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Abstract

This article examines effects of the regulatory framework of post-harvest agricultural markets on agricultural growth across Indian states over the period 1970-2008. We propose a new measure that captures various legislative dimensions of a key 'Act' - the Agricultural Produce Markets Commission (APMC) Act & Rules - governing the agricultural markets, evolved from the dismal colonial history of India, and use this measure to estimate growth models using panel methods. We have applied Fixed-Effects, Feasible Generalized Least Squares, and Fixed-Effects Instrumental Variable models to the panel data to address the endogeneity associated with the regulatory framework. Our results show that the Act significantly promotes not only agricultural growth but the use and the adoption of agricultural technology. Evidence presented suggests that a policy to remove market regulation rather than advancing effective ones would fail consequentially to draw investments and improve agriculture growth.

Keywords – law, regulation, agricultural markets, colonial institution, technology, economic growth, panel data, Indian states

JEL codes: C23, D02, K23, Q13, Q18

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Do Agricultural Marketing Laws Matter for Rural Growth? Evidence from the Indian States

Agricultural growth matters for the majority of the poor in developing countries. While much of the literature on the determinants of agricultural growth has examined the issues such as climatic factors, geography, irrigation, infrastructure, access to technology, extension services and land reforms in fostering agricultural growth in developing countries [examples include Feder, Gershon, Just and Zilberman (1985); Binswanger, Hans, Khandker and Rosenzweig (1993); Foster and Rosenweig (1995); Johnson, Hazell, and Gulati (2003); Palmer-Jones and Sen (2003); Benerjee and Iyer (2005); Fan, Gulati and Thorat (2008); Besley and Burgess (2000); Evenson and Gollin (2003); Dercon, Gilligan, Hoddinott, and Woldehanna (2009); Duflo, Kremer and Robinson (2011); Krishnan and Patnam, 2013; Emerick, de Janvry, Sadoulet and Dar (2016)], relatively little is known about the effect of regulation and its reforms pertaining to agricultural markets on agricultural growth. In this paper, we examine the effect of post-harvest agricultural marketing regulation and its reforms on agricultural growth in Indian states over the period 1970-2008 (See a series of papers by Simeon Djankov, Edward Glaser, Rafael La Porta, Andrei Shleifer in 1990s and later – for instance, De Long and Shleifer, 1993; Rodrik, 2003; Shleifer, 2005; Porta, Lopez-de-Silanes, and Shleifer, 2006; Djankov, McLiesh and Ramalho, 2006; Acemoglu and Robinson, 2008 and so on – that examine the effects of regulation on growth in areas as diverse as labour markets and barriers to entry in product markets. However, no studies, to our knowledge, have examined the role of regulation of agricultural markets on agricultural growth).

Inappropriate or ineffective regulations in agricultural markets can adversely affect economic activities of farmers. Firstly, in unregulated or inefficiently regulated markets, farmers can be subject to exploitation of market agents who act as monopolists (by raising prices of farm inputs) and/or monopsonists (by lowering prices of farm produce). Secondly,

in poorly regulated markets, farmers - particularly those with little financial and social resources or political leverage - face high, often prohibitive, costs in accessing information on produce prices and demand conditions that can reduce incentives to invest in technology and to market their produce commercially. This, in turn, could lead to thin agricultural markets, inadequate coordination, high transaction costs and high unit costs for infrastructural development (North, 1990; Cullinan, 1999; Dorward, Fan, Kydd, Lofgren, Morrison, Poulton, Rao, Smith, Tchale, Thorat, Uray and Wobst, 2004; Dorward, Kydd, Morrison and Poulton, 2005).

In this article, we will examine the growth effects of the Agricultural Produce Markets Commission (hereafter, APMC) Act & Rules in India – a unique legislative institution of colonial lineage.[1] As a regulatory institution, the APMC Act is the first exclusive statute on regulation on the marketing of agricultural produce, dating back to the year 1886, when elements of regulation were first introduced in the cotton market under the British rule in India. The APMC Act and Rules are set to establish transaction norms, correct market failures, promote market competition and offer marketing infrastructure services in marketing yards. It is expected to incentivize farmers with secured marketing system and encourage them to adopt improved farm technology to increase crop production and augment food security of the country. Most agricultural markets in Indian states have functioned under the framework of the Act over the last 60 years. A key feature of the APMC Act is that individual Indian states have changed important provisions in the Act over time, as agriculture is under the purview of Indian states under the Indian Constitution. The cross-state variation in the legislative provisions of the Act as well as its time-series variation, that is, how various regulations that are part of the Act have been enforced over time, provides us

[1] This is consistent with the theme of the World Development Report 2017: Governance and the Law (World Bank, 2017).

with an ideal environment to test the effects of market regulations on agricultural growth, using India as a case-study.

To quantify the effects of the APMC Act, we have utilized a multidimensional index that measures different components of the APMC Act & Rules for 14 states of India during the period 1970-2008. The strength of our measure is that it is comprehensive and varies both over time and across states of India. We apply this index to evaluate the role of regulation of the agricultural markets in explaining the variation in agriculture yield growth across Indian states and over long time-span, controlling for other determinants of agricultural growth in Indian states. We use Fixed-Effects (FE) as well as Feasible Generalized Least Squares (FGLS), while we also employ the Fixed-Effects Instrumental Variable (FE-IV) model to account for endogeneity concerns that arise related to reverse causality from agricultural growth to the regulatory framework. India offers a particularly interesting case, as the Indian government has always placed agricultural growth at the centre of its growth strategy. Over the last decade, the role of regulation of agricultural markets in economic development has become contestable in India (Pal, Bahl, and Mruthyunjaya, 1993; Expert Committee Report on Agricultural Marketing Reforms, 2001; Gujral, Joshi, and Anuradha 2011; Minten, Vandeplas, and Swinnen, 2012). In addition, various Indian states have drastically changed or eliminated market regulations (such as the state of Bihar) with a view to encouraging private sector investment in the agricultural marketing sector. Concurrently, wide differences in agricultural growth exist across the states of India (Pal et al., 1993; Mukherjee and Kurodo, 2003). Using the index of nearly forty years of the regulatory framework of post-harvest agricultural markets, we find that improvement in regulation by at least 0.1 point on a scale increases agricultural growth by 0.24% points. As regards the effect on modern farm technology adoption, we also witness an increase by 53.7 % points in the area under high variety yield (HVY) rice, 73.2% points in the area under wheat HVY, 0.34% points of

fertilizer use and an increase by 10% points of land under irrigation. We conclude that malfunctioning agricultural markets need institutional reforms and not institutional vacuum. The results are robust to changes in model specification and estimation methods.

The remainder of the article is organized as follows. The next section begins by providing a historical account of the APMC Act to understand why regulation of agricultural markets matters for agricultural performance. The section then describes the approach to read, code and quantify the APMC Act & Rules for select fourteen Indian states. In Section 3, we will present the empirical specification and discuss the econometric methodology, to be followed by a description of the dataset and variables used for our empirical analyses. The main results are explained in Section 4 and the FE-IV in Section 5. In Section 6 we report the results of robustness checks based on alternative specifications. The final section concludes.

Regulation of Agricultural Markets in India

Overview of colonial history of the APMC Act

In this section, we provide a brief discussion on the historical origins of the APMC Act to motivate why the impact of agricultural market regulation on economic outcomes is an empirical matter. Until the outbreak of the Second World War, the system of marketing of agricultural and allied produce that developed in India resulted in devastating socio-economic conditions from time to time. The Berar Cotton and Grain Market Law of 1897 was the first law instituted by the British rulers to enhance commercialization of cotton production and control grain movement in order to make the colonial empire flourish. At that time, the sole motivation behind elements of regulations was to ensure stable supplies of pure cotton as raw material to the textiles mills in Manchester (England) at below world prices (Rajagopal, 1993). By setting farm payments substantially below world prices, the agricultural marketing boards under the British administration effectively levied a tax on farmers, which discouraged farm production and dampened farmer income. Meanwhile, the surpluses the

government accrued were rarely used to improve marketing facilities or to stabilize price. The marketing boards became not only the means for collecting patronage resources but also the medium for distributing them. Jobs within the agricultural marketing system became rewards for party loyalty. As a result, the marketing boards soon developed a reputation as an inefficient institution that exploited farmers and discouraged agricultural production (Knight, 1954; Lele, 1971; Bhattacharya 1992).

Each market centre initiated and developed its own practices and code of business. A host of functionaries and intermediaries deploying their services within market got involved in the system, and exploited the ignorance and weak bargaining position of cultivator-sellers, who had no say in the disposal of their produce (Bhatia, 1990).

After the two centuries of the old colonial administrative design of agricultural market and stagnating agricultural development in India, the new improved model Act 'Agricultural Produce Markets (Commission) Act' (APMC Act) was introduced in 1938 by the Ministry of Food and Agriculture of the Indian government. The subsequent state-level agricultural market law, whenever passed by the states either immediately or after an interval, was virtually based on the general principles embodied in the original British law (Bhatia, 1990). Despite the efforts by the central government of India, the progress made with the regulated markets in terms of growth and their geographical distribution remained slow and highly uneven. The heavy concentration of the agricultural markets in the cotton-growing states remained prominent. The markets did not embrace other agricultural produce, and were largely confined to cotton marketing. Until the late 1960s, certain states of India, such as Uttar Pradesh, West Bengal, and Assam had few regulated markets (Rajagopal, 1993). See Appendix A for salient features of the colonial APMC Act, state-wise APMC legislation and Rules enforcement (Table A1) and the number of the regulated markets in the states since the year 1930 (Table A2).

This colonial history of the APMC Act serves as an important reference for the purpose of undertaking an enquiry of present day legal framework of APMC Act in the Indian states. We believe that the history of the APMC Act & Regulations we have reviewed in the section has faded and the present agricultural market institutions are steadily reworked through reforms by the state as part of the progressive growth of India. However, the evidence is needed to identify the causal relationship between the regulations and agriculture growth given the complex mechanism of institutional transformations (North, 1990; Acemoglu and Robinson 2008). These APMC legal provisions that traditionally provided and enforced codes of conduct to a considerable degree in agricultural markets across the states of India appear to influence the cost of exchange and production, alter preferences of actors and serve interest group (Acharya, 2004).

Measurement of the APMC Act and the composite APMC index

We propose a new composite measure of regulations of the agricultural markets based on the statutory law: the APMC Act & Rules to understand the role of regulations of the agricultural market in promoting agricultural yield growth. Purohit (2016) constructed a composite measure of the APMC Act & Rules by making classification of legislative measures on the six dimensions for fourteen major Indian states from 1970 to 2008. This APMC index is based on variables from *de jure* (in law) set of indicators to construct a quantitative measure of the APMC Act & Rules evolved over the period of 38 years (1970–2008).[2] The choice of *de jure* (rules based) indicators controls biases both "for" and "against" a particular state. It limits the selection of spurious indicators of the APMC Act, driven by political or ideological

[2] Our approach is similar to that of Besley and Burgess (2004), who code state-level amendments to the Industrial Disputes Act 1947 of the Indian government, to study the effects of labour regulations on industrial performance.

biases or beliefs that experts' assessments may have. It also allows us to distinguish objective indicators easily from the outcome indicators of the APMC Act & Rules. Methodologically, the APMC index is inspired by the measurement approach proposed by Kolenikov and Angles (2009) and Branisa, Klasen, Ziegler, Drechsler and Jütting (2014). This method applies principal component analysis (PCA) for continuous variables and tetrachoric PCA for binary variables (0/1) to multiple indices to extract the common information of the variables that belong to a sub-index in the form of the first principal component, as a weighted sum of the standardized corresponding variable. The composite APMC index is calculated as an average of a non-linear function of the six sub-indices (Purohit, 2016, p.40). This is a new approach to aggregate the quantitative measure of the APMC Act in several dimensions over time, penalising sub-optimal regulatory framework in each dimension. As a multidimensional measure, the APMC index allows only for partial compensation between dimensions. The six sub-indices of APMC Act & Rules related to administrative and regulatory framework of the agricultural markets that are combined to form APMC composite index are (i) scope of regulated markets; (ii) constitution of market and market structure; (iii) regulating sales and trading in market; (iv) infrastructure for market functions; (v) pro-poor regulations; and (vi) channels of market expansion[3].

[3] Each single sub-index measuring a specific dimension of the APMC Act constitutes a set of legal variables read from the state Act is guided by the history, semi-structured interviews with subject experts and government officials at Directorate of Agricultural Marketing and Inspection, Ministry of Agriculture, Government of India, New Delhi and National Institute of Agricultural Marketing, Government of India, Jaipur, undertaken during the field-visit to India between January-July 2011 (Purohit, 2016).

Coding and Measuring APMC Act & Rules: Classification of Variables

The New Model APMC Act & Rules of 2003 is used as the baseline model Act & Rules for the classification of the core legislative measures (variables) in the construction of state-wise APMC index[4]. The historical background of regulated markets has guided to identify the variables that link to creation of institution of the present day agricultural markets in the states. Each state's APMC "Act" corresponds with state APMC "Rules." The rules serve as a blueprint to implement the clauses of the Act which simply outlines how regulated markets are to be established and function for effectively implementing the provisions of the APMC Act. This means that the Act is enforced only if the Rules exist.

[4] The model APMC Act & Rules of 2003 was introduced by the union government of India as a response to address and overcome criticism of the existing regulated marketing system in various states of India. It is comprised of 14 chapters and 111 sections, covering clause for declaration and establishment of markets to regulate notified agricultural produce, constitution of market committee and marketing board, conduct of business and power and duties of the market committee, regulation of trading, model specification for contract farming, private market yard, penalty, budget and the like. In this article, we, thus, recognize the model Act 2003 as the reference document to relate and compare clauses of the state's Act & Rules with the union government's model Act & Rules. The model Act 2003 is regarded as the one to facilitate the state achieving economic outcomes with reference to how far they support or structure economic activities of the agricultural markets by reducing uncertainly with the predictable, stable structure and supporting pro-poor growth model. A copy of the model Act and Rules 2003 can be found at:

http://agmarknet.nic.in/amrscheme/modelact.htm ;

http://agmarknet.nic.in/amrscheme/FinalDraftRules2007.pdf

The Agricultural Produce Markets Act & Rules in different states differ in vital contents across the states, while they show the underlying path dependency of institutions which have evolved gradually over the long period. This provides variation in the key variables across states over time in constructing the index. With the New Model APMC Act of 2003 as the baseline law, a legal clause in the state's APMC Act & Rules is scored either one (+1) if a legal provision exists in the state's APMC Act & Rules or zero (0) otherwise. Such a classification of legislative measures allows us to codify the level of the APMC Act & Rules for each state. It distinguishes between different states with different levels of APMC Act and Rules over the time. To demonstrate this coding procedure, we take the example of a positive regulatory market clause from Rajasthan, the clause on "terms and procedure of buying and selling" Section 15–D (2 a–c) of the Act 1961 reads as follows:

> Section 15–D(2-a) of the Act, 1961 reads: 'The price of agricultural produce brought in the principal market yard or sub-market yard or private sub-market yard shall be paid on the same day to the seller in principal market yard or sub-market yard or as the case may be, private market yard…'
>
> Section 15–D(2-b) of the Act, 1961 reads: 'In case purchaser does not make payment as specified under clause (2–a), he shall be liable to make payment within five days from the date of purchase with an additional amount at the rate of 1% per day of the total price of the agricultural produce payable to the seller'
>
> Section 15–D(2-c) of the Act, 1961 reads: In case the purchaser does not make payment as specified in clause (b) within the said period of five days, his licence shall, without prejudice to his liability under any other law, be deemed to have been cancelled on the sixth day and he shall not be granted any licence or permitted to operate in a market area as any other functionary under this Act for a period of one year from the date of such cancellation.'

Here Rajasthan gets a code of '+1' in the data set since 1963. The rules to enforce the Act which were framed in 1963 satisfy three identified variables: (i) provision of payment to grower/seller on the same day; (ii) provision of interest payment over the delayed payment and (iii) penalty for default payment. In comparison, except for Madhya Pradesh and Karnataka that included similar clauses in 1986 and 2007 respectively, the Acts of other states' excluded clauses on interest over the delayed payment and penalty for default payment, and in this case these states included the only provision on point (1) of payment to grower/seller on the same day. So these states get zero on two of the three legal aspects. The APMC Act & Rules of the selected 14 states are compared and quantitatively coded to draw variables, which capture differences in administrative design, ways of efficiency in trading, special protection to disadvantaged farmers, and market orientation of agricultural sector to increase agricultural income and attain economic welfare. The measurement of the APMC Act & Rules was supplemented also with information on post-harvest hard infrastructure which was collected from the secondary records, published by the Directorate of the Agricultural Marketing, Ministry of Agriculture, Government of India. Table A3 in Appendix provides a list of clauses (variables) constituting each of the following dimension (sub-index) of the APMC Act & Rules of 14 states of India.

(i) The Scope of Regulated Markets dimension measures the geographical spread of the regulated markets (accessibility) and the sufficiency (against shortage) of the number of markets in the state.

(ii) The Constitution of Market and Market Structure dimension measures the level of fairness (democracy) in the administrative structure of the APMC governing committee which equitably represents diverse interests – farmers, trader/broker and consumer – involved in sale and purchase of agricultural produce in the yard.

(iii) The Regulating Sales and Trading in the Market dimension measures the level of regulatory provisions such as single-point tax, open auction, payment and receipt provision etc. that fosters fair commercial rules for the farming community.

(iv) The Infrastructure for Market Functions dimension measures the level of physical infrastructural facilities and services in the market yard to facilitate trading in perishable and non-perishable agricultural produce with less wastage and loss.

(v) The Pro-Poor Regulations dimension measures pro-poor regulatory environment to stop exploitation ensuring social justice to small and marginalized farmers.

(vi) The Channels of Market Expansion dimension measures legal space for modern alternative marketing channels such as contract farming, direct marketing, private markets, e-markets etc. in the State. Guided by the model Act 2003, this sub-index captures legal steps to encourage private sector investment in the establishment of an alternative agricultural marketing system and also private-public partnership in joint management to increase marketing efficiency through the removal of barriers and monopoly in the state functioning of agricultural markets. Details on the status of recent reforms in the APMC Act are indicated in Annex table A4.

Each of the sub-indices as well as the composite index are statistically normalized to range between 0 and 1, with 1 corresponding to optimal regulations and 0 to inferior regulations of the agricultural markets. Table 1 shows the state-wise summary statistics of the six sub-indices and composite APMC index, 1970-2008. Figure 1 shows trends of the aggregate APMC measure for each state during 1970-2008. An important feature of this measure is that it varies in both time-series and cross-sectional dimensions, which is, to our knowledge, the most comprehensive empirical characterization of post-harvest agricultural marketing law for India.

[Figure 1 to be inserted around here]

Empirical Framework, Methods and Data

(a) An Empirical Framework

Our interest centres around the effect of our measure of APMC Act & Rules on agricultural yield per hectare. Figure 2 illustrates the relationship between the regulatory measure of APMC Act and agricultural performance across different states over time.

[Figure 2 to be inserted around here]

We estimate the reduced form panel regression as follows:

$$Y_{it} = \beta_0 + \mathrm{X}_{it}\beta_1 + \beta_2 APMC_{it-k} + \delta_t + \eta_i + \varepsilon_{it} \qquad (1)$$

where for state i at time t (year), Y_{it} denotes a measure of agricultural yields $Ln(Yields)_{it}$, the logarithm of the aggregate yield of principal foodgrains per hectare in kilograms. X_{it} is a vector of control variables. δ_t and η_i are time fixed effects and unobservable state fixed effects. ε_{it} is an error term, independent and identically distributed.

The key parameter of interest is β_2 in Equation (1), which measures the effect of the lagged regulatory measure of AMPC Acts & Rules that would guide code of business of post-harvest agricultural produce markets in state i at time $t-k$ on agricultural yields taking into account the possible endogeneity of $APMC_{it}$. Following the recent empirical literature on institutions, a measure of the APMC Act is lagged by 5 years (Besley and Burgess 2000, 2004).[5] $APMC_{it}$ is lagged not only because any legislation (even the effective one) will take

[5] We have also carried out the panel unit-root tests (Levin, Lin and Chu, 2002; Im, Pesaran, and Shin, 2003) to see if the variables are stationary. We found that the most variables, including Yield and lagged APMC index, are stationary with or without

time to be implemented and to have an impact. This is also due to the endogeneity concern, that is, any form of shock, such as other policy changes or natural weather shocks, to agricultural growth outcome may be correlated with incentives to reform APMC. By taking lags - together with the IV approach to be discussed later -, we will partly address the concern that the APMC measure is endogenous to economic conditions due to the common and unobservable hidden factors influencing the APMC measure and the agricultural outputs at the same time. The interview with local experts during the field work has confirmed that it would take about 5 years for the impact of any changes in regulations to be realized.[6] As an extension, however, we will instrument $APMC_{it-k}$ by the political variables, namely the share of electoral seats of leftist or right wing parties in the legislature.

(b) Econometric Method

In a long panel, like the one used in the article, with a relatively long time periods for a relatively small number of states, non-identically distributed errors (heteroscedasticity) or identically dependently distributed errors (autocorrelations) are often an issue in the panel data analysis. There could also be a correlation or dependency among the errors of the same cross-sectional unit, though the errors from different cross-sectional units are independent. Therefore, ignoring a possible correlation of regression disturbances over time and between states can potentially lead to biased coefficient estimates (Driscoll and Kraay, 1998; Baltagi, 2005; Hoechle, 2007).

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trend. We do not reject the null hypothesis for some input control variables like fertilizer and capital, and labour, but we use them as levels because they tend to be slow to change over time and previous works (e.g. Mundlak, Butzer and Larson, 2012) use their levels (in log) in estimating yield in levels (in log).

[6] The main results are robust to different lag structures.

The diagnostic test results show that the panel heteroscedasticity and cross-sectional dependency are present with statistical significance at the 5% level in our dataset. There are several estimation methods to deal with the problem of panel heteroscedasticity. Following the empirical literature on panel data analyses, such as, Besley and Burgess, 2000; Lio and Liu, 2006; Mundlak et al., 2012, we will use a Feasible Generalized Least Squares (FGLS) estimation technique that allows for richer modelling of error process than those specified in the short-panel case to ensure the validity of statistical results. It satisfies the classical assumptions with modifications to allow stochastic regressors and non-normality of errors (Greene, 2003; Frees, 2004; Wooldridge, 2010). The estimation via FGLS method allows the error term, ε_{it}, in the model to be correlated over i (individual state) and allows for a heteroskedasticity in error structure with each state having its own error variance. It also allows to model error term ε_{it} as AR(1) process where the degree of autocorrelation is state-specific, i.e. $\varepsilon_{it} = \rho_i \varepsilon_{it-1} + \mu_{it}$. As noted, both state and time fixed effects are controlled in the model. In the literature, although FGLS method is used in random effects models (RE) to account for a particular type of correlations among the errors, Maddala (2001:578) explains that FGLS method is consistent in fixed effects (within group estimation) whether the key assumption under the RE model that η_i are not correlated with x_{it} in Equation (1) is valid or not, since all time-invariant effects are subtracted out and as *t* gets larger, the estimates of FGLS and FE tend to converge.[7,8] In the article, according to the Gauss-Markov theorem,

[7] Maddala (2001:578) gives the statistical derivative proof showing that estimates from the random effects model and fixed effects model are the same.

FGLS transformation estimation is more efficient than FE model estimation in the linear regression model, leading to smaller standard errors, narrower confidence intervals and larger t-statistics (Wooldridge, 2010). We, thus, focus here on the FGLS approach.

We use the panel dataset at sub-national units for our empirical analysis. The data cover 14 out of the total 29 states and the period from 1970 to 2008 (38 years). The selected 14 states covered in the article account for over 88 percent of total value of output from total agricultural and allied activities for each year in India. These states also comprise the bulk of the Indian population (around 94 percent). As noted earlier, we use the new composite measure of Agricultural Produce Markets Commission (APMC) Act & Rules, a state-specific and longitudinal index, reflecting multidimensional aspects of regulations (Purohit, 2016).

[Table 1 to be inserted around here]

(c) Data Description

The state-wise time-series data on *agricultural foodgrain yields* – both the aggregate and crop-wise data – are the key outcome variable, defined as the logarithm of aggregate (crop-

[8] Note that the Hausman specification test statistics suggests that unobserved individual effect are correlated with regressors and fixed effects model is recommended over random effects model. For robustness checks, we have estimated FE model. The results from the FE are unbiased and consistent estimator but it is inefficient under the class of linear unbiased estimators due to presence of panel heteroscedasticity and cross-sectional dependency. Regression results from both FE and FGLS approaches will be reported. All FGLS results are broadly similar to FE model results, except that magnitude of APMC coefficient from FE estimation is larger. We mainly focus on the results from FGLS approach as it is more robust technique for our data structure.

wise) production in kilograms divided by cultivated land area in hectare in a state. Data on aggregate agricultural yield is an index of foodgrains, which includes (i) Cereals – rice, wheat, jowar, bajra, maize, ragi, barley and small millets and (ii) Pulses – Gram, tur and other pulses. The data coverage in the article is limited to only foodgrains because regulated markets established under the APMC Act & Rules has prevalently dealt with the marketing of food crops. We also model the use of modern farm inputs measured as area under high variety yield (HVY) of rice and wheat and the use of fertilizer per hectare as a function of the level of APMC index.

Controls Variables

The earlier studies explain the spatial heterogeneity in the agricultural productivity growth in India by using the variables on farm inputs (e.g. irrigation; fertilizer), R&D, and/or infrastructure (Dantwala, 1986; Chand, 2005; Fan et al., 2008). In line with the earlier studies (Chand et al., 2009; Mundlak et al., 2012), we include in the baseline specification *use of fertilizer,* measured as the log of use of fertilizer in kilograms per hectare of land, *area under irrigation*, a percentage of land irrigated of the total gross cropped area and *capital*, an index of number of pump-sets and number of tractors per thousand hectares of land, computed by principle component analysis (PCA technique). The state-specific (log of) *average annual rainfall* in millimetres per year is also included to take into account the differential effects of annual rainfalls on the state-level agricultural productivity at state levels (Calì and Sen, 2011). We also include a variable on *labour,* measured as the log of the number of agricultural workers *(cultivators + agricultural labourers)* per thousand hectares of gross cropped area. It controls for the economically active population in state agriculture in the year and proxies state's resource endowment (Bhalla and Singh, 2001).[9]

[9] The variable on education has been dropped due to its high correlation with farm inputs.

Some studies found that the use of technological innovations, such as new crop varieties specifically for rain-fed, dry-land and other ecological settings helped farmers in low-productivity areas to pick up the productivity growth and this explains regional differences in agricultural productivity across states after the initial phase of green revolution of the 1960s (Sawant and Achutan 1995; Bhalla and Singh, 2001). To capture use of such technology innovation, we account for *cropping intensity* which is measured as the log of gross cropped area (GCA) subtracted by net cropped area (NCA) (based on Chand et al., 2009). Intuitively, the measure of cropping intensity captures the number of times land is sown by using new variety seeds in a year.

In an expanded specification, we add three more variables: *landholdings* (average farm size) to control for the size of *farm land* to capture efficiency effects on productivity, as well as *road density* (length of the roads in kilometres per thousand population) and *annual per capita state expenditure on agriculture sector* to capture the level of infrastructure in a state.

Finally, in all specifications, the *state fixed effect* are included to control for unobserved, time-invariant differences, such as specific resource endowments, cultural and geographic characteristics that may have an impact on agricultural performance across Indian states. For example, this may be colonial land tenure institutions that have been found to affect district-level agricultural growth in India in the post-Green Revolution period (Banerjee and Iyer, 2005). They could also be unfavourable agro-ecological conditions that can negatively impact on agricultural growth (Palmer-Jones and Sen, 2003). The *year fixed- effects* are also included to capture any aggregate shock, such as a monsoon failure that would affect productivity output across all states in a given year (Besley and Burgess, 2004; Calì and Sen,

2011).[10] The data are weighted by the land area or the state population data so that different states are comparable. Table A3 in the appendix shows data source and base for data standardization.

Table 2 shows the summary statistics of the key outcome and control variables averaged over 1970-2008 for the full sample. The aggregate APMC index measure has a mean of 0.27, with a standard deviation 0.12 for the full sample. Examining the levels and changes in the state-wise APMC measure, we can infer that the APMC measure of Maharashtra, Punjab, Haryana, Karnataka and Rajasthan started on a good footing. The index improved from around 0.20 to 0.40 or higher. Madhya Pradesh, particularly, as well as Tamil Nadu and Andhra Pradesh provide an example of states that set off from a very low-level score of the APMC measure and demonstrated a leap positive change in their APMC measure over time. For instance, Madhya Pradesh improves the measure from as low as 0.050 to as high as 0.52 in the same period. Gujarat starts at medium level (0.199) and remains at medium level (0.274). West Bengal, Uttar Pradesh, Assam, Bihar, and Odisha also demonstrate some positive change from very low levels in the APMC measure, but the APMC score in these states remained low over the period (Purohit, 2016). We also observe a large variation in the mean statistics with relatively high standard deviations of each of the six sub-indices. The summary of the data provides us with a strong motivation to examine the relationship between the state APMC measure and agricultural outcome in a multivariate econometric setting.

[Table 2 to be inserted around here]

[10] A statistical test for joint significance of time fixed-effects with the full model specification (with all controls) has been carried out to examine whether time fixed effects should be included in the FE model. The result suggests the inclusion of time effects in the model.

Econometric Results

APMC Index and agricultural yield

As the primary focus of this article is the impact of composite APMC index on agricultural yield growth, a starting point of our empirical modelling strategy is to recognize that we want to model a yield growth as a function of changes in available APMC Act & Rules (via APMC index measure while controlling for possible endogeneity). We begin doing so by estimating Equation (1) by using time lags ($APMC_{it-5}$). Table 3 present the results of the log of aggregate agricultural yields in kilogram per hectare based on the use of different estimation techniques: FGLS panel model (column 1-3) and FE panel model (column 4-6). We will mainly focus on the results based on FGLS in this section as they are considered more robust. We also separately run fixed-effects instrumental variable (FE-IV) yield growth model (column 7-8, table 3) and discussion of the IV regression results is presented in section 6. The Column 1 of Table 3 presents the coefficient estimates of covariates such as labour, fertilizers, irrigation, machine capital (the index of pumpsets and tractors), and the cropping intensity conventionally used in the existing literature. In this case the APMC measure is excluded to focus only on the relationship between yield per hectare of agricultural production and these factors.[11] The coefficient of conventional variables, except machine capital variable, is positive and statistically significant.

APMC measure is introduced in Column 2 to gauge its effect on agricultural yield after controlling for the same determinants. In line with model predictions, the coefficient estimate

[11] According to the literature on agronomy, agricultural technology, such as short duration cropping seeds, draught/ flood resistant seeds, etc., is available in most of the food crop varieties to suit the various climatic regions of India, and improve the actual yield. Chand (2005) reports that even in agriculturally advanced state like Punjab the actual yield of paddy can be raised by 87% using the existing improved technology.

of APMC measure is positive and significant. A point increase in the index measure of APMC regulations is associated with a 0.24 percentage point increase in agricultural yield in the states. This result suggests that the legal framework of the APMC measure influences the material and economic environment in which farmers operate to increase agricultural production. The estimated coefficient on other conventional variables also remains statistically significant at the 1% level. The magnitude of coefficients for two important variables, however, changes. The coefficient of cropping intensity becomes smaller. Since this variable is a proxy for the use of modern seed varieties allowing for use of land area multiple times during a crop year, the change in the coefficient of cropping intensity suggests that investment in agricultural technology may not be purely exogenous to the role of APMC measure, that is, the regulation to an extent orients farmers to use modern farm innovations and technology. Moreover, the coefficient on the use of labour shows a very large statistically significant change of 0.10 from 0.09 in its magnitude ($p<0.01$) (column 1 & 2, in Table 3). It suggests that APMC measure has a complimentary effect on the economic structure of the sector in addition to its significant positive effect on aggregate high yield outcome.

Column 3 of the table extends the baseline model and adds other farm controls, such as road density, average land holdings, and per capita state expenditure on agriculture to check the robustness of the results. The coefficient on APMC measure remains robust and significantly different from zero. We find a positive and significant coefficient on the effect of road density which is measured as road-length in km per thousand number of population on yield productivity (Column 3). The result is consistent with earlier studies showing the role of public investment in infrastructure in stimulating yield productivity in the long run (Acharya, 2004; Fan et al., 2008). It indicates that rural road connectivity to the regulated agricultural markets would accelerate the transition from low productivity subsistence agriculture to a productive agro-industrial economy.

[Table 3 to be inserted around here]

Contrasting capital and labour in terms of their role in the agricultural sector, we find that the coefficient estimate for labour remains highly significant in contrast to the statistically insignificant coefficient estimate for capital. This emphasizes the persisting role of labour in the state agricultures. In view of India's labour surplus economy where more than 50 percent of India's workforce is engaged in agriculture as the principal occupation, the results are not surprising. Also, the rate of mechanization in agriculture, especially the use of tractors for ploughing is low due to small land-holdings within the states. Around 65 percent holds marginal holdings (area less than 1 hectare), 18 percent small holding (1-2 hectare), about 16 percent medium holdings (more than 2 to less than 10 hectare) and just less than 1 percent large holdings (10 hectare and above) (Eleventh Five Year Plan Report, Planning Commission, GoI, 2008). As regards the role of land size for yield, the coefficient estimate is weakly significantly positive. Bhalla and Singh (2001), however, demonstrate using the dataset on Indian states that agricultural productivity was becoming land-size neutral over time. The article finds that the agricultural growth can occur either through net sown area, where land size would matter, or through the increase in intensity of cultivation. The estimated coefficient on rainfall has mostly shown an erratic impact on the dependent variable in the regressions. It may be explained by the type of data used to capture rainfall effect in the model. The variable on rainfall is aggregated rainfall data for the entire state to capture annual weather. It does not capture clearly the heterogeneous weather conditions of the state and thus fails to capture any consistent and significant impact. We would expect that a normal and well spread-out rainfall would lead to better agricultural yields whereas both excessive and very low rainfall would adversely affect production decisions and productivity.

Finally, with respect to the coefficients on time dummies in the model, we find that they significantly and negatively affect the agricultural performance over the period. These results are unsurprising because year dummies control for common agricultural related policy shocks, where India's national agricultural policy is criticized for its 'lacked direction' (Chand, 2005:21). India's agricultural policy scenario is specifically characterized as *ad hoc*, myopic and mere reaction to the situation that lacks direction as compared to its economic policy towards building competitiveness in the industry sector (ibid; Acharya, 2004). These statistically significant and positive results, nonetheless, suggest the dependence of agricultural yield and sources of its growth on the APMC regulatory measure.

Instrumental Variable Estimation

In this section, we estimate the fixed-effects instrumental variable (FE-IV) model to address the endogeneity of the AMPC index with a focus on the cases corresponding to Columns 7-8 of Table 3. By using time lag of five years on the APMC index, the endogeneity concern of causation was minimized in the results of Table 3 as agricultural outcomes at the current period in a state cannot affect prior events such long as five years back a legal structure of regulated agricultural markets. However, a possible concern of biased estimation may arise if some long-term positive policy shock to agricultural sector continues to affect agricultural APMC regulated markets and thus bias the estimated relationship between APMC measure and crop yields. For instance, with impressive agricultural development in the state of Punjab due to the green revolution, the state experienced flourishing of the regulated agricultural markets (Sidhu, 1990; Maheshwari, 1997). Also, the presence of measurement error in a regressor (APMC measure) could also underestimate the results. The estimated measure of the APMC Act & rules is a close representation of the Act. As the literature shows, it is incorrect to assume a completely deterministic and perfect measurement process of a latent

variable, such the APMC Act & Rules that cannot be measured directly. Therefore, an existence of possible random or systematic measurement error in the APMC measure may provide an inaccurate estimation of the relationship (Bollen and Paxton, 1998). For these reasons, it is important to identify exogenous sources of variation in the APMC measure in order to establish its relationship with the economic performance of the agricultural sector. In order to address this endogeneity concern, we will apply IV model to the current value of AMPC index given that most of the control variables are in the first lag.

Our IV for the APMC measure is the share of seats of hard left or right wing parties in the legislature based on the results of the political elections at the state level (Besley and Burgess, 2000). For decades, food policy reforms have played an important role in states' politics (Mooij, 1998; Saez and Sinha, 2010). For instance, various schemes of food procurement, allotment and distribution in the states are used for different party politics (leftist or right wing parties) mostly as vote garnering instrument (See Pal et al., 1993; Mooij, 1998). Both state's policy of food procurement and its distributions have direct implications on the structure of regulations of the marketing system, since the government procures the foodgrains from the regulated markets. Thus, in Indian states "the regulation of markets is commonly understood as being a proper activity for the state" (Harriss-White, 1995:586). State regulations of the agricultural markets are essentially designed and shaped by political interests. The association between the regulatory APMC measure and political parties became vital evidence considering the case of Bihar where the state government took the decision to repeal the state's APMC Act and disband of Bihar's Agricultural Produce Marketing Board in 2006. The political regime having its individual approach to food policy in the state is identified as a good instrument for the APMC measure. According to Besley and Burgess (2000), this instrument would be less suitable if shocks to agriculture yields (e.g. bad weather) influence the election process and contribute in political party winning the state

election. In view of this concern, three-year lag is used for the identified political group that serve as an instrument (Hard Left or Congress party) for the regulatory measure. It is safe to consider that any contemporaneous shocks to current agricultural yields are uncorrelated with a shock that puts a particular group in power three years ago (Besley and Burgess, 2000).

We considered data from records of the number of seats won by political national parties at each of the state elections under four board groups, classified by Besley and Burgess (2000). The data have been updated by Calì and Sen (2011) to cover the most recent elections. The four groups are constructed as a share of the total number of seats won by parties in the state legislative assembly. The parties affiliated to each group are noted alongside the name of the group. They read as follows: (1) Congress Party (Indian National Congress + Indian Congress Socialist + Indian National Urs + Indian National Congress Organization), (2) Hindu Parties (Bhartiya Janata Party + Bartiya Jana Sangh); (3) a hard left grouping (Communist Party of India + Communist Part of India Marxist); (4) a soft left grouping (Socialist Party + Praja Socialist Party). The variable is described as a share of total seats in the legislature. We used a hard left party of India in the main analysis.[12] Congress and left party as joint instruments are also considered in our supplementary analysis.

The first stage estimates for the regulatory measure is presented in Panel A of Table 4. The results suggest that political variables significantly influence the APMC measure of the agricultural markets. Column 1 of the table shows a positive and significant coefficient on party variables (lagged by three year time): Congress and Hard left. The results on political parties indicate a significant political influence on the regulatory and administrative

[12] The election results over the time suggest that Congress parties appears to have dominant seats in the assemblies, while hard left parties have been in power in Kerala and West Bengal and Janata Parties were mostly prevalent in Bihar, Haryana, Karanataka, Madhya Pradesh, Rajasthan and Uttar Pradesh.

framework of the agriculture markets. F test for excluded instrument is 12.13 (columns 1) or 15.90 (column 2), above the threshold value of 10, confirming that the regressions do not suffer from weak identification problems. In this case all the control variables are lagged by one year period.

[Table 4 to be inserted around here]

Columns 1 and 2 of Panel B in Table 4 display the second stage results for IV estimation on the full extended model by FE-IV regression. All controls and time effects were included in the model. IV estimation has been performed instrumenting three period-lagged political variables. The results confirm that instrumented regulatory measure indeed has a large and significant impact on agricultural yields (1.52 percentage points higher yields, Column 1). The standard errors are also larger, but the coefficient on APMC measure continues to be statistically significant for agricultural yield productivity. The diagnostic statistical tests used in the exercise are statistically robust, that is, standard requisite IV tests – Sargan-Hanson test for overidentifying restrictions, endogeneity test, tests of under-identification and test for weak identification – would justify our instrumentation strategy. FE-IV estimation reconfirms the robustness of the results obtained in the standard fixed effects and FGLS model. IV results of a large yield coefficient 1.53 as compared to 0.24 (FGLS) further strengthen our main finding that the measure of the APMC Act & Rules significantly increases agricultural performance. However, it is noted that the larger coefficient estimate may be due to instrumentation of the APMC index without lags (that is at time t).

Robustness checks and alternative model specifications

Results on Agricultural Investments in modern inputs

In this section, we will provide the results based on alternative model specifications. First, we will estimate how much farm investment decisions in the states are influenced by the regulatory system of the agricultural markets. It would be surprising if APMC measure that affected aggregate agricultural yield did not impact on key modern farm input investments. Due to the small sample size, we will focus only on the relationship between APMC regulation and investment in farm technology.

Table 5 shows the results on each outcome variable of Column 1 (use of fertilizer kg per hectare, 1970-2008), Column 2 (proportion of land irrigated, 1970-2008), Column 3 (% area under HVY rice, 1984-1996) and Column 4 (% area under HVY wheat, 1984-1996). We run panel regression model separately to estimate the effect of the lagged APMC on each of these dependent variables representing the use of the modern farm input investment. The effect of APMC measure ($APMC_{it-5}$) is positive and significant to boost the use of fertilizer and irrigation. The results show that a one-percentage point improvement in APMC measure leads to 0.33% points higher use of fertilizer (Table 5, Column 1) and 10.3% points higher proportion of land under irrigation (Table 5, Column 2). Improving APMC Act amplifies both land area under HYV (high yield variety) wheat and HYV rice by 73.2% points and 53.8% points. These results on modern farm investment indicate that post-harvest market regulation (APMC measure) tends to increase investment in the modern farm inputs, which is likely to boost the yield improvement.

[Table 5 to be inserted around here]

Results on APMC Sub-indices and Agricultural Yield

Second, for further robustness checks of our main results, another alternative model specification is explored in Table 6. Here we perform the yield analysis using the six sub-components of the APMC Act measure as independent variables, using FGLS panel method, that is, (1) *Scope of Regulated Markets*; (2) *Constitution of Market and Market Structure*; (3) *Regulating Sales and Trading in Market*; (3) *Infrastructure for Market functions*; (5) *Pro-Poor Regulations*; and (6) *Channels of Market Expansion.* It investigates which of the dimensions drive the impact of APMC measure on agricultural yield.

All components of the APMC measure, except one, are lagged by five-year time periods, which is to keep in line with the earlier analysis of the composite index. The index on *Channels of Market Expansion* is lagged by two-year time period because certain legal variables that feature the measurement of 'market expansion' sub-index were enforced in the states around the year 2006. It is largely based on new legal features of the model APMC Act of 2003. Columns 1-6 of Table 6 show the results of six different measures of the APMC index included separately in each specification with a full set of controls, state and time fixed effects. Column 7 of the table displays the results on six regulatory components of the APMC measure controlled together in a model, after including all other explanatory controls, state fixed effects and year effects in the model.

[Table 6 to be inserted around here]

The coefficient estimates on market expansion (Column 3), pro-poor regulations (Column 5) and market infrastructure (Column 6) are positive and significant. Table 6 shows that a point improvement in *market expansion* measure leads to 0.26% points higher yield (Column 3); a point improvement in *pro-poor regulations* measure leads to 0.058% points higher yield (Column 5) and a point improvement in *Market infrastructure* measure leads to 0.20% points

higher yield (Column 6). The results imply that each of the regulatory components of the APMC market impacts the yield outcome independent of the presence of other APMC components.

Column 7 of Table 6, where all six components are regressed together in a single specification, not only reconfirms the significant and positive role of *market expansion, pro-poor regulations and Market infrastructure* on yield productivity of the states but now also displays positive and significant coefficient on *market scope*. The coefficient on *constitution of market and market structure* and *regulating sales and trading in the market* continue to appear insignificant. The coefficient on r*egulating sales and trading in the market* also shows a negative correlation (Column 7).

Discussion of the regression results: APMC sub-indices

What sense do the results presented on sub-indices make? The results of Column 7 in Table 6 indicate that both hard (physical infrastructure) and soft (rules and administration infrastructure) complements each other in order to efficiently structure the agricultural markets to affect agriculture performance in the states. We discuss the interpretation of the estimates in terms of why do we observe these varying effects.

(i) Role of Regulated Markets Infrastructure

The results on regulated markets infrastructure are consistent with the existing literature. Studies on India finds that physical infrastructure (such as roads, railways, transport facilities, electrification, agricultural produce storage facilities, cold stores, grading, packing, processing and so on) is instrumental in increasing the integration of spatially separated markets of the country. They significantly enhance the performance of marketing functions and expand the size of the markets through increased horizontal and vertical integration of agricultural produce markets, which improves the process of price discovery and transmitting

price signals from deficit to surplus areas (Acharya, 2004). So the results on the infrastructure sub-index in our article reconfirm that marketing infrastructure assumes critical importance in agricultural development.

(ii) Role of Regulated Market Scope

Statistically insignificant results on the sub-index on market scope (when examined alone, and together with other components) are consistent with the existing literature. The results suggest that the benefits available to the farmers from regulated markets depend on the trading facilities and amenities available within the market-yard rather than the number of market places in the area. An earlier study by Rao, Rao and von Oppen (1984) finds that the effect of a number of regulated markets establishment on productivity increases at a decreasing rate from a certain point of saturation with markets of 132 to 161 markets per 100,000 sq. Km. Further regulated markets have no productivity effects on the aggregate level. Our results suggest a similar story. According to the secondary sources, the severe infrastructure shortages were prevalent across the states of India. Both covered and open auction platforms exist in only two-thirds of the regulated markets and only one-fourths of the markets have common drying yards. To facilitate trading in the market yard, godown and platform facility in front of a shop is available in only 63 percent of agricultural markets, the cold storage units exist in only 9 percent of the markets and grading facilities exists in less than one-third of the markets (Acharya, 2004). Clearly, our results show that the number of market-yards alone cannot fully explain the variation in agricultural performance and the role of trading facilities in the market yard is more important in strengthening the scope of regulated markets.

(iii) Role of Pro-poor Regulations

The results indicate that the pro-poor sub-component of the legal framework of the APMC Act plays a significant role. The sub-index captures how certain market regulation ensures the protection of farmers' interest by monitoring the market conduct and establishes fair trading practices to ensure protection to the weak farmers. The results suggest that some states are more successful in using APMC Act as a development-cum- administrative measure that significantly incentivizes small and marginal cultivators to augment agricultural yield.

(iv) Role of Market's Administrative Structure and Trading Practices

The insignificant results on both *Market Administration sub-index* and *Trading Practices sub-index* reflect current market realities in the states of India. The literature on Indian experience of agricultural markets reveals the bureaucratization of the management of regulated markets. The statistics suggest that more than 80 percent of the market committees are superseded and state administrators manage the markets notified by the state governments (Acharya, 2004). Criticism goes that state-officials are neither under compulsion to provide needed marketing services for efficient trading nor could any other private agency is easily allowed to enter this venture (unless APMC reforms are suitably undertaken and implemented). The complex and expensive legal provisions, such as licensing bureaucracy, undermines the quality of reforms of the agricultural market. The insignificant empirical results of the article (Table 3) confirm how non-dynamic market governing administration undermines competition and its impact on agricultural yield in the states of India.

(v) Role of Market Expansion Analysis

The coefficient estimate of the sub-index on market expansion is significant and positive. From 2003 onwards, some of the Indian states initiated legislative reforms in the APMC Act

to improve efficiency and competitiveness of Indian agriculture. The main reform initiative in the Act was to liberalize the regulated markets and allow for an alternative agricultural marketing system in private sector, promoting direct marketing by farmers, legalizing contract farming etc. in the states. Mistrust and challenge to the new set of regulatory reforms are prevalent. Our empirical result on sub-index market expansion, therefore, is of critical importance to inform the public debate.

In light of the result of the sub-index on market expansion, the instance of the repeal of the APMC Act in the state of Bihar in 2006, instead of correcting it with a view to facilitating private investment in the sector, raises significant apprehension for pro-poor agricultural growth in the state. The problem of weak agricultural performance in Bihar and most of other states in India is not the absence of private markets, but that of its correction for the efficiency of the system as a whole (Maheswari, 1997; Minten et al., 2012). According to Acharya (2004), the private trade handles around 80% of the total marketed quantities of all agricultural commodities taken together. The marketed surplus handled by cooperatives is estimated as 10% and that by public agencies as 10%.

The combined results on components of the APMC Act suggest that markets are interactive and regulatory components of the system need to operate in tandem. Each of the components of the APMC Act reinforces and strengthens each other for a resultant composite institutional engineering to be economically productive for the agricultural performance in Indian states.

Conclusion

This article examines the effect of agricultural marketing law –specifically the Agricultural Produce Markets Commission Act (the APMC Act & Rules) – on agricultural outcomes for 14 Indian states over the period 1970-2008. Using a range of empirical models, we have

found a positive relationship between the legal framework of the APMC Act and agricultural yields. We have applied Fixed-Effects, Feasible Generalized Least Squares, and Fixed-Effects Instrumental Variable models to the panel data to address the endogeneity associated with the regulatory framework. The results show that regulation plays a decisive role in motivating farm investment decisions and agricultural production, independent of other factors that have been found to be important in explaining differences in agricultural performance across the states over time. Our findings suggest that a framework of regulation appropriate for well-functioning markets of agricultural produce is important in enhancing agricultural growth.

The nature of the agricultural marketing regulations assumes critical importance for 'balancing act', such as maintaining a degree of rationality in price fixation, moderating trading practices of private traders, market agents and farmers in a way to enhance economic viability of both better-off surplus producing classes as well as of huge mass of subsistence farmers in the states. Our results highlight the importance of well-regulated agricultural markets to address market failures and promote the effective functioning of domestic agricultural trade in order to impact on agricultural growth.

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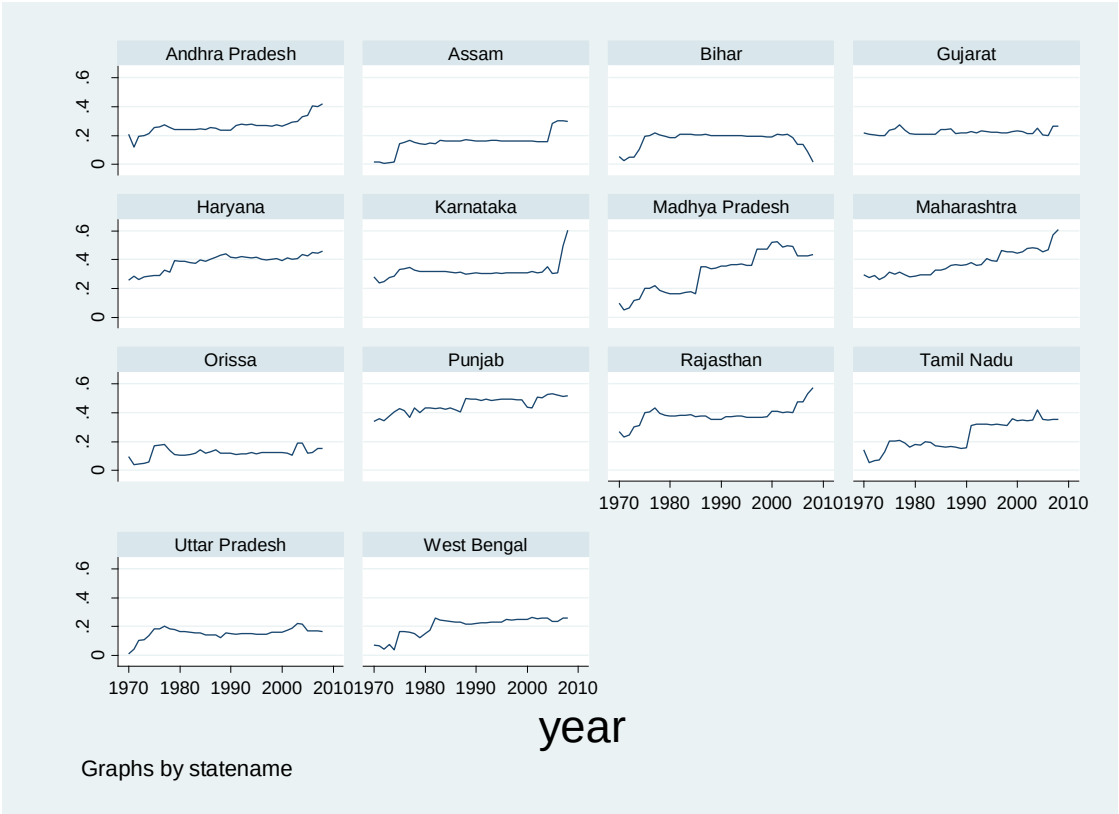


Figure 1: APMC composite index by state, 1970-2008 (Purohit, 2016)

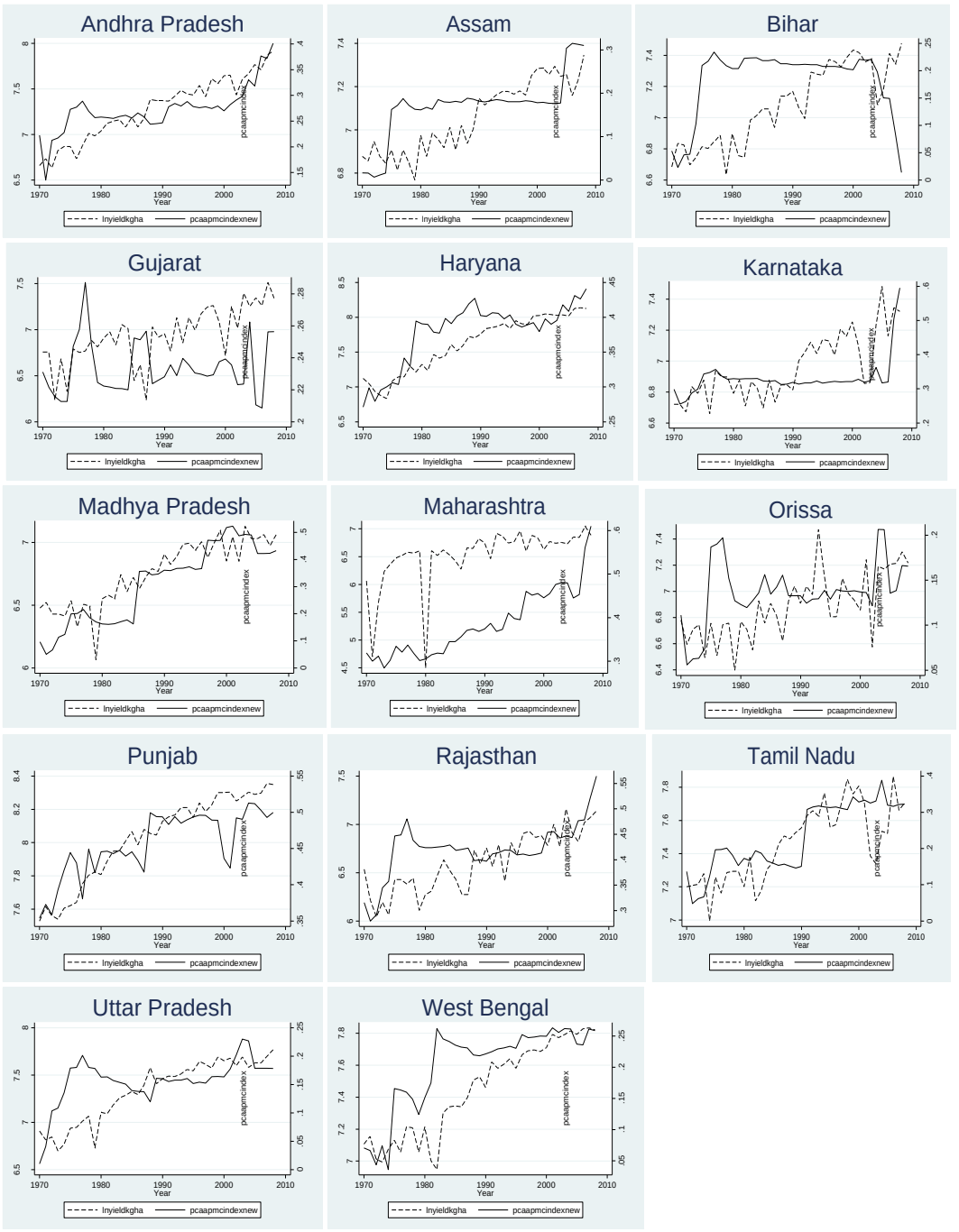


Figure 2: State-wise trend plots of regulatory measure and agricultural yield, 1970-2008

Note: dash line: ln(yield) kilogram per hectare and solid line: APMC Act & Rules measure

Table 1: State-wise Summary Statistics (Mean and Std.Dev) of the Sub-indices and APMC Index, 1970-2008

1	2	3	4	5	6	7	8
State	**APMC**	**Structure**	**Alternative Mkt Channels**	**Sales &Trade**	**Pro-poor**	**Infrastructure**	**Scope**
Andhra Pradesh	0.264 (0.055)	0.359 (0.108)	0.109 (0.243)	0.684 (0.035)	0.151 (0.127)	0.267 (0.050)	0.886 (0.111)
Assam	0.153 (0.069)	0.597 (0.244)	0.026 (0.092)	0.583 (0.226)	0 (0)	0.218 (0.082)	0.073 (0.219)
Bihar	0.169 (0.058)	0.236 (0.114)	0.096 (0.073)	0.357 (0.169)	0 (0)	0.084 (0.081)	0.856 (0.179)
Gujarat	0.223 (0.018)	0.668 (0.093)	0.039 (0.135)	0.257 (0.020)	0 (0)	0.219 (0.100)	0.857 (0.090)
Haryana	0.382 (0.087)	0.405 (0.145)	0.209 (0.137)	0.866 (0.114)	0 (0)	0.576 (0.069)	0.973 (0.019)
Karnataka	0.319 (0.059)	0.780 (0.065)	0.034 (0.132)	0.673 (0.020)	0.051 (0.223)	0.135 (0.037)	0.871 (0.071)
Madhya Pradesh	0.307 (0.143)	0.495 (0.241)	0.031 (0.070)	0.489 (0.271)	0.675 (0.399)	0.145 (0.059)	0.753 (0.158)
Maharashtra	0.374 (0.086)	0.763 (0.165)	0.071 (0.225)	0.703 (0.044)	0.261 (0.273)	0.388 (0.077)	0.886 (0.070)
Orissa	0.120 (0.034)	0.192 (0.034)	0.022 (0.081)	0.493 (0.044)	0 (0)	0.082 (0.040)	0.625 (0.181)
Punjab	0.452 (0.053)	0.418 (0.052)	0.128 (0.139)	0.815 (0.141)	0 (0)	0.901 (0.098)	1.000 (0.002)
Rajasthan	0.381 (0.063)	0.723 (0.142)	0.056 (0.183)	0.710 (0.045)	0.769 (0.078)	0.130 (0.085)	0.744 (0.165)
Tamil Nadu	0.241 (0.098)	0.481 (0.388)	0.184 (0.250)	0.275 (0.283)	0.256 (0.00)	0.368 (0.082)	0.767 (0.157)
Uttar Pradesh	0.153 (0.038)	0.172 (0.150)	0.015 (0.033)	0.421 (0.205)	0 (0)	0.193 (0.087)	0.745 (0.222)
West Bengal	0.201 (0.066)	0.283 (0.194)	0.104 (0.070)	0.398 (0.269)	0 (0)	0.365 (0.104)	0.800 (0.262)
Total	0.267 (0.122)	0.469 (0.268)	0.080 (0.158)	0.552 (0.251)	0.154 (0.289)	0.291 (0.229)	0.774 (0.265)

Note: Standard Deviation in parenthesis (Purohit 2016)

Table 2: Summary Statistics of the Main Variables, 1970-2008

Variable	Level	Mean	Std. Dev.	Min	Max	Observations
APMC composite	overall	.2674108	.1222625	0.006668	.6097309	N = 546
	between	.1039933	.1200582	.1200582	.4525169	n = 14
	within	.069911	.0102181	.0102181	.5538221	T = 39
Market Structure	overall	0.469399	0.268075	0	1	N = 546
	between	.2107443	0.210744	0.171688	0.780047	n = 14
	within	.1747789	0.174779	-0.12778	0.98824	T = 39
Market Expansion	overall	0.080383	0.158492	0	1	N = 546
	between	.0612565	0.061257	0.015381	0.209397	n = 14
	within	.1470676	0.147068	-0.12901	1.009441	T = 39
Sales and Trade	overall	0.551612	0.250554	0	1	N = 546
	between	.1958812	0.195881	0.256977	0.865987	n = 14
	within	.1645701	0.16457	-0.03109	0.889074	T = 39
Pro-poor Market	overall	.1546828	0.250554	0	1	N = 546
	between	.2591848	0.195881	0	.7698666	n = 14
	within	.1463679	0.16457	-.520539	1.103401	T = 39
Market Infrastructure	overall	0.290696	0.229373	0	1	N = 546
	between	.2240237	0.224024	0.082013	0.900523	n = 14
	within	.0769725	0.076973	-0.02556	0.639548	T = 39
Market Scope	overall	0.773865	0.265476	0	1	N = 546
	between	.2245226	0.224523	0.072973	0.999744	n = 14
	within	.1535634	0.153563	-0.02583	1.416151	T = 39
Yield (kg/hec) (log)	overall	7.140898	0.502102	4.49981	8.35585	N=546
Congress share of seats	overall	.4126128	.2636241	0	.93	N=532
Hard left share of seats	overall	.068703	.1458207	0	.67	N=532
Irrigated % of gross cropped area	overall	37.96172	23.53948	0.557951	97.8804	N=546
Agricultural workers per ‘000 GCA (log)	overall	6.823341	0.506881	4.31696	8.00963	N=546
Cropping Intensity (log)	overall	7.692027	0.64086	6.15909	11.3048	N=546
Fertilizers (kg/hec) (log)	overall	3.71174	1.090916	0.04879	5.47943	N=546
Capital Index (no. of tractors and pumpsets per ‘000 hec land)	overall	0.058098	0.077354	0	1	N=546
Average land size (hec) (log)	overall	2.087445	1.156354	0.01	5.46	N=546
Road Density (Km/1000 popu)	overall	0.340348	0.258253	0	1	N=546
Agricultural Expenditure per capita (INR) (log)	overall	3.98619	2.685572	0.77	15.05	N=546
Average Actual annual Rain (mm, log)	overall	6.801804	0.623922	3.94061	8.09704	N=546
Proportion of high yielding varieties (HYV) of rice	overall	70.18567	20.1323	24.12	100	N=282
Proportion of high yielding varieties (HYV) of wheat	overall	82.07275	19.77883	28.56	100	N=269

Source: Authors’ calculations

Table 3: Agricultural Yield explained by the APMC Act & Rules and Other Controls, 1970-2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var: Ln(Yield) kg/hec	**FGLS (No APMC)**	**FGLS (APMC)**	**FGLS (Extra controls)**	**FE (No APMC)**	**FE (APMC)**	**FE (Extra controls)**	**FE-IV (Instrumented)**	**FE-IV (Extra controls)**
APMC Index (t-5)		**0.244*** **	**0.205** **		**0.289***	**0.330***		
		[0.082]	[0.096]		[0.168]	[0.169]		
Instrumented APMC Index (IV)							**1.527** **	**1.635** **
							[0.656]	[0.716]
Proportion of irrigated area	0.003***	0.003***	0.001**	0.004***	0.004***	0.004***	0.006***	0.006***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Ln(Labour) (000'/GCA)	0.099***	0.101***	0.084**	0.139***	0.147***	0.148***	0.142	0.142
	[0.029]	[0.031]	[0.039]	[0.048]	[0.049]	[0.050]	[0.090]	[0.097]
Ln(Fertilizer use (kg/hec)	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.030	0.021
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.031]	[0.029]
Ln(Cropping intensity)	0.165***	0.146***	0.155***	0.153***	0.129***	0.129***	0.002***	0.002***
	[0.017]	[0.017]	[0.020]	[0.028]	[0.027]	[0.028]	[0.001]	[0.001]
Capital (tractors & pumpsets) '000/hec	0.165	0.031	-0.072	0.090	-0.047	0.013	-0.316	-0.458*
	[0.146]	[0.151]	[0.150]	[0.152]	[0.142]	[0.152]	[0.221]	[0.265]
Ln(Rainfall)	0.001	-0.001	0.004	-0.007	-0.007	0.000	-0.007	0.004
	[0.012]	[0.011]	[0.012]	[0.023]	[0.022]	[0.022]	[0.022]	[0.023]
Ln(Landholding) (hec)			0.031*			0.015		0.112
			[0.017]			[0.026]		[0.083]
Road density (km/'000 popu)			0.062*			0.123*		0.024
			[0.032]			[0.074]		[0.032]
Ln(Agri Expenditure pc)			0.028**			-0.017		-0.044***
			[0.013]			[0.013]		[0.013]
Constant	5.192***	5.351***	5.443***	4.833***	4.951***	4.871***		
	[0.290]	[0.282]	[0.386]	[0.476]	[0.483]	[0.518]		
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2				0.751	0.730	0.733	0.684	0.686
No. of excluded instruments							1	1
F (Weak identification test/ test for excluded Instrument)							15.897	14.77
Underidentification test (p-value)							14.938(.0001)	12.27(.0005)
No. of States	14	14	14	14	14	14	14	14
Observations	546	476	476	546	476	476	504	504

Standard errors in brackets * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: First Stage, Instrumental Variable Estimation of Agricultural Yield, 1970-2008

	(1)	(2)
Panel A: First Stage, IV	**APMC Index (with 2**	**APMC Index (with 1**
Dep. Var: APMC Index	**FE-IV)**	**FE-IV)**
Congress (t-3) (Instrument)	**0.0310*** **	
	[0.009]	
Hard left (t-3) (Instrument)	**0.327*** **	**0.290*** **
	[0.0688]	[0.067]
Proportion of irrigated area (t-1)	-0.0003	-0.0003
	[0.0003]	[0.0004]
Ln(Labour) (000'/GCA) (t-1)	-0.077**	-0.078**
	[0.034]	[0.033]
Ln(Fertilizer use (kg/hec) (t-1)	-0.0016	-0.002
	[0.008]	[0.008]
Ln(Cropping intensity) (t-1)	-0.0005***	-0.0005***
	[0.0002]	[0.0002]
Capital (tractors & pumpsets) '000/hec (t-1)	0.221***	0.222***
	[0.079]	[0.077]
Ln(Rainfall)	0.005	0.005
	[0.006]	[0.006]
Time fixed effects	Yes	Yes
State fixed effects	Yes	Yes
R^2	0.713	0.684
F	45.835	38.072
No. of States	14	14
Observations	504	504

Robust Standard errors in brackets * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Second Stage, Instrumental Variable Estimation of Agricultural Yield, 1970-2008

Panel B: Second Stage, IV	(1)	(2)
Dep. Var: Ln(Yield) kg/hec	**2 IVs**	**1 IV**
APMC Index (IV) (Instrumented, current)	**1.072***	**1.527****
	[0.556]	[0.656]
Proportion of irrigated area (t-1)	0.005***	0.006***
	[0.001]	[0.001]
Ln(Labour) (000'/GCA) (t-1)	0.108	0.142
	[0.078]	[0.090]
Ln(Fertilizer use (kg/hec) (t-1)	0.029	0.030
	[0.029]	[0.031]
Ln(Cropping intensity) (t-1)	0.002***	0.002***
	[0.000]	[0.001]
Capital (tractors & pumpsets) '000/hec (t-1)	-0.228	-0.316
	[0.200]	[0.221]
Ln(Rainfall) (t-1)	-0.005	-0.007
	[0.020]	[0.022]
Constant		
Time fixed effects	Yes	Yes
State fixed effects	Yes	Yes
No. of excluded instruments	2	1
F (Weak identification test/ test for excluded Instrument)	12.129	15.897
Underidentification test (p-value)	20.695(0.0000)	14.938(0.0001)
Over identification test (p-value)	0.985(0.3210)	-
No. of States	14	14
Observations	504	504

*Standard errors in brackets; * p < 0.1, ** p < 0.05, *** p < 0.01*

Note: APMC instrumented by IV: l3congress l3hardleft in column 1 and, with l3hardleft in column 2 and farm inputs by (internal instruments, lag by one period)

Table 5: Use of Modern Farm Technology explained by the APMC Act & Rules

Dependent variable	(1) Ln(Fertilizer use) (kg/hec) 1970-2008 FGLS	(2) Proportion of irrigated area 1970-2008 FGLS	(3) % Rice area under HVY 1984-1996 LSDV¥	(4) % Wheat area under HVY 1984-1996 LSDV¥
APMC Index (t-5)	0.337***	10.310***	53.788**	73.252***
	[0.101]	[1.893]	[20.784]	[27.432]
Coastal region dummy	1.999***	-28.829***	-17.272	-20.562
	[0.107]	[1.763]	[23.533]	[27.350]
Ln(Landholding) (hec)	-0.098***	1.437***	2.745	-12.738
	[0.018]	[0.279]	[7.719]	[9.741]
Ln(Rainfall) mm	0.013	0.516**	-1.465	-2.007
	[0.014]	[0.253]	[1.841]	[2.161]
Literacy rate	-0.008***	0.253***	-1.380	-2.498**
	[0.003]	[0.045]	[1.025]	[1.060]
Constant	3.687***	46.114***	165.030**	282.747***
	[0.255]	[3.546]	[79.157]	[92.717]
Time fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
R^2			0.878	0.747
No. of states	14	14	14	13
Observations	476	476	182	169

*Standard errors in brackets: * p < 0.1, ** p < 0.05, *** p < 0.01*

¥: Unbalanced panel does not support FGLS. FE results are also robust but it drops time-invariant coastal dummy. So, results are produced using least square dummy variables (LSDV), which is a manual form of FE technique.

Table 6: Agricultural Yield explained by Sub-components of the APMC Act & Rules: Extended Model, 1970-2008, FGLS

Dep. Var: Ln(Yield) kg/hec	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Scope (t-5)	0.055						**0.092****
	[0.035]						[0.040]
Structure (t-5)		0.018					0.013
		[0.031]					[0.049]
Expansion (t-2)			**0.257*****				**0.161****
			[0.068]				[0.082]
Sales & Trade (t-5)				-0.016			-0.038
				[0.028]			[0.042]
Pro-poor (t-5)					**0.058***		**0.063***
					[0.035]		[0.037]
Infrastructure (t-5)						**0.203*****	**0.204*****
						[0.055]	[0.059]
Proportion of irrigated area	0.003***	0.003***	0.004***	0.002***	0.003***	0.001**	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Ln(Labour) (000'/GCA)	0.065**	0.067**	0.102***	0.051	0.106***	0.079**	0.110***
	[0.032]	[0.033]	[0.032]	[0.034]	[0.036]	[0.034]	[0.042]
Ln(Fertilizer use (kg/hec)	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Ln(Cropping intensity)	0.138***	0.142***	0.154***	0.154***	0.141***	0.147***	0.154***
	[0.019]	[0.019]	[0.019]	[0.020]	[0.019]	[0.020]	[0.020]
Capital (tractors & pumpsets) '000/hec	0.059	0.067	0.040	-0.023	0.100	-0.107	-0.213
	[0.206]	[0.200]	[0.200]	[0.144]	[0.201]	[0.156]	[0.176]
Ln(Rainfall)	0.012	0.011	0.011	0.012	0.011	0.006	0.002
	[0.011]	[0.011]	[0.011]	[0.012]	[0.011]	[0.011]	[0.012]
Ln(Landholding) (hec)	-0.016	-0.014	-0.012	0.022	0.0002	0.032*	0.055***
	[0.015]	[0.015]	[0.015]	[0.017]	[0.017]	[0.017]	[0.019]
Road density (km/'000 popu)	0.084*	0.097**	0.141***	0.067**	0.101**	0.066**	0.058*
	[0.043]	[0.044]	[0.043]	[0.031]	[0.043]	[0.033]	[0.032]
Ln(Agri Expenditure pc)	-0.010	-0.009	-0.015***	0.027**	-0.010	0.035**	0.037***
	[0.007]	[0.006]	[0.005]	[0.013]	[0.006]	[0.014]	[0.014]
Constant	5.663***	5.650***	5.199***	5.715***	5.380***	5.558***	5.244***
	[0.307]	[0.318]	[0.323]	[0.351]	[0.321]	[0.342]	[0.395]
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of states	14	14	14	14	14	14	14
Observations	476	476	518	476	476	476	476

Standard errors in brackets; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Online Appendix A

Refer section two on 'Regulation of Agricultural Markets in India' of the main text

History in Brief: The APMC Act

The history of establishment of regulated markets in India dates back to 1886, when elements of regulation were introduced in the Karanja Cotton Market under the Hyderabad Residency's Order. The motive behind this regulatory measure by the then British rule was to ensure supply of pure cotton at reasonable prices to the textile mills in Manchester, England, and so the first regulated market was established in India. Subsequently in the year 1897, a special legislation known as "The Berar Cotton and Grain Market Law" was enacted in Berar, then known as "Hyderabad Assigned District" in 1897. Under the provisions of this Act, the British Resident acquired the authority to declare any place in an assigned district a market for sale and purchase of agricultural produce, and to form a committee to supervise these regulated markets. It was the first exclusive statute on regulation of marketing of agricultural produce. Subsequent Acts, whenever passed were generally modelled on the general principles embodied in this law (Acharya and Agarwal, 2009).

The salient features of the colonial agricultural marketing law were as follows:[13] All the markets that existed on the date of enforcement of the law fall under the state's law fold; (i) The British Resident could declare any additional markets or bazaars for the sale of agricultural produce. (ii) A Commissioner was to appoint from among the list of eligible persons, a committee ordinarily of five members: two representing the Municipal Authority with the remaining three from amongst the cotton traders for enforcing the law. (iii) Unauthorized markets and bazaars were banned within five miles of a notified market. (iv) Trade allowance or prevalent local market customs in the Resident were abolished; (v) Market functionaries were required to take licenses. (vi) The Resident was empowered to make rules for some specific matters such as levy and collection of fees, licensing of brokers, weighmen and also for checking of weights and measures (services), (vii) The Act was applicable to both cotton and grain markets. (viii) Penalties for breach of certain provisions of the law were laid down.

The serious drawback of this law was that it provided no representation for the growers/farmers on the market committee even though the grower would need legislative protection (Bhatia, 1990). Though the Act provided for the regulation of market for all agricultural produce, only markets for cotton were established. There was no independent machinery for the settlement of disputes between the seller and the buyer. Further, limitations emerged in the course of time, for instance, it was found that regulated markets were turning into a source of municipal revenue as the Act provided that after expenses has been paid out of revenue derived of the market fees, surplus (if any) should be given to respective municipalities in which the market was located. It was later recommended that revenue raised from the markets should be spent in developing facilities and services in the markets that would benefit producers etc. But the progress under the Act was very discouraging because the process of obtaining necessary resolution from the District local Boards, municipalities and other bodies was quite lengthy (Gosh, 1999).

[13] The Berar Cotton and Grain Markets Law, 1897, vide Appendix VI to "Report of the India Cotton Committee, published in 1919, p. 236-38 (Gosh, 1999)

Subsequent Historical Account of evolution of the APMC Act in the States of India

The Indian Cotton Committee (General Cotton Committee) was appointed by the Government of India in 1917 to look into the problems of marketing of cotton. This Committee had observed that in most of the cases the cotton growers were selling cotton to a village trader-cum-money lender, under whose financial obligation they were, at a price much below the ruling market rate and other agriculturalists were seriously handicapped in securing adequate price for their produce because of long chain of middleman in the marketing process. The Committee therefore, recommended that markets for cotton on Berar system should be established in other provinces having compact cotton tracts. This could be done by introduction of suitable provisions in the Municipal Acts or under a special regulation as in the case of Berar.

The Government of Bombay presidency was the first to implement this recommendation by enacting the Bombay Cotton Markets Act in 1927. This Act was an improvement over the Berar Cotton and Grain Markets Law of 1897 as it provided for representation to the growers on the market committee and also contained a provision for spending the surplus funds of the marketing committee, which should be transferred to the respective local bodies in whose jurisdiction the market was established in 1929 and the first regulated market was established under this Act at Dhulia during the year 1930-31.

The Royal Commission on Agriculture, in its report submitted in 1928, recommended the regulation of market practices and the establishment of regulated markets in India on the Berar pattern as modified by the Bombay Cotton Markets Act 1927, with special emphasis on the application of the scheme of regulation to all agricultural commodities instead of cotton alone. The Commission advized to include provisions for establishment of machinery in the form of Board of Arbitration for the settlement of disputes; prevention of brokers from acting for both buyers and sellers in the markets; adequate storage facilities in the market yards; standardization of weights and measures under a single all pervading Provincial legislation. The Commission also recommended that the Provincial Governments should take initiative in the establishment of regulated markets and grant loans to market committees for meeting initial expenditure on land and buildings. Its recommendations were subsequently endorsed by the Central Banking Enquiry Committee, 1931. This recommendation had an effect on the states as borne out from the fact that a number of states have enacted regulated markets Acts thereafter.

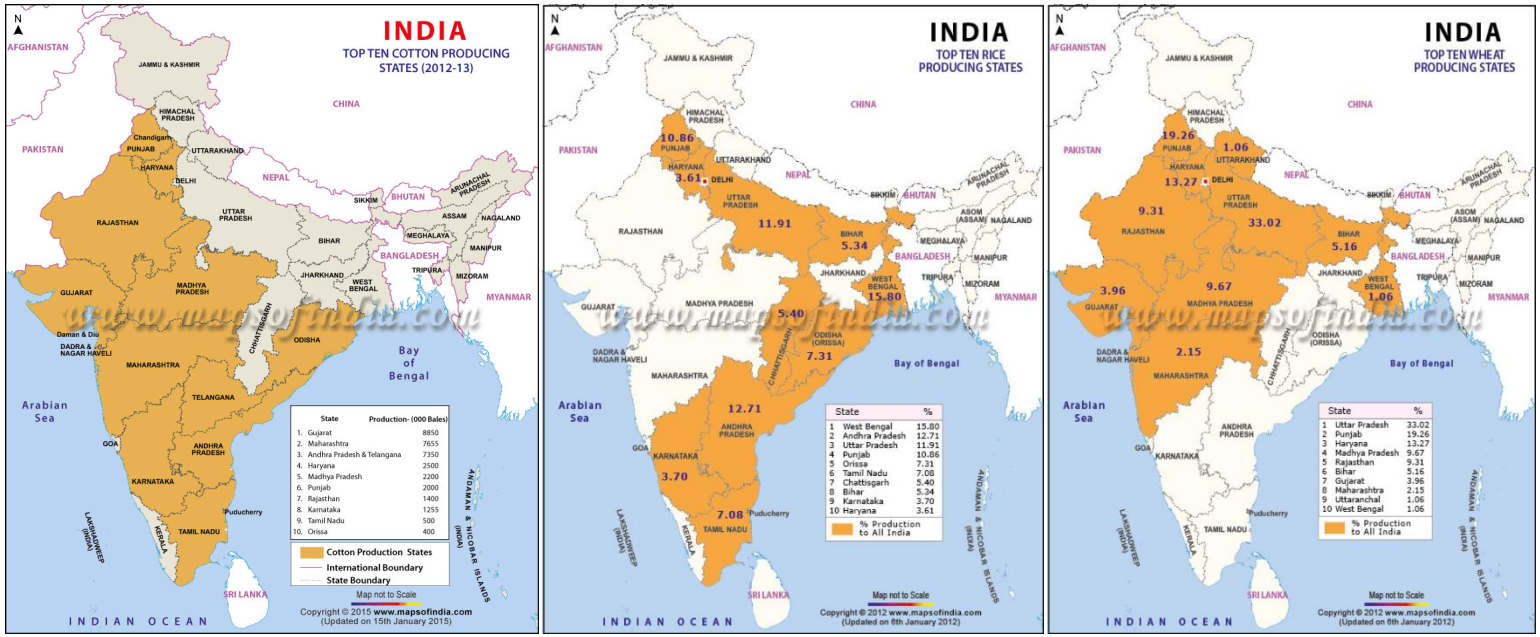
In the year 1930, the Hyderabad Agricultural Markets Act, largely modelled on the Bombay Agricultural Markets Act, 1927 was passed. The Central provinces (now Madhya Pradesh) came next with the 'Central Provinces Cotton market Act', 1932. In 1935, another law called Central Provinces Agricultural Produce Markets Act' was on lines of 'Central Provinces Cotton market Act' 1932. According to this Act, markets could be regulated for the sale and purchase of all kinds of agricultural produce other than cotton as the latter was already covered by the Cotton Markets Act of 1932. Market regulation was introduced in Madras (now Tamil Nadu) under the Madras Commercial Crops Markets Act, 1933 and the first regulated market was established in the State in 1936 at Tirupur in Coimbatore District.

In 1935, Government of India established the office of the Agricultural Marketing Adviser (Directorate of Marketing and Inspection) under the Ministry of Food and Agriculture to look into the problems of the marketing of agricultural produce. The Directorate recommended to the State Governments that markets be regulated to safeguard the interest of the producers and to remove prevalent malpractices in the markets. In 1938, the Directorate of Marketing and Inspection prepared a model Bill, on

the lines of which several states drafted their own Bills. Since then, State Governments have enacted legislation for the regulations of markets in their states.
They are: the Hyderabad Agriculture Market Act, 1930; The Madras Commercial Crops Market Act, 1935. In 1939, the Government of Bombay enacted the Bombay Agricultural Produce Markets Act and made it applicable to all the agricultural commodities including cotton. As a result, the Cotton Market Act on 1927 was repealed and all the market committees set up under this Act were declared deemed to be the market committees under the new Act. In Mysore State (now Karnataka), the 'Mysore Agricultural Produce Markets' Act was passed in 1939. However, the first regulated market at Tiptur could be established only about a decade later i.e. in November, 1948. The outbreak of the Second World War in September 1939 dislocated the normal economic activities in the country. Controls on food grains and other essential commodities were imposed and their free movement was restricted. The levy system for direct procurement of food grain from producers was resorted to and price control and statutory/informal rationing was introduced. As a result, very limited progress could be achieved in the field of regulation during the war period. Market regulation was introduced in the erstwhile Patiala State in January, 1948 under the Patiala Agricultural Produce Markets Act, 1947. The Government of Madhya Bharat passed the Madhya Bharat Agricultural Produce Markets Act in 1952. This was modeled mostly on lines of Bombay Act. All regulated wholesale markets which were governed by the previous laws of the respective merged states were declared as regulated under the new Act. In the mean time, Andhra Pradesh adopted Madras Act, Gujarat and Maharashtra States inherited the Bombay Act and Delhi and Tripura passed legislation on the lines of Bombay Model Act. Figure A1 shows present major cotton and grain growing states. The Agricultural Produce Market Acts, in force, in different states are given in the Table A2. After independence, despite efforts by the central government, the progress made with the regulated markets in terms of growth and their geographical distribution remained slow and highly uneven. Heavy concentration of the agricultural markets in the cotton growing states remained prominent. This largely explains why in 1964, 80 percent of the total 1000 regulated markets, then in existence, were located in the five western states, although, they accounted for only 30 percent of India's population. The markets did not embrace other agricultural produce, and were largely confined to cotton marketing. Until late 1960s, certain states of India such as Uttar Pradesh, West Bengal, and Assam hardly had any regulated market (Rajagopal, 1993). See table A3 for market distribution in the states of India.
The colonial policy was to serve the interests of colonialism rather than planning the long-range development of the Indian agriculture or welfare of the rural population of India (see Sir Henry Knight, 1954; Lele, 1971; Bhattacharya, 1992). Bhattacharya (1992) explains that British officials were confronted with the contradictory demands of colonialism and the need to resolve them. On the one hand there was need to enhance revenue and augment the financial resources of the British state, and on the other hand the desire to maintain the purchasing power of the peasantry in order to expand the market for British manufactures. Regulation of markets for agricultural product was stressed by several Committees and Commissions from time to time. The important ones are the Banking Enquiry Committee, 1931; The Congress Agrarian Reforms Committee, 1947; The Rural Marketing Committee of the National Congress, 1948; The Planning Commission, 1958; The All India Rural Credit Committee, 1954, the Agricultural Production Team on Ford Foundation and the Task Force on Agricultural Marketing Reforms, 2001.

Source: Acharya and Agarwal, 2009:268-270; Rajagopal, 1993:31-34

Figure A 1: Major Cotton, Rice and Wheat Producing States of India



Source: http://www.mapsofindia.com/ as on January 2012

Table A 1: Agricultural Produce Market Act & Rules in force in different States of India

S.no	State	Title of the APMC Act	Rules
1.	Andhra Pradesh	The Andhra Pradesh Agricultural Produce and Livestock Markets Act, 1966 (AP Act 16 of 1966)	1969
2.	Assam	The Assam Agricultural Produce Markets Act, 1972 (Assam Act 23 of 1974)	1975
3.	Bihar	The Bihar Agricultural Produce Markets Act, 1960 (Bihar Act 16 of 1960)	1975
4.	Gujarat	The Gujarat Agricultural Produce Markets Act, 1963 (Gujarat Act 20 of 1964)	1965
5.	Haryana	The Haryana Agricultural Produce Markets Act, 1961 (Haryana Act 23 of 1961)	1962
6.	Karnataka	The Karnataka Agricultural Produce Marketing (Regulation) Act, 1966 (Karnataka Act 27 of 1966)	1968
7.	Madhya Pradesh	The Madhya Pradesh Krishi Upaj Mandi Adhiniyam, 1972 (Madhya Pradesh Act 24 of 1973)	1973
8.	Maharashtra	The Maharashtra Agricultural Produce Marketing (Regulation) Act, 1963 (Maharashtra Act 20 of 1964)	1967
9.	Orissa	The Orissa Agricultural Produce Markets Act, 1956 (Orissa Act 3 of 1957)	1958
10.	Punjab	The Punjab Agricultural Produce Markets Act, 1961 (Punjab Act 23 of 1961)	1962
11.	Rajasthan	The Rajasthan Agricultural Produce Markets Act, 1961 (Rajasthan Act 38 of 1961)	1963
12.	Tamil Nadu	The Tamil Nadu Agricultural Produce Markets Act, 1959 (Tamil Nadu Act 23 of 1959)	1962
13.	Uttar Pradesh	The Uttar Pradesh Krishi Utpadan Mandi Adhiniyam, 1964 (Uttar Pradesh Act 25 of 1964)	1965
14.	West Bengal	The West Bengal Agricultural Produce Marketing (Regulation) Act, 1972 (West Bengal Act 35 of 1972)	1982

Source: Various State Laws

Table A 2: Number of Regulated Agricultural Markets pre and post Independent Indian States, 1931- 2010

S.no	State	1931-40	1941-50	1951-60	1961-70	1971-70	1985	2008	2010
1.	Andhra Pradesh	10	35	86	123	525	568	891	901
2.	Assam	-	-	-	-	14	32	224	226
3.	Bihar*	-	-	-	144	438	798	526	0
4.	Gujarat	-	-	-	236	297	324	414	414
5.	Haryana	-	-	-	150	177	255	284	284
6.	Karnataka	5	23	72	168	318	372	498	501
7.	Madhya Pradesh	-	3	86	246	317	514	501	513
8.	Maharashtra	52	121	280	315	512	759	880	880
9.	Orissa	-	-	15	54	67	129	314	314
10.	Punjab	-	92	132	243	481	665	437	488
11.	Rajasthan	-	-	-	152	297	380	428	430
12.	Tamil Nadu	11	11	37	95	218	272	292	292
13.	Uttar Pradesh	-	-	-	132	617	630	587	605
14.	West Bengal	-	-	-	1	1	2	684	687

Note: The number for Gujarat is included in Maharashtra up to 1960; The number for Haryana is included in Punjab up to 1960; *The Bihar APMC Act was repealed with effect 1.9.2006.

Source: Directorate of Agriculture Marketing and Inspection, Ministry of Agriculture, Government of India

Online Appendix A

Table A 3: Data Sources and Standardization of Variables

Variables	Variable Description	Data Source
APMC Act	Read and quantitatively coded clauses of the state Agricultural Produce Markets Commission Act (APMC Act) of each 14 states that captures the differences in clause on accessibility of the markets (Market Scope); administrative design (Market Structure); Efficiency in trading (Market Sales n Trade); protection for farmers (Pro-poor Market); liberal market orientation (Market Expansion); and availability of the infrastructure (Market Infrastructure). We combined the codes ranging between 0 and 1 to generate regulatory measure of the post-harvest agricultural markets.	State APMC Act & Rules published by local state law agency; obtained from respective State's Government Agricultural Marketing Board (SAMB), State Ministry of Agriculture.
Market Scope (Scope of the Regulated Market)	It uses the data on (i) average area covered by a regulated markets in square km, calculated by: state area in square kms/total regulated markets in the state; and (ii) population served by each regulated markets per thousand people, calculated by: total state population per thousand/ total number of regulated markets.	Data on state land area was obtained from the Economic Organisation and Public Policy Programme (EOPP, LSE) – Indian states' database at the London School of Economics. The EOPP compiled the data of Indian states from the Statistical Abstract published by the Central Statistical Organisation, Department of Statistics, Ministry of Planning. Available on http://sticerd.lse.ac.uk/eopp/_new/data/indian_data/default.asp Other data source – Rural Development Statistics, National Institute of Rural Development and Panchayati Raj (NIRD), Land Utilization Statistics, Ministry of Agriculture; Directorate of Agricultural Marketing and Inspection, Ministry of Agriculture.
Market Structure	Equals 1 if composition of market committee	State APMC Act & Rules published by local state law

(Constitution of Market and Market Structure)	take place through a provision of direct election; otherwise 0 Equals 1 if the chairman of the market committee is agriculturalist; otherwise 0 Equals 1 if the chairman of the market committee is an elected chairman; otherwise 0 Equals 1 if a provision to dismiss the chairman of the market committee exists; otherwise 0 Equals 1 if a provision to suspend the market committee exists; otherwise 0 Equals 1 if a provision to suspend the market committee exists; otherwise 0 Equals 1 if the state marketing board has legal status; otherwise 0 Equals 1 if a website of the state marketing board exist; otherwise 0	agency; obtained from respective SAMB, State Ministry of Agriculture.
Market Expansion (Channels of Market Expansion)	Equals 1 if law allows single license to trade in the whole State; otherwise 0 Equals 1 if law allows License to trade in more than one market area; otherwise 0 Equals 1 if law has Provision for setting private market yard; otherwise 0 Equals 1 if law provides Rules to procure license for setting private market yard; otherwise 0 Equals 1 if law has Provision for private consumer-farmers market; otherwise 0 Equals 1 if law provides Rules for establishing Private consumer-farmers market; otherwise 0 Equals 1 if law has Provision for direct procurement from farmers; otherwise 0	State APMC Act published by local state law agency; obtained from respective SAMB, State Department of Agriculture.

	Equals 1 if law has Rules for direct procurement from farmers; otherwise 0 Equals 1 if law has Provision of contract farming; otherwise 0 Equals 1 if law has Rules for contract farming; otherwise 0 Equals 1 if law has Provision of Public-Private Partnership market function; otherwise 0 Equals 1 if law permits State National Spot Exchange; otherwise 0	
Market Sales n Trade	Equals 1 if law mandates sale by open auction in the market; otherwise 0 Equals 1 if law mandates payment to grower-seller on the day of sales in the market; otherwise 0 Equals 1 if law mandates issuance of sale-slip to the seller in the market; otherwise 0 Equals 1 if law mandates sale by open auction in the market; otherwise 0 Equals 1 if law offers provision of agricultural inputs for sale in the regulated produce market; otherwise 0 Equals 1 if law mandates for issuance of a sale-slip (receipt) to the seller; otherwise 0	State APMC Act published by local state law agency; obtained from respective SAMB, State Department of Agriculture.
Pro-poor Market (Pro-Poor Regulation)	Equals 1 if law offers provision of imposing interest on delayed payment to seller; otherwise 0 Equals 1 if law offers provision of minimum period to settle payment to seller; otherwise 0	State APMC Act published by local state law agency; obtained from respective SAMB, State Department of Agriculture.

	Equals 1 if law offers provision of regulating advance payment to agriculturalists; otherwise 0	
Market Infrastructure (Infrastructure for Market Functions)	It uses the data on: (i) number of central warehouse available per 1000 sq km, calculated as (No. Of central warehouse/Land area sq kms)x1000; (ii) Central warehouse capacity available in per 1000mt production (Central warehouse capacity/total agricultural productionx1000); (iii) number of state warehouse available per 1000 sq km, calculated as (No. of state warehouse/Land area sq kms)x1000; (iv) state warehouse capacity available in per 1000mt production (state warehouse capacity/total agricultural productionx1000); (v) FCI storage capacity per 1000mt production (FCI storage capacity/total agricultural productionx1000; (vi) number of grading units available per 1000 sq km, calculated as (No. of grading units/Land area sq kms)x1000; (ii) No. of grading units available in per 1000mt production (no. of grading units/total agricultural productionx1000)	Bulletin on Food Statistics, Directorate of Economics and Statistics, Ministry of Agriculture, India; Directorate of Agricultural Marketing and Inspection, Ministry of Agriculture, India; Data on state land area was obtained from the Economic Organisation and Public Policy Programme (EOPP, LSE) Indian states database at the London School of Economics. Available on http://sticerd.lse.ac.uk/eopp/_new/data/indian_data/default.asp
Road Density, (Km/1000 popu)	It uses the data on: length of roads per 1000 population, calculated as (length of roads/total state population)	Centre for Monitoring Indian Economy (CMIE) database on Infrastructure and after 2001, updated from the online database: IndiaStat. (http://www.indiastat.com/default.aspx)
No. of tractors per ‘000 hec land (log)	It uses data on natural logarithm of number of tractors per 1000 hectares of land	CMIE database (various annual issues) aided by online database: IndiaStat.
No. of pumpsets per ‘000 hec land	It uses data on natural logarithm of number of pumpsets per 1000 hectares of land	CMIE database aided by online database: IndiaStat.

(log)		
Irrigated % of gross cropped area	It uses data on percentage of land irrigated of the total gross cropped area	Land Utilization Statistics published by the Ministry of Agriculture, Government of India (GOI), New Delhi obtained from CMIE.
Fertilizers (kg/hec) (log)	It uses data on natural logarithm of use of fertilizer in kilograms per hectare of land;	CMIE database (various annual issues) aided by online database: IndiaStat.
Agricultural workers per'000 GCA (log)	It uses data on natural logarithm of number of agricultural workers per 1000 hectare of gross cropped area	Various issues of the Agricultural Statistics at a Glance and Indian Agricultural in Brief, published by GOI, New Delhi and online database IndiaStat.
Total gross cropped area ('000 hec) (log)	It uses data on natural logarithm of per 1000 hectare of gross cropped area	Land Utilization Statistics, Ministry of Agriculture, New Delhi.
Average landholding (hec) (log)	It uses data on natural logarithm of average land holding (farm size)	Agriculture at a Glance, Ministry of Agriculture/ CMIE database (various annual issues) aided by online database: IndiaStat.
Cropping Intensity (log) (GCA-NCA)	It uses data on natural logarithm of gross cropped area subtracted by net cropped area (number of times land is sown in a year)	Land Utilization Statistics, Ministry of Agriculture, GoI, New Delhi.
Literacy rate	It uses data on percentage of population who is literate in the state	The demographic data (population, literacy rate) from the decennial Census of India and have been interpolated to obtain annual data.
Agricultural Expenditure per capita (INR)	It uses data on per capita expenditure on agriculture sector as a share of total expenditure in Indian rupees.	Collected from the Reserve Bank of India Bulletin – State Budget, online database Macroscan and the Public Finance Statistics published by the Ministry of Finance, accessed from the library of National Institute of Public Finance and Policy (NIPFP), New Delhi.
Average Actual annual Rain (mm,	It uses data on natural logarithm of annual average rainfall in millimetres	CMIE database – Agricultural Harvest, New Delhi.

log)		
Aggregate Yield (kg/hec) (log)	It uses data on natural logarithm of aggregate yield in kilogram per hectare of land	Compiled from the CMIE database, New Delhi, from various issues of Agricultural Situation in India, Season and Crops Reports and Statistical Abstracts published by the Directorate of Economics and Statistics (DES) of the Ministry of Agriculture, Government of India, New Delhi.
proportion of high yielding varieties (HYV) of rice	It uses data on proportion of land under HYV of Rice production	CMIE database (various annual issues) aided by online database: IndiaStat.
proportion of high yielding varieties (HYV) of Wheat	It uses data on proportion of land under HYV of Wheat production	CMIE database (various annual issues) aided by online database: IndiaStat.

Note: Data was collected during the field visit to India between January-July 2011

Table A4: Progress of Reforms in Agricultural Markets (APMC Act) as on 31.10.2011

Sl. No.	Stage of Reforms	Name of States/ Union Territories
1.	States/ UTs where reforms to APMC Act have been done for Direct Marketing; Contract Farming and Markets in Private/ Coop Sectors	Andhra Pradesh, Arunachal Pradesh, Assam, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, , Maharashtra, Mizoram, Nagaland, Orissa, Rajasthan, Sikkim and Tripura.
2.	States/ UTs where reforms to APMC Act have been done partially	a) Direct Marketing: NCT of Delhi, Madhya Pradesh and Chhattisgarh b) Contract Farming: Chhattisgarh, Haryana, Punjab, Chandigarh. Madhya Pradesh c) Private Markets Punjab and Chandigarh
3.	States/ UTs where there is no APMC Act and hence do not require reforms	Bihar*, Kerala, Manipur, Andaman & Nicobar Islands, Dadra & Nagar Haveli, Daman & Diu, and Lakshadweep.
4.	States/ UTs where APMC Act already provides for the reforms	Tamil Nadu
5.	States/ UTs where administrative action is initiated for the reforms	Meghalaya, Haryana, J&K, Uttrakhand, West Bengal, Pondicherry, NCT of Delhi and Uttar Pradesh.

* APMC Act is repealed w.e.f. 1.9.2006.

Status of APMC Rules

The status of APMC reforms in different states is given below:—

a) States where Rules have been framed completely :

Andhra Pradesh, Rajasthan, Maharashtra, Orissa, Himachal Pradesh, Karnataka,

b) States where Rules have been framed partially:

i) Mizoram only for single point levy of market fee;

ii) Madhya Pradesh for Contract Farming and special license for more than one market;

iii) Haryana for Contract Farming.

Source: State of Indian Agriculture, Government of India, 2011-12