the farm level.

Agribusiness freedom provides farmers with the opportunity to expose their products to domestic and international markets, thereby completing the marketing challenges [12]. Business freedom also improves farmers' technical skills. Since, the efficiency of cultivation depends on the advancement of technology [13]. Efficiency enables farmers to produce the same quantity with fewer inputs or more quantity with the same inputs [14]. In this way, the provision of business freedom is needed for enhancing efficiency in the agricultural sector. Therefore, business freedom is introduced to expand the marketing structure of agribusiness through greater choices and freedoms to the farmers for selling farm products. Moreover, these options shift farm marketable surplus and shortages from the state regulations towards expanding the freedoms of an individual farmer [15]. In this way, business freedom will empower the capabilities of the farmers.

In this regard, the present study both develop a theoretical model and empirical analysis of how to evaluate the components of business freedom in agriculture and examine its impact on farm-level technical efficiency. A primary survey was conducted in the reference year 2020-21 to get information on size-based different categories of farmers, landless, marginal, small, and medium. Each cultivating household in the village listed in one of the four categories. In this way, a total of 336 farms were randomly selected from villages in the state of Haryana in India. The study covered three districts, namely; Ambala, Karnal and Yamuna Nagar. Cross-sectional data was compiled to analyze the impact of the business freedom index on output-oriented technical efficiency. A scheduled questionnaire was aimed to get responses against each quantifiable component and indicator of business freedom on a four-point assessment scale. We calculated farm level technical efficiency using data envelopment analysis.

The subsequent section defines agribusiness freedom for enhancing technical efficiency in India, next to next section presents data sources and procedures used to measure the agribusiness freedom index and technical efficiency. Conclusions and policy implications are described in the last section.

2 Agribusiness freedom in India and efficiency of farms

During the 1960s a supply-driven model to promote agribusiness freedom was developed by agricultural price marketing committees (APMCs) to expand local and domestic trade of farm products. Farmers in India can trade after obtaining a license or fee (Seedhi Khareed) at the district and state levels [16]. The state administrations appointed APMCs and commission agents (arhtiyas) to handle wholesale trading of products through mandis or market yards [17]. Moreover, electronic platform of the national agriculture market and the APMC reforms were introduced in 2015 to benefit farmers with superior value and hassle-free dealings [18]. These market structures are expected to regulate transparent and uniform transactions to ensure farm revenue through stabilizing product prices. Nevertheless, these markets have become stiff and less competitive, they rarely provide a direct link for farmers to

interact with processing units, mills, merchants, traders, etc. [19]. As a result, large number of marketing middlemen, or arthiyas, have been added to the value chain of the farm product in India.

The effectiveness of Agricultural marketing committees (AMCs) on technical efficiency in the Coastal region of Andra Pradesh has been recognized in comparison to ineffective AMCs (see Table-1). This indicates the importance of AMCs in this particular area. Moreover, it is interesting and uplifting to observe that the number of efficient AMCs witnessed an increase from the fiscal year 2005-06 to 2008-09. Table-1 signifies a positive trajectory and inclination towards advancing the AMCs activity in accordance with the Government's scheme in the Coastal region of Andhra Pradesh. Therefore, the effectiveness relies on the well-regulated APMCs.

In India, there is high transaction costs associated with market access and the limited holding capacity of smallholders, that is why, most of the marketable surplus is sold at the farm gate to traders and village merchants [21]. How much agricultural production is marketed by farmers at the regulated market? This is an important indicator of commercialization of farming is, besides in India, this agricultural development suffers from institutional inequalities, farm size, lack of modern equipment and technology [22]. Reason being, farm-level efficiency could be enhanced by resolving market access issues and trade information asymmetry [23]. Farm efficiency is significantly improved by institutional changes, reforms centered on market institutions, and reforms focused on reducing market imperfections in agricultural input and output markets [24].

Moreover, market access extends through joining the contract farming after confirming the product price, inputs and technical assistance to the farmers with specific firms and corporations. The trading contracts give assurance to the cultivators against the market price fall, crop diseases, climate change, etc. thereby empowering them to produce earnest crops. Technical services and farming inputs can be provided to the farmers [25]. Contract farming has a good impact on technical efficiency. This highlights the need for focused interventions to remove obstacles that prevent people from participating in contracts effectively [26] (see Table -2). According to Table 2, participants in the spider plant and chili contracts had mean technical efficiency scores that were greater (0.66 and 0.24) than those of non-participants (0.12 and 0.15), respectively. In this way, farmers will become capable of connecting with companies, firms, processing units and customers like cafeterias, mills, etc. This kind of farming process may decrease the farm-to-fork markup price (i.e. the difference between the price that farmers received and what customers paid for the farm products), for promoting both the buyers and the sellers [27]. Moreover, this policy may endorse diversification, and quality products at the best price as well as encourage exports and sales. It carries new investments and techniques of farming, improving the position of farmers as agronomists' [28].

Indeed, market access offers information symmetry to the farmers and buyers while trading the products. It gives choices and options of several other markets located in any big villages or small towns or nearby to the farming place. In this way, the business freedom option resolved marketing issues. These marketplaces check the quality, ranking, weight and value of the products to resolve marketing issues [29] and connect farmers, procurement activities and private dealers in the direct transaction, as well as regulating the market price not to fall lesser than the informed minimum support price (MSP) [30]. This way of dealing may provide transactions at MSP or the superior price to the larger proportion of farmers.

It is found that small and marginal farmers have poor access to the regulated markets in India [31]. Besides, marginal and small farmers are unable to apply efficient machinery, equipment, and good-quality seeds for improving the efficiency of the farm. Although these reforms have reduced farmers' stress, still they continue to be denied an unfair share of final buyers' payments [32]. The government of India reports that there are 126 million small and marginal farmers in India who cultivate an average of 0.6 hectares of land and contribute 40 percent of the country's marketable surplus [33]. Thus, at the production level, marketing and market access glitches often discourage farmers from adopting highly efficient techniques of production, and as a result, the productivity and efficiency of the

sector are adversely affected.

On the other hand, Nigerian agricultural households' technical efficiency was examined, and the significance of the mean technical efficiency of both food-secure and food-insecure agricultural households is determined (see Table-3). Table-3 shows that, on average, agricultural households had a mean technical efficiency of 52%, indicating a tendency for these households to increase their technical efficiency by 48% by making better use of the resources that are available. There is a significant one percent difference in technical efficiency between homes with and without food security and those with food security. The findings offer helpful insights into how land size and asset count affect agricultural households' food security and level of technological efficiency [34].

The policies that aimed at improving farmers' technical efficiency can also have a strong impact on reducing food insecurity [35]. A developed nation, however, has the option and opportunity to invest in better technology and research, while an emerging nation that relies heavily on agriculture needs to expand its technical and marketing structure [36]. Thus, the study provides insight to introduce agribusiness freedom and opportunities for farmers, merchants, traders, and mills in the form of marketing reforms, market access, and liberal trade policies including protection for food security and quality control.

3. Methodology

3.1 Scale to measure business freedom in agriculture

With a four-point assessment scale (rare, sometimes, most of the time, and always) ranging from 1 to 4; always or full freedom (4), most of the time or moderate freedom (3), sometimes or low freedom (2), or rare or negligible freedom (1) estimated to define the intensity of the indicator. The purpose of a scheduled questionnaire was to gather responses against each quantifiable component and indicator of business freedom. The respondents were given yes/no open-ended questions; if they answered "no," the insignificant freedom score is (1); if they answered "yes," the intensity of the indicator is assessed using a points system. To determine a weighted average score for each indicator, the qualitative scores are quantified in a similar way (see Chart-1).

Chart-1: Qualitative assessments of business freedom

Marketing reforms:

(a) Marketing policy: Have marketing reforms in the form AMCs reduced the marketing costs? If yes, have AMCs been disregarded to offer better prices and reduce marketing commissions? / have offered a better price but not reduced the marketing commission/have offered a better price and reduced the marketing commission both?

(b) Market access policy: Whether have transport and cold storage benefitted in trading agricultural products? If yes, have such facilities provided hassle-free transactions but no direct contact with buyers/have provided hassle-free transactions and direct contact with buyers?

(c) Contract farming: Whether have contract farming offered better price than MSP? If yes, have contract farming reduced the costs of farm aggregation, reduced the farm aggregation cost but not affected the proportion of marketable surplus. Whether have reduced the farm aggregation cost and increased the proportion of marketable surplus as well.

(d) Liberal trade policy for agri-products: Have reduction in taxes expanded the market of farm products? If yes, have increased the demand for farm products, but not expanded the agribusiness/ increased the demand as well as expanded the agribusiness?

(e) Have liberal trade policies improved the competency level of the farm-products? If yes, the policy made products less competitive in the international market/ improved the competency level of products/improved the competency level and global challenges.

Food Security and self-sufficiency:

(a) Food self-sufficiency and Food security: Have food security and self-sufficiency targets expanded the agribusiness option and opportunities? If yes, have found the food surplus/have found food surplus but not achieved self-sufficiency targets/have found both food surplus and achieved self-sufficiency targets?

(b) Are quality control measures effective in resolving trade and marketing issues? If yes, have the measures increased the food grain supply at the higher price/have found food grains supply at a higher price in the local market but disregarded the trade and marketing issues/have

increased both food grains supply at a higher price in the local market and resolved trade and marketing issues?

3.2 Indexing method to measure freedom using PCA weights

For every agribusiness freedom indicator, the weights are estimated using the first principal component. Using the factor reduction method, the correlation coefficient between the dimension-wise components of business freedom and its sub-components/indicators were estimated. By converting the indicators and loading the weights by each standardized original variable, then multiplying the results to obtain the average weighted index, the PCA technique is used to evaluate component scores [37]. In this way, PCA weights (factor loadings l_{ij}) are estimated by dividing the column sum of covariance $\Sigma r_{z_i z_j}$ of each sub-components/indicator by the square root of column sum of covariance: $\sqrt{\Sigma\Sigma r_{z_i z_j}}$,

i.e. $l_{ij} = \frac{\Sigma r_{z_i z_j}}{\sqrt{\Sigma\Sigma r_{z_i z_j}}}$ ..... (1)

PCA factor loadings [weights (∅)] are estimated by adding the square sum of the covariance of each indicator (see Table-4).

i.e. $\emptyset = l_1^2 + l_2^2 + l_3^2 + \cdots \ldots\ldots\ldots\ldots\ldots + l_r^2$ ....(2)

An empirical model to measure business freedom: $\mathrm{Bf_i} = \sum \mathrm{C}_i \mathrm{W_{ri}}$ .....(3)

Where; i = observations and r = set of indicators

Table 4 reveals that factor loadings can be inferred as correlation coefficients, higher the factor loading, the greater its relationship with the identified indicators of the index.

3.3 DEA framework for output-oriented technical efficiency

The output-oriented technical efficiency estimated using BCR [38] model with variable returns to scale (VRS). The following is the expression of the output-oriented model for the ith farms with variable returns to scale:

$\underset{\theta_q \varepsilon_i}{\mathrm{Max}}\, \theta_q$ .....(4)

Subject to:

$\sum_{i=1}^{n} \varepsilon_i y_{iq} - \theta_i y_q - s = 0$ .....(5)

$\sum_{j=1}^{m} \varepsilon_j x_{jq} + e_q = x_{qi}$ .....(6)

$\sum_{j=1}^{n} \varepsilon_j = 1$.....(7)

$\varepsilon_j \geq 0; s \geq 0, e_q \geq 0;$

$m = 1 \ldots inputs;\ q = 1, n\ DMUs$; Where θ_i is the proportional increase in output possible for the *i*th DMU; s is the output slack; e_q is the *k*th input slack; and ε_j is the weight of the *q*th dmu. To obtain the constant returns to scale, the limitation of $\sum_{q=1}^{n} \varepsilon_i = 1$ is removed.

The output-oriented DEA model provides a maximum proportional increase in output within the same production possibility set. The situation is obtained when output slack is zero. An efficient qth farm lies on the frontier when $\theta_q = 1, \varepsilon_i = 1\ and\ \varepsilon_q = 0$ for $q \neq i$.The production function of *q*th farm is denoted by y_q^* is given by:

$y_q^* = \sum_{i=1}^{n} \varepsilon_i y_{iq} = \theta_i y_i$ .....(8)

The output-oriented technical efficiency of qth farm is denoted by TE_qcan be estimated by;

$TE_q = \frac{y_q}{y_q^*} = \frac{1}{\theta}$.....(9)

This is observed in production about the corresponding potential production from the given resource.

3.4 Tobit regression

Tobit regression is the second stage-econometric analysis that used the DEA efficiency of farms for regressing against some institutional factors [39]. It is used to estimate determinants of agricultural efficiency when the observed dependent variable lies between 0 and 1. Tobit regression is also known as censored regression. In agriculture, it is used to analyze the impact of farm-specific factors on efficiency in the cultivation of crops [40]. In this paper, the two-limit Tobit model is used with a random effect, which is based on the assumption that identified indicators of agribusiness freedom are not correlated with the observed variables.

The empirical Tobit model for ith observation is given as $q_i^* = \beta_j \Sigma z_{ij}' + u_i$Where, $i = 1, 2, 3, \ldots.252$, q_i^* = latent variable representing DEA technical efficiency of farm j used as a dependent variable in the model, u_i/z_i is $N(0, \sigma_0^2)$. $\{q_i, z_i\}(i = 1, 2, \ldots n)$, β_j is a vector of independent variables (j =1, 2…..k) and are known parameters associated with farm-specific factors. u_i is a normally distributed error term with zero mean and constant variance $u_i \sim N(0, \sigma_0^2)$. q_i is observed variable, $q_i = 1$, if $q_i^* \geq 1, q_i = q_i^*$, if $0 < q_i^* < 1$, $q_i = 0$, if $q_i^* \leq 0$. Tobit regression is used to apply the

maximum likelihood approach to estimate the model.

$$L = \prod_{q_i=0}(1-F_i)\prod_{q_{i>0}}\frac{1}{(2\prod\sigma^2)^{1/2}}e[\frac{1}{2\sigma^2}](q_i-\beta z_i)^2 \ldots\ldots..(10)$$

$$F_i = \int_{-\infty}^{\beta^i zi/\sigma}\frac{1}{(2\Pi\frac{1}{2})}e^{-i^2/2}\partial_i \ldots\ldots\ldots\ldots\ldots(11)$$

Where F_i is normally scattered in $\beta^i zi/\sigma$. In this way, farm-level technical efficiency scores are used following Tobit regression to analyze the measurement of efficiency and socio-economic indicators of farmers. It is reviewed from the literature that there are several variables identified to examine technical efficiency level among farmers, such as age, education, family labour, year of farming experience and farm size, information is collected based on surveys and interviews.

Where, $TE =$ technical efficiency of ith no of observations, $i = 252$, $Ui =$error term, DUMI=1……..3 (for marginal, small and medium farms). TE is a latent variable ranging from $0\ to\ 1$, $\Upsilon_0, \Upsilon_1, \Upsilon_2, \Upsilon_3, \Upsilon_4,$ and Υ_5 are the coefficients of agribusiness freedom index, age of head of the family, education level, non-farm income and dummy of farm-size, respectively; herein the study, four regression models run with $STATA$ 14.0$^{@}$ to examine the effect of business freedom and socio-economic variables on technical efficiency of farms. The given five explanatory variables are taken as factors affecting efficiency across the farms.

4. Results and discussions

4.1 Agribusiness Freedom Index

Table 5 shows that almost 45 percent of the sampled farmers have a low score on the business freedom index, while around 35 percent are in the moderate range. On average, nearly 60 percent of the total sampled farms did not realize the benefits of freedom. About 12 percent of total farmers score very low on the index, as they are not able to enjoy deliberation or are not able to connect with retailers and food processors. However, around 8 percent of sampled farmers score high on the index as they minimized marketing difficulties and were able to access the market.

More than 35 percent of medium farms score low on the index while more than 50 percent have moderate scores. Medium households are more likely to benefit from agri-business options and opportunities. More than 70 percent of medium farmers have access to APMC mandis for selling farm products. Almost 10 percent of medium landholders have a high range on the index as they have invested in cold storage, warehouses and transports to expand their agri-business. However, a few medium farms have very low scores.

More than 40% of small landholders score low for business freedom, and almost 50 percent of small farms score moderate. The results show that a large proportion of small landholders rank low for business freedom compared to medium farmers. The situation of marginal farmers is poorer than that of small and medium farmers. More than 55 percent of marginal farmers score low and almost 25 percent score very low (see Fig for details). A group of about 8 percentage points of small landholders fall on the very low range on the index. Due to high transaction costs, it is found that small and marginal farmers have less access to the regulated markets than medium-sized farmers. Similar conclusions were reached when evaluating the sold and marketable excess of the main food grains in India [41]. Additionally, it has been noted that marginal and small farmers are less proficient in negotiating. Similarly, marginal and small farms are unable to diversify their crop production toward high-value crops due to high management and transaction costs [42].

Conversely, a moderate level of business freedom is enjoyed by up to 18 percent of marginal farmers. Consequently, a few marginal and small farmers score highly for business independence. In conclusion, Table 1 shows that over 40 percent of landless farmers are in a very low level of business freedom and 50 percent are in the low range.

A positive relationship has been seen between farm size and the weighted mean scores of business freedom, as indicated by the mean estimates of the indicators of business freedom presented in Table 6. For landless farmers, the predicted maximum mean scores for food security, quality control, and hunger issues are found. Afterwards, marginal farmers have likewise received the highest scores possible for food protection and security. With mean scores ranging from 3.15 to 2.78 to 2.66, respectively, small farmers benefited most from quality control measures, transportation and cold storage, food security, and protection policies; the quality control measures' standard deviation is the lowest (0.59) of all. In addition, quality control, cold

storage, and transportation have all had a moderate impact on medium farmers, with mean values of 2.81 and 2.69, respectively; the standard deviation of cold storage and transportation is the lowest of the two. Medium farmers have the highest weighted mean score (3.34) for food security and protection. Transport and cold storage, as well as food security and protection policies, are considered to be significant indicators of the business freedom index for farms as a whole. As farm size increases, the weighted mean score increases as well. In this way, the mean value of the business freedom index is highest (2.60) for medium farms and lowest (2.04) for landless farmers.

4.2 Input-output data used in the model

Data was collected on the annual output, input pattern, and input expenditure of sampled farmers in the reference year 2020-21. Table 7 shows all expenditures in rupees/acre of land. In order to fit the model, farm output is aggregated into a single output. The output is the monetary value of major crops estimated at the current market price. A wide range of materials are used in the production process, including land, seeds, fertilizers, pesticides, electricity, machinery, and labour. Table 7 reveals that the utilization of farming inputs varies across farms. For marginal farmers, the average farm income was (130834.1) per acre, for small farmers it was (125857.1), for medium farmers it was (136439.8) and for overall farms, it was (131043.7). Average farm income is higher for medium farmers than marginal, and for small farmers than marginal. The mean expenditure on land increases farm-wise. It is found that the average expenditure on land is minimal on marginal farms. The mean expenditure on seeds is higher for small farmers (2081.67) than for medium (1789.29) and marginal farmers (1749.17). Farmhouse size and seeds spending are associated with a progressive relationship, except for medium-sized farms.

For medium farms, the average expenditure on fertilizer is slightly higher at 5479.34 compared to 5405 and 5279.79 for small and marginal farmers. Big landholders spend more on manures such as urea. Fertilizer usage varied by farm size due to lack of capital and knowledge of fertilizer usage per acre. Table 3 shows that spending on pesticides increases as the farm size increases (per acre). This means medium size cultivators consumed more pesticides. Per acre electricity consumption increases with the size of the farm. Generally, marginal cultivators consume less electricity per acre than marginal landowners.

The outlay plan shows that marginal landowners have made rational expenditures on resources. It is found that marginal and small farmers have almost the same spending on hiring equipment, such as tractors, combines or threshers, used during the reaping and seedling stage. However, medium landholders paid a bit more than marginal and small farmers. It is found that small and marginal farms used a larger amount of labour compared to marginal and medium. According to the results, marginal and medium farmers chose to maximize output using the appropriate units of inputs, while small-scale farms did not use the resources effectively and produced the least units of products.

4.3 Technical efficiency of farms

The technical efficiency score between (.9>1) is treated as extremely efficient, less than that is considered inefficient or inefficient, between .5 and .7 as moderately efficient and between (.7 > .9) is considered highly efficient. On average, marginal, small, and medium-sized farms achieve 60, 55, and 75 percent of their potential output from the given mix of inputs. The result suggests that around 40, 45 and 25 percent of the production of the respective farm group, on average, is forgone due to technical inefficiency. The scores indicate that there is potential capacity to increase the farm output (Table-8) across the sampled farms, although efficiency reveals variability across farms. Mean technical efficiency was higher among medium farmers (Table-8) compared to marginal/small/medium-sized farmers.

About 13 percent of the medium landholders were extremely efficient. This percentage increases to about 5 percent among small farmers and increases to about 11 percent among marginal/small farmers (Table-8). Moreover, it is observed that more than 44 percent of small farmers are inefficient which increases to (around 4 percent) for marginal and again decreases to (around 24 percent) for medium. Around thirty percent of overall farms are inefficient. Twenty-four percent of medium farmers are highly efficient technically, this proportion is greater than (15 percent) for marginal and again higher than (13%) for small farms. On average, 13 percent of overall farms

are highly efficient. Thus, it is found that DEA technical efficiency varies across farms.

4.4 Regression outcomes

Table 9 shows the results of the econometric Tobit regression model. All models (model-1 (minor), model-2 [small], model-3 [medium] and model-4 [overall]) are statistically significant at a level of 1% (p-value < F(0.000)). The five variables selected {namely, BFI, Age of Head of the Family [AGE], Education level [EDU], Source of Non-Farm Income [NFI] and dummy of Farm-size [DUMI}] significantly increased farm-level technical efficiencies. Table-9 shows a positive association of the coefficients with the technical efficiency. The coefficient of business freedom is positively associated with the technical efficiency at a level of significance of 1% for marginal, small, and medium farmers.

The results indicate that a 1% increase in agri-business freedom options and opportunities, such as market access policy, storage, transports, liberal trade policy, dummy of farm-size and total farm-size increased technical efficiencies by 19.6%, 22, 21, 22, 23 and 24.

Small and Medium-sized Landholders (SMEs) are strongly linked to agribusiness opportunities and opportunities. R-squared values (0.246), (0.247), (0.217), and (0.262) indicate that approximately 25 to 27 percent of the overall variation in technical efficiency can be attributed to selected explanatory variables. Age is estimated to positively correlate with marginal farmers' efficiency but the relationship is not significant. A one percent increase in marginal farmers' age improves their ability to adopt new farming techniques by 0.013 percent. Therefore, aged marginal farmers are technically more efficient than younger counterparts at their counterparts' level. Small and medium size farmers are more capable than younger farmers of their peers.

Table 9 reveals that education is positively related to the technical efficiency of small, marginal and overall farms, whereas negatively related to the efficiency of medium-sized farmers. It means that a one percent increase in the year of schooling increased the extent of efficiency by 0.82, 0.10, and 0.05 percent for marginal, small and overall firms, but decreased the efficiency of medium farmers by 0.07 percent. However, the relationship is insignificant. The result suggests that education has least affected the efficiency of farms.

For marginal and overall sample farms, non-farm income is negative and insignificant, but positive and insignificant for small and medium-sized farms. In other words, a one percent reduction in income from secondary jobs or off-farm jobs reduced the efficiency of adopting new technology in farming by 0.15 percent for marginal farms and 0.07 percent for overall farms, while income from off-farm jobs increased the efficiency of small and medium farms by 0.01 and 0.11 percent, respectively (see Table-9). A dummy of farm size is estimated negative and significant at a 1% level, indicating that farm membership decreased by approximately 0.08% percent. It is evident from the result that farms do not receive any incentives for technological upgrades because of their membership in a particular category.

5. Conclusions

The paper focuses on agricultural marketing, market access, and liberal trade policies to resolve trade and transaction related issues and to expand market access so that farm level efficiency can be enhanced. A marketing policy must be specific for certain locations, farms, and crops, otherwise business freedom becomes uneven for diverse farms and situations. As such, these policies are considered a first step toward expanding agribusiness freedom to allow farmers, processing units and consumers to directly trade and transact with farm produce across countries. In addition, the paper specifies policies to ensure food security and self-sufficiency.

Accordingly, weights are assigned to each indicator to determine the business freedom index's farm-wise intensity. A positive association was found between farm size and business freedom index. According to this study, medium farms have the highest business freedom index (2.60) and landless farmers have the lowest (2.04). The mean values are estimated to be 2.25 for marginal farms and 2.46 for small farms. However, the indicators of business freedom vary from farm to farm. On average, the average estimate of food safety, quality control, transport, and cold storage contributed significantly to the development of business freedom and agribusiness options. Small and medium farms are found

technically more efficient than marginal farms.

The result indicates that the sampled farms have optimized their resources and are operating close to the optimal scale size, except for the smaller farms. As a result, the technical efficiency is observed differently across farms. Tobit regression indicates that business freedom is beneficial and significantly affect the efficiency of the farms in the sample. The elasticity of business freedom improves efficiency by about 19.6 for marginal farms, 22.3 for small farms, 21 for medium farms, and 20 for overall farms. Other socioeconomic variables such as age, education and non-farm income, and dummy of farm size also varied across farms.

6 Implications of the study

According to the study, policy makers should create provisions to improve the farmers' ability so that they could take advantage of business opportunities. Agribusiness freedom is expected to open up opportunities for farmers by reducing marketing and market entry challenges for small and marginal farmers by updating techniques and broadening trade opportunities for agribusiness. These freedoms will bring private investment into rural infrastructure such as more prospects on investing in cold storage and transport. Further business opportunities will allow companies and startups with innovative ideas to enter the market and take advantage of new opportunities. The study provides insights on policy reform to improve the technical efficiency at the farm level. The study recommends the government to implement agricultural business freedom through farm bills, 2020. These types of bills are a step toward marketing reform to address the present dearth in the regulations of the APMCs transforming a transparent and fair market for the farmers at national level, rather than at the state and local level. The study recommends policy makers to offer more possibilities of contract farming, so that farmers can sell their products at the right price after trading at home or on their farm. Farmers must engage in intra-state or inter-state trading by setting up a digital platform for their agricultural products. Trade liberalization is highlighted in the study, in the form of reductions in taxes, tariffs, cess or charges, marketing commissions, transaction costs etc. Agricultural business freedom and possibilities would induce private investors to build procurement infrastructure at the farm gate.

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Table -1 AMCs, business freedom and efficiencies in Coastal region of A.P.									
Description	2005-06			2006-07			2008-09		
	CRS	VRS	SCALE	CRS	VRS	SCALE	CRS	VRS	SCALE
No. of efficient AMCs	83	103	83	85	107	85	71	101	71
No. of inefficient AMCs	44	24	44	42	20	42	56	26	56
Mean Score	0.913	0.972	0.938	0.922	0.978	0.941	0.887	0.969	0.912

Source: Estimates of Rao & Chari (2013).

Table -2 Contract Farming, Technical Efficiency and Business Freedom					
Model	Statistics	Contract Farmers, n=70	Non-Contract Farmers, n=57	Contract Farmers, n=79	Non-Contract Farmers, n=94
Farm Produce		Chilli		Spider Plant	
T.E. Stochastic Frontier	Mean	0.675	0.338	0.797	0.940
	Min	0.382	0.006	0.683	0.066
	Max	0.827	0.999	0.859	0.837
	S.D.	0.088	0.300	0.033	0.220

Source: Estimates of Joseph & David (2021)

Table – 3 Mean Technical Efficiency of Agricultural Households			
Variable	Observations	Mean	S.D.
Overall	2746	0.521	0.191
Food Secure	1346	0.539	0.179
Food Insecure	1400	0.504	0.200

Source: Estimates of Oyetunde-Usman Z, Olagunju (2019)

Table: 4 Factor loadings (weights) of agribusiness freedom indicators*

Nos.	Indicators	Landless	Marginal	Small	Medium	Pooled
1	Agricultural marketing committees (AMCs)	0.443	0.518	0.428	0.489	0.486
2	Transport & cold storage	0.439	0.536	0.499	0.444	0.552
3	Contract Farming	0.460	0.555	0.476	0.409	0.468
4	Trade liberalization	0.458	0.606	0.491	0.408	0.589
5	Competitive market	0.513	0.479	0.504	0.419	0.516
6	Food security and self-sufficiency	0.466	0.597	0.528	0.583	0.546
7	Quality control & marketing issues	0.443	0.431	0.674	0.470	0.461

Source: Authors' estimates from primary survey

Table 5 Intensity of Agribusiness Freedom Index

Business freedom level	Landless		Marginal		Small		Medium		Pooled/Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
$1 \geq f_I > 2$ (Very low)	42	50	20	23.81	6	7.14	2	2.38	43	12.8
$2 \geq f_I > 2.5$ (Low)	35	41.7	47	55.95	35	41.6	31	36.9	146	43.45
$2.5 \geq f_I > 3$ (Moderate)	7	8.33	15	17.86	41	48.8	44	52.4	120	35.71
$3 \geq f_I > 3.99$ (High)	0	0	2	2.38	2	2.38	7	8.33	27	8.04
Total Sample	84	100	84	100	84	100	84	100	84	100

Source: Authors' estimates from primary survey

Table: 6 Summary Statistics: Indicators of Agribusiness Freedom

Indicators	Landless	Marginal	Small	Medium	Pooled
Agricultural Marketing Committee (AMCs)	1.69 (0.63)	2.15 (0.65)	1.87 (0.61)	2.46 (0.72)	2.08 (0.69)
Transport and cold storage (TCS)	2.05 (0.89)	*2.39 (0.68)*	*2.78 (0.65)*	*2.81 (0.39)*	*2.86 (0.87)*
Contract Farming (CTF)	2.04 (0.91)	2.14 (0.57)	1.98 (0.51)	2.12 (0.47)	2.03 (0.65)
Liberal Trade Policy (LTP)	1.89 (0.69)	*2.39 (0.77)*	2.28 (0.60)	2.43 (0.53)	2.33 (0.89)
Competitive Market (CMT)	1.99 (0.95)	2.02 (0.69)	2.48 (0.76)	2.34 (0.56)	2.37 (0.85)
Food security and self-sufficiency (FSP)	*2.35 (0.66)*	*2.91 (0.80)*	*2.66 (0.65)*	*3.34 (0.82)*	*2.78 (0.74)*
Quality control and Marketing Issues (QTM)	*2.24 (0.63)*	1.77 (0.59)	*3.15 (0.59)*	*2.69 (0.66)*	2.18 (0.62)
Business freedom (BFI)	2.04 (0.32)	2.25 (0.36)	2.46 (0.31)	2.60 (0.29)	2.43 (0.39)
No. of Observations	84	84	84	84	336

Source: Authors' estimates from primary data, standard deviation in parentheses

Table: 7 Summary statistics of input-output data (in Rs. /per acre)

Inputs	Output	Seed	Fertilizer	Pesticide	Electricity	Machine	Labour	Land
Scale	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)
Marginal farms, DMUs = 84								
Mean	130834.1	1749.17	5279.79	2851.19	2702.02	5653.57	5448.98	42809.52
SD	33268.2	592.31	602.33	688.02	878.07	876.53	1400.94	7640.22
Min	40425	800	3000	1200	1000	3400	3000	30000
Max	253700	4000	6230	4200	4880	7400	9900	58000
Small farms, DMUs = 84								
Mean	125857.1	2081.67	5405	3294.05	3011.55	5654.76	6445.23	44107.14
SD	37214.26	788.63	507.57	608.84	988.49	810.76	1466.23	6349.30
Min	70411	1100	4200	2000	1500	4000	3900	30000
Max	252800	5000	6260	5000	5400	8000	9900	58000
Medium farms, DMUs = 84								
Mean	136439.8	1789.29	5479.34	3460.11	3569.88	5826.19	5670.24	45178.57
SD	25363.97	668.56	478.66	649.92	1781.53	920.86	936.09	6178.39
Min	87588	1100	4200	1900	1300	4000	3600	30000
Max	220500	5000	6610	5500	10000	8400	7650	58000
All farms, DMUs = 252								
Mean	131043.7	1873.37	5388.05	3201.78	3094.48	5711.50	5854.82	44031.75
SD	32487.49	701.09	536.40	696.49	1325.54	870.88	1353.82	6796.92
Min	40425	800	3000	1200	1000	3400	3000	30000
Max	253700	5000	6610	5500	10000	8400	9900	58000

Source: Author's estimate from the primary survey, SD=standard deviation, Min=minimum, Max=maximum value

Table 8 Farm-wise DEA Technical Efficiency Score

Technical efficiency	Marginal		Small		Medium		Overall	
	Freq.	Percent	Freq.	percent	Freq.	Percent	Freq.	Percent
Less than 0.5 (inefficient)	34	40.42	36	43.7	16	19.05	78	31.2
0.5> 0.7 (moderately efficient)	30	37.35	28	33.8	37	44.05	85	33.6
0.7 > 0.9 (highly efficient)	12	14.82	11	12.41	20	23.8	34	13.2
0.9 > 1 (extremely efficient)	8	7.41	9	10.09	11	13.1	55	22
Total Sample	84	100	36	43.7	84	100	252	100
Mean_ Tech efficiency	0.603		0.545		0.743		0.595	
Standard Dev.	0.146		0.141		0.141		0.134	
Minimum	0.159		0.291		0.447		0.159	
Maximum	0.99		0.99		0.99		0.996	

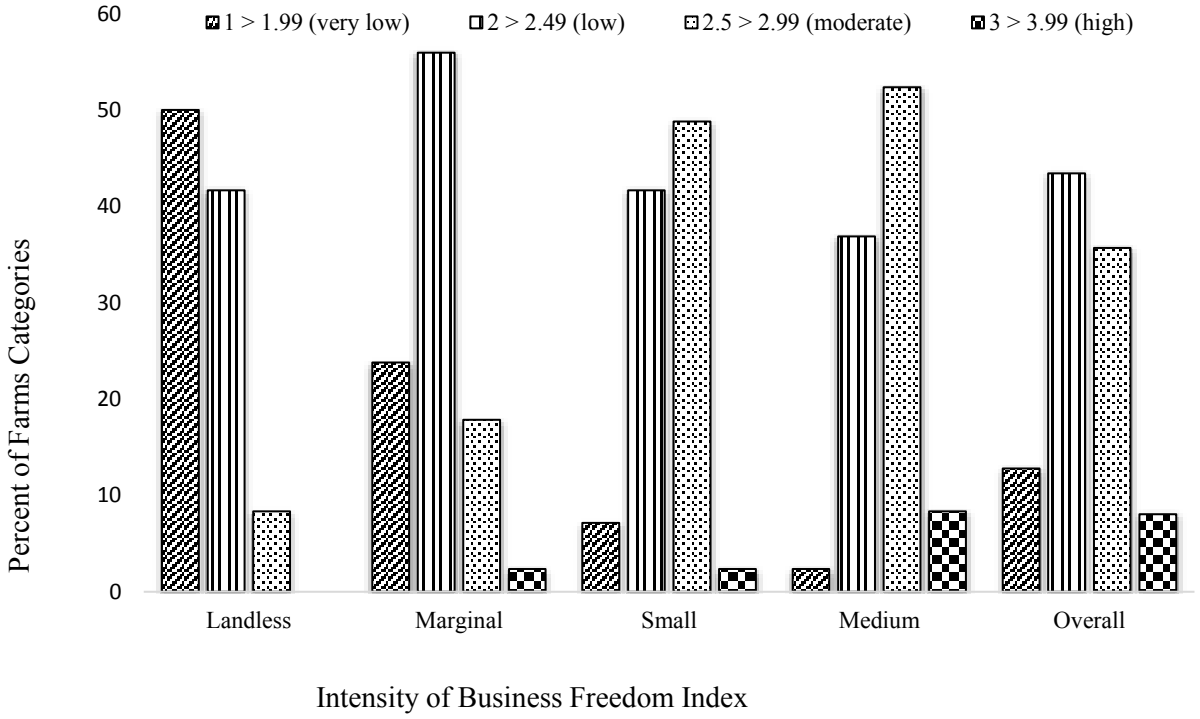
Source: Authors' estimates from primary survey

Table 9 Impact of Agribusiness Freedom on Technical Efficiency

Variables	Regression Outcomes				
	Parameters	Model-1	Model-2	Model-3	Model-4
Constants	Υ_0	0.114 (0.86)	-0.039 (-0.21)	0.220 (1.28)	0.188 2.48
Business freedom Index	Υ_1	0.196*** (5.04)	0.221*** (4.90)	0.215*** (4.59)	0.204*** 9.25
Age	Υ_2	0.013 (0.81)	-0.004 (-0.21)	-0.004 (-0.22)	-0.002 -0.26
Education	Υ_3	0.008 (0.72)	0.010 (0.89)	-0.007 (-0.52)	0.005 0.83
Non-farm income	Υ_4	-0.015 (-1.49)	0.001 (0.04)	0.011 (0.76)	-0.007 -1.04
Dummy of farms	Υ_5	Na	na	Na	-0.079*** (-6.55)
R-squared		0.246	0.247	0.217	0.262
p-value > F		0.000***	0.000***	0.000***	0.000***
LR χ^2		23.73	23.88	19.9	76.74
Log-likelihood estimates		54.63	58.017	55.748	188.09
No. of observations		84	84	84	252

Source: Authors' estimate from the primary survey
t-ratio in parentheses, ***significant at 1%.

Fig.-1 Farm-wise Intensity of Agribusiness Freedom Index



Source: Authors' estimates from primary survey