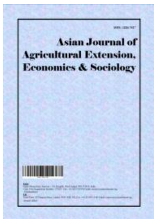

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An Analysis of Carbon Market and Carbon Credits in India

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Authors' contributions

This work was carried out in collaboration among all authors. Author SG wrote the first draft of the manuscript. Authors AM and SC performed the literature reviews and collected required data for the study. Author SG proposed the design of the study and managed the econometric analysis. All authors read and approved the final manuscript.

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ABSTRACT

Global climate change is becoming an alarming problem of the 21st century, with global warming as the biggest challenge. Anthropogenic activities have added significant quantities of greenhouse gases (GHGs) to the atmosphere ever since the Industrial Revolution. The agriculture sector is a significant source of GHG emission in many countries. Crop stubble burning or agricultural biomass burning is one of the highest contributors to this emission. In India, around 92 million tons of crop residue is burned every year, causing several negative impacts on the climate as well as on human health. Under the Kyoto Protocol, Carbon trading and Clean Development Mechanism (CDM) are the two robust processes to mitigate the GHG emissions for any country. In this study, we have assessed the overview of world's carbon market and analysed how much carbon credit India may have traded in the world carbon market, if emission from the crop residue burning was stopped in the Indian agricultural sector. Further we have fitted an econometric model to determine the effect of carbon trading on other stock market variable.

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Keywords: Carbon trading; carbon credit; crop residue burning; greenhouse gases; carbon market.

1. INTRODUCTION

Climate change is recognized as one of the biggest challenges before humanity in the 21st century. The problem of climate change is a consequence of the greenhouse effect- a natural phenomenon that maintains an average temperature of 15℃ on earth, allowing life to exist [1]. The American Meteorological Society defines the term climate change as any systematic change in the long-term statistics of climate elements (such as temperature, precipitation, pressure, or winds) sustained over several decades or longer [2]. The causes of climate change can be natural, like changes in solar emission or slow changes in the earth's orbital elements or from anthropogenic sources like emission of greenhouse gasses (GHGs). Emissions of GHGs are speculated to be highest in the last three decades (1983 – 2012), resulting in successively warmer at earth's surface than any preceding decade since 1850 [3]. The greenhouse effect is caused by the natural presence of greenhouse gases (GHGs), which trap part of the sun's heat in the atmosphere. These gases are carbon dioxide (CO_2), methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons. Due to the excessive accumulation of these gases in the atmosphere, the problem of climate change occurs. Human impact on climate system is very much evident. A linear upward trend is followed by the global average combined land and ocean surface temperature data which shows a warming of 0.85 (0.65 to 1.06°C) over the period of 1880 to 2012 (Fig. 1) [3]. CO_2 is the primary cause of the human induced greenhouse effect, which comes mainly from burning fossil fuels and deforestation.

Another greenhouse gas, namely methane comes from burning of forests, ruminant livestock, rice paddies, farms and landfill gas. Other GHGs, such as nitrous oxide (NO_X) comes from fertilizers and some chemical processes, halocarbons from refrigerant gases and tropospheric ozone is released by the combustion of hydrocarbons [4].

Open burning of biomass results in around 37 per cent of global black carbon [5] which causes emissions of 2760 Gg per year [6]. Agriculture is considered to be the largest sector emitting black carbon and crop residue burning is the biggest problem of this sector which causes GHG emission to a great extent. According to the Indian Ministry of New and Renewable Energy (MNRE), India generates on an average 500 Million tons of crop residue per year among which around 92 Million tons of residue is burned every year on average [7]. The amount burned may comprise of only 18.4% of total crop residue produced, but it is the source of grave concern regarding the GHG emission and climate change. According to National Policy for Management of Crop Residues (NPMCR), state of Uttar Pradesh, followed by Punjab and Haryana are the top three states ranked in India for generating emission from crop residue burning [8]. India has recently witnessed severely increased levels of particulate matter (PM) and smog due to uncontrolled stubble burning in several states that cause health hazards in every year. It is estimated that, particulate matter emitted from stubble burning in Delhi and adjacent areas is 17 times greater than that from all other anthropogenic sources like industry emission, vehicle emissions, garbage burning etc. [9]. Another investigation by researchers

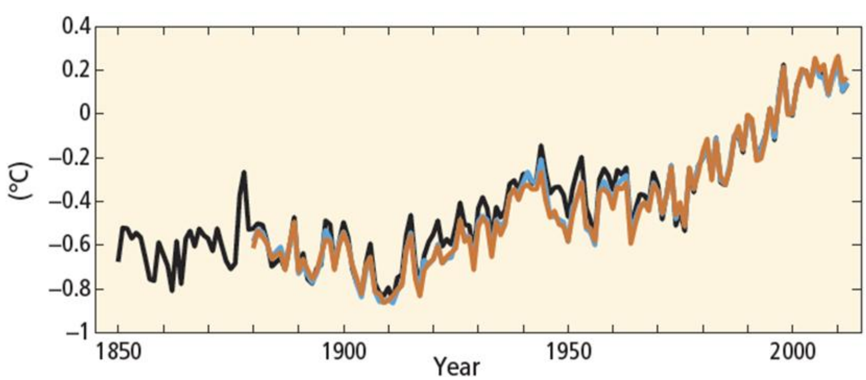

Fig. 1. Globally averaged combined land and ocean surface temperature anomaly (After, IPCC AR5 [3])

working in the US and India has discovered that effect of agricultural biomass burning in the North-western region of India can spread vigorously to as far as to the central and southern states like Maharashtra, Madhya Pradesh, Telangana, Chhattisgarh and even parts of Odisha [5]. Around 66% of all emitted GHGs from crop residue burning is carbon dioxide (CO2). Crop residue burning is also a major source of Non-Methane Volatile Organic Compound (NMVOC) and Non-methane hydrocarbons (NMHCs) which are known to have adverse impacts on air quality index due to high reactivity. Crop residue burning has several direct and indirect health impacts on human, like irregular heartbeat, nonfatal heart attacks, aggravated asthma, decreased lung functions, increased respiratory problems etc.

To mitigate global greenhouse emissions and climate change, Kyoto Protocol was ratified in 1997 which proposed the concept of carbon credits and carbon market. Carbon credit is a process of reimbursement made by the countries or parties emitting more GHGs. These carbon credits can be bought or sold at international markets at a certain market price, dependable upon several factors. This gave rise to the international carbon market where carbon trading is done among the parties to encourage more environment friendly and sustainable practices in terms of global GHGs emission. India is a signatory party in Kyoto protocol and hence responsible for its share in mitigation of global GHGs emission. Crop residue burning in Indian agriculture sector is a major source of GHGs emission and costs India a huge loss of carbon credits in global carbon market. In other words, India can earn a lot of international exchange through carbon trading if stubble burning can be stopped.

2. OVERVIEW OF WORLD'S CARBON MARKETS

2.1 Carbon Trading

Carbon-trading is an administrative approach used to control emission of Carbon dioxide (CO_2) by provision of economic incentives. A central authority sets a limit or cap on the amount of carbon that can be emitted [10]. Companies, individuals or other groups are issued emission permits and are required to hold an equivalent number of allowances (or credits) representing the right to emit a specific amount. The total amount of allowances and credits cannot exceed the cap, limiting total emissions to that level. Companies that need to increase their emission allowance must buy credits from those who pollute less or who have carbon credits in their bucket [11]. In effect, the buyer pays the price for emitting, while the seller is rewarded for having reduced emissions. Over the last few years, such trading has given rise to the evolution of carbon markets.

2.2 Economic Theory Behind Carbon Markets

To stabilize the levels of carbon in the atmosphere, we need to focus on forest conservation, clean energy technologies and emission reduction strategies and generate the market pull for them. Carbon markets are among the most innovative and cost-effective methods for creating market pull for forestry credits and new clean energy technologies while, at the same time, putting a price on emission and thereby providing incentives for people to emit less carbon markets are able to achieve this aim because they help channel resources toward the most cost-effective means of reducing GHG emissions. They also punish those who emit more than an established quota, and reward those who emit less. The market-based approach also allows third-party players, such as speculators, to enter the fray and make investments in green endeavour. Other interested parties also can get involved. If, for example, an environmental group wants to see emissions decrease below a regulated target, they can raise money to buy and retire emission allowances. This drives up the costs of emissions and can force emitters to become more efficient.

2.3 Types of Carbon Markets

The term carbon market refers to the buying and selling of emissions permits that have either been distributed by a regulatory body or generated by Greenhouse Gas (GHG) emission reduction projects. GHG emission reductions are traded in the form of carbon credits, which are equal to one metric ton of CO_2, (tCO_2e), the most common greenhouse gas [1,12]. Carbon markets can be separated into two major categories: compliance markets and voluntary markets.

a) **Compliance markets:** Compliance markets are created and regulated by mandatory regional, national, and international carbon reduction regimes like the Kyoto Protocol. The biggest success of compliance markets so far has been to send market signals for the price of mitigating carbon emissions. The total traded volume in the compliance carbon market grew from 4.8 Giga-tons (Gt) in 2008, to 8.7 Gt in 2009. Demand is driven by the emitters who must operate within proportion of the cap that has been allocated to them. An emitter has to buy additional emission permits, as soon as it exceeds the amount that has been initially allocated to it. However, demand falls due to employment of mitigation technologies or due to fall in the production output of the firm.

b) **Voluntary markets:** Voluntary carbon markets function outside of the compliance markets, enabling companies and individuals to purchase carbon offsets on a voluntary basis. The voluntary market reflects the sum of all transactions of carbon credits and allowances, where the final purpose of cancelling or retiring the carbon credit is not to comply with legislation or to fulfil agreements between companies and governments. The voluntary carbon market, although much smaller than the compliance market, is now growing rapidly.

2.4 Prospects of Carbon Trading

Global climate change is becoming an alarming problem of the 21st century with global warming as the biggest challenge [12]. Manmade activities have added significant quantities of greenhouse gases (GHG) to the atmosphere ever since the Industrial Revolution. According to the Intergovernmental Panel on Climate Change (2001), the atmospheric concentration of CO_2, CH_4 and N_2O has risen by about 31%, 151% and 17%, respectively between 1750 and 2000. This International concern about climate change led to the Kyoto Protocol in 1997, which consists of legally binding emission target for industrialized countries to be achieved during the Kyoto commitment period i.e. 2008-2012. Until August 2011, 191 countries have ratified to the Kyoto Protocol.

The Protocol depends on the standard of common but differentiated duties: it recognizes that individual nations have various capacities in mitigating environmental change, attributable to financial turn of events, and in this way puts the commitment to decrease current discharges on created nations on the premise that they are truly answerable for the current degrees of ozone depleting substances in the climate.

The Protocol provides various flexibility mechanism to mitigate the climate change. This includes International Emission Trading (IET), Joint Implementation (JI) and Clean Development Mechanism (CDM).

a) **International emission trading or emission trading (IET):** IET is explained in article 17 of Kyoto Protocol. It is also known as cape and trade. It is a market-based approach used to control pollution by providing economic incentives for achieving reduction in GHG emission. It allows Annex I [1] countries to trade their emissions Assigned Amount Units (AMU's).
b) **Joint implementation (JI):** Under Article 6 of the Protocol, any Annex I country can invest in emission reduction project on any other Annex. I country where investment on GHGs emission reduction is cheaper. It is done as an alternative of reducing emission domestically.
c) **Clean development mechanism (CDM):** This mechanism, under Article 12 of the Protocol, allows developed industrialized countries (Annex I) to meet their emission reduction targets by developing or designing projects to reduce emission in developing countries (Non- Annex. I) that are signatory to Kyoto Protocol.

This project could be started wherever it is cheapest globally. This helps the developing countries to adapt newer technology, emit less GHG and save energy. These reductions are produced and then subtracted against a hypothetical baseline of emissions that are predicted to occur in the absence of a particular CDM project. The CDM is supervised by the CDM Executive Board (CDM EB) and is under the guidance of the conference of the Parties (COP / MOP) of the United Nations Framework Convention on Climate Change (UNFCCC). All the major GHG's are sold within carbon market,

[1] Annex I countries refers to a list of countries under UNFCCC regime including members of the Organisation for Economic Co-operation and Development (OECD) as well as economies in transition. These countries are subjected to additional obligation for taking lead in mitigating climate change. According to the Kyoto Protocol, there are in total 41 Annex I countries [13].

not just CO_2. The other gases are converted to their CO_2e (Carbon dioxide equivalent) using their global warming potential (GWP). CO_2e is how much carbon dioxide it would take to cause the same amount of global warming. The GWP and GTP of major GHGs is given in Table 1.

2.5 Carbon Credits and Trading

CDM is to promote sustainable development by encouraging investments by governments and private firms in projects in developing countries. Developed countries will receive credit against their targets for emissions avoided by these projects. CDM allows emission removal projects in developing countries to earn Certified Emission Reduction (CER) credits, each equivalent to one tonne of CO_2. These CERs can be traded and sold, used by the industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. All the major GHG's are sold within carbon market, not just CO_2. The other gases are converted to their CO_2e (Carbon dioxide equivalent) using their global warming potential (GWP). CO_2e is defined as how much carbon dioxide it would take to cause the same amount of global warming.

Carbon credits are a key component of National and International emission trading schemes. These are certificates awarded to the countries that are successful in reducing emission of GHGs. They serve the dual purpose of protection of nature as well as source of revenue generation for the developing and underdeveloped countries. It encourages reducing GHG emission by capping total annual emission and letting the market assign a monetary value to any shortfall through carbon trading. For trading purpose, one carbon credit is equivalent to one tonne of CO_2 emitted. These credits can be exchanged between businesses or bought and sold in international market at the prevailing market price. There are two ways by which a company can reduce emission. Firstly, it can adopt new technology or improve upon the existing technology to reduce GHG. Secondly, it can tie up with developed nation and help them in setting up new eco-friendly technology, which reduce emission and are less energy consuming ultimately helping them to earn credits. In India, carbon is traded on India's Multi-Commodity Exchange. It is the first exchange in Asia to trade carbon credits. Other region specific markets are Chicago Climate Exchange (United States), Blue Net (France), European Climate Exchange (London), The London Energy Brokers' Association (London), NordPool (Norway), The NYMEX Green Exchange (United States), European Energy Exchange (Germany), Montreal Climate Exchange (Canada), Australian Climate Exchange (Australia), and Climex (The Netherlands). According to the Kyoto Protocol, three types of project-based credits are granted.

1. Emission Reduction Units (ERUs): These are the credits created from project undertaken under the joint Implementation (JI) of the Protocol.
2. Certified Emission Reduction (CERs): These are the credits created under Clean Development Mechanism.
3. Removal units (RMUs): These are credit created from project that involves land use, land use change and forestry.

2.6 Indian Agriculture and Carbon Trading

India is a developing country that has ratified the Kyoto protocol on 26th August 2002. Whereas, it signed and ratified the Climate Change Convention on 10th June 1992 and 1st November 1993, respectively. It has vast opportunity to explore in terms of CDM and carbon credits. Up to August 2010, India has registered 2313 projects. In the past few years, India has emerged as a world leader in the reduction of greenhouse gases by adopting CDM [14]. According to the report on National Action Plan for operationalising CDM by Planning Commission, Govt. of India, the total CO_2e emissions in 1990 were 1001352 Gg (Gigagram) which is approximately 3% of global emission. Thus, if India captures 10% share of the global CDM market, annual CER revenues to the country could range from US $10 million to 300 million.

Agriculture practices account for about 20% of India' total emission. Total Emission in 2018 (CO_2eq) from Agricultural sector in India is estimated at 647,814.77 gigagrams [15]. From 2010 to 2018, we can see a huge upward trend in emission from agricultural sector in India (Fig. 2) majority of which is sourced to crop residue burning or agricultural biomass burning. Hence cost-effective reduction from this sector could significantly reduce India's total emission. Even though agriculture is a high priority sector but a very few projects have been registered so far. Table 2 gives the overview of CDM projects

Table 1. GWP and GTP of major GHGs [14]

GHGs		GWP (Global Warming Potential)		GTP (Global Temperature change Potential)	
	Lifetime (yr)	Cumulative forcing over 20 years	Cumulative forcing over 100 years	Temperature change after 20 years	Temperature change after 100 years
CO2	Variable	1	1	1	1
CH4	12.4	84	28	67	4
N2O	121	264	265	277	234
CF4	50000	4880	6630	5270	8040
HFC-152a	1.5	506	138	174	19

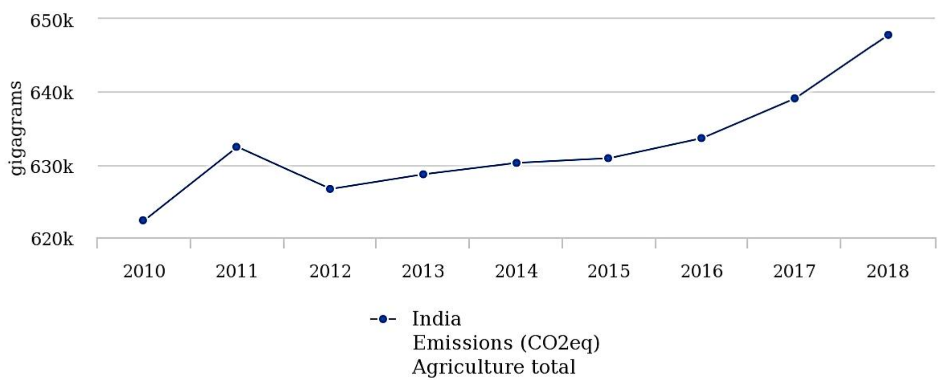

Fig. 2. Upward trend of emission (CO_2 equivalent) from agricultural sector in India (After, FAOSTAT [15])

approved under agricultural sector in India till far [16]. This is because of the major uncertainties in measuring and verifying the performance of soil carbon stores and agriculture in our country is highly unorganized which leads to difficulty in providing evidences under the CDM.

3. METHODOLOGY

3.1 Data Sources

The study is based on secondary data sources. From various governmental and non-governmental sources data has been retrieved and used for analysis. Emissions of different air pollutants from crop residue burning has been retrieved from Ministry of New and Renewable Energy, 2011 [17]. Beside these other data sources are as follows (Table 3).

3.2 Model Specification

3.2.1 Methodology to calculate GHG emission in agriculture sector from burning of crop residue

Crop residue is burnt in the fields in many Indian states such as Uttar Pradesh, Punjab, West Bengal, Haryana, Bihar, Madhya Pradesh, Himachal Pradesh, Maharashtra, Gujarat Chhattisgarh, Jharkhand, Tamil Nadu, Uttaranchal and Karnataka producing CO, CH_4, N_2O, NOx, NMHCs, SO_2 and many other gases. The major crop includes wheat, rice, maize, cotton, sugarcane, mustard, groundnut, jute. Using the following equation, emission from crop residue burning (EBCR) has been calculated.

$$\boldsymbol{EBCR} = \sum \boldsymbol{crops}\ (\boldsymbol{A} \times \boldsymbol{B} \times \boldsymbol{C} \times \boldsymbol{D} \times \boldsymbol{E} \times \boldsymbol{F}) \qquad .(i)$$

Where, EBCR is Emission from crop residue burning, A is crop production, B is the ratio of residue to crop, C is fraction of dry matter, D is burnt fraction, E is actually oxidized fraction and F is the emission factor for air pollutants. From this equation Ministry of New and Renewable Energy, 2011 calculated emissions of air pollutants from crop residue burning [16].

3.2.2 Econometric model

To examine the effect of carbon credits on stock market. In India carbon credit decision are taken by Kyoto protocol under united national frame work of climate change (UNFCC). Any fluctuations on, export of CO_2, *iip*, *greenex*, price

Table 2. CDM projects under agricultural sectors in India [15]

Sr. No.	Project Title	Annual CERs (Emission reductions)	Date of registration
1	3 MW Poultry litter-based power generation project, Hyderabad	65794	30-Jun-06
2	Methane avoidance by municipal solid waste processing, Chandigarh	40308	4-Sep-06
3	Avoidance of waste water and on-site energy use emission and renewable energy generation in IFB Agro-distillery plant	50760	8-Sep-06
4	Methane recovery and power generation in a distillery plant Shreyans Industrial Limited (SIL)	44729	-
5	SESL 6 M W Municipal solid waste-based power project at Vijayawada and Guntur in Andhra Pradesh	64599	-
6	Methane capture and use as fuel at Raja ram Maize Products, Chattisgarh, Chamundeswari Sugar Ltd.	4609	5-Jun-07
7	3.76 M W Electricity generation project from poultry litter in Tamil Nadu	55858	4-Mar-09
8	Rice husk-based cogeneration projects of Nahar Spinning Mills, Ltd.	10948 (CERs earned)	-
9	24 MW Bagasse based cogeneration power project of The Godavari Sugar Mills Ltd.	170103 (CERs earned)	-
10	Bagasse based power project of Rajshree sugars	80000 (CERs earned)	-
11	Core CarbonX Solutions Private Limited, Methane avoidance in rice cultivation	-	10-Oct-12
12	GHG emission reductions through methane avoidance in North Bengal" in the Madhupur village of Uttar Dinajpur District in North Bengal by M/s CNG Agrocare Private Limited.	-	-
13	Methane recovery from Manure Management System (MMS) at dairy farm of Narayana Farm Produce Pvt. Ltd., Nagpur, India	-	6-Aug-2009
14	Value Network Ventures Advisory Services Private Limited, Alternate wetting and drying rice cultivation in India	85498 (42749 CERs earned)	2018

Table 3. Data sources

Sl. No.	Data	Source
1.	Export of Carbon di oxide (CO_2)	Multi Commodity Exchange of India Limited (MCX)
2.	Index of Industrial Production	BSE (formerly Bombay Stock Exchange)
3.	Greenex (Green Index)	BSE (formerly Bombay Stock Exchange)
4.	Price of Gold (US$)	World Gold Council
5.	Price of Powerex (US$)	Indian Energy Exchange
6.	Price of Coal (US$)	Coal India Limited

of gold, price of power, price of coal etc. will impact on carbon credits. During this analysis we have taken determinants which effects directly or indirectly on stock market returns. The following econometric model is used to determine the effect of carbon credits on stock market.

$$Y = f\begin{pmatrix} \textit{Export of } CO_2,\ \textit{iip},\ \textit{greenex}, \\ \textit{price of gold, price of power,} \\ \textit{price of coal} \end{pmatrix} + \mu_i \quad .(ii)$$

Where, Y is the dependent variable (carbon emission price) and the explanatory variables are export of carbon in million tonnes, indices of *iip* primary goods, *greenex* price, price of gold, price of coal and price of power.

4. RESULTS AND DISCUSSION

4.1 Economic Impact of Crop Residue Burning

Emissions of major air pollutants from the burning of crop residue through equation (i) analysed and published by Ministry of New and Renewable Energy, 2011 [17]. In 2011, 149.24 million tonnes of CO_2, 9.06 million tonnes of CO, 6900 tonnes of NO_x and 0.25 million tonnes of SO_x has emitted from crop residue burning (Table 4).

From this data we have calculated, what India could have been earned from avoiding crop residue burning in terms of carbon credit. As only CO_2 is traded in carbon market, we have considered only CO_2 for calculation purpose. India produced 149.24 million tonnes of CO_2 in 2011 from crop residue burning and 1 tonne CO_2 is equivalent to 1 carbon credit. Therefore, India could have transacted 149.24 million carbon credit by avoiding crop residue burning in 2011. On September 2011 price of one carbon credit was $18.53 (1 US$ = 44.60 INR). By avoiding crop residue burning India could have earn 109.97 billion rupees in 2011 current price.

4.2 Correlation Matrix between Selected Variables

Table 5 depicts the correlation matrix between selected variables. Through this study we have tried to analyse the existence of correlation i.e., whether the variables are negatively related among each other, positively or un correlated. The coefficient from 0-0.3 is slightly correlated; moderate correlation ranges from 0.3-0.7 and 0.7-1 depicts strong correlation between variables.

Table 5 shows that carbon emission price and export of carbon is moderately positively correlated to each other. Carbon emission price is also negatively correlated to *iip* indices, *greenex*, price of gold and price of power. Export of carbon is negatively correlated to *iip* indices and price of coal. However, export is positively correlated with *greenex*, gold price and price of power.

4.3 Regression Results of Econometric Model

To know the degree of dependency of a variable (carbon emission price) on the other explanatory variables, in this study we run linear a regression Table 6.

Table 4. Emissions of air pollutants from crop residue burning [17]

GHG gases	Gigagram	Tonnes
CO_2	149240.68	149240680
CO	9062.8	9062800
NO_x	6.9	6900
SO_x	246.27	246270

Table 5. Correlation between selected variables

	Carbon emission price	Export of carbon (mt)	Indices of iip	Greenex price	Price of gold	Price of coal	Price of power
Carbon Emission Price	1						
Export of Carbon (mt)	0.3846	1					
Indices of iip	-0.2041	-0.9491	1				
Greenex Price	-0.1011	0.3485	-0.4925	1			
Price of Gold	-0.4607	0.0733	-0.1892	0.4835	1		
Price of Coal	0.1015	-0.0227	0.1409	-0.4651	-0.1218	1	
Price of Power	-0.0922	0.2228	-0.3161	0.9043	0.2496	-0.5315	1

Table 6. Regression results of econometric model

Variables	Linear model R square = 0.68, Adjusted R square = 0.57		
	Coefficients	**Standard error**	**P>|t|**
Intercept	3.634	6.877	0.604
Export of carbon (mt)	0.802	0.194	0.043
Indices of *iip*	0.461*	0.044	0.002
Greenex	0.108*	0.003	0.012
Price of gold	-0.212*	0.004	0.003
Price of coal	-0.307	0.007	0.336
Price of power	-0.46**	0.017	-0.008

*Note: ** indicates significant at <1% and * indicates significant at <5%*

From the regression analysis we found that 1 rupee increase in price of gold leads to decrease carbon emission price by 0.21 rupee. Similarly, 1 rupee increase in price of power leads to 0.46 rupee decrease carbon emission price. 1 per cent increase in the index of industrial production (iip) leads to decrease carbon emission price by 0.46 rupee.

5. CONCLUSION

The Indian government has already taken several interventions to curtail crop residue burning. India losses a massive amount from the burning of crop residue each year. By avoiding crop residue burning, India could have earned 109.97 billion rupees in 2011. Crop residue burning is not only a threat to agriculture sector, this issue goes way beyond agriculture. There are some economic factors like export of CO_2, index of industrial production, price of gold, *greenex*, price of power, price of coal is influencing the factors before taking a decision to enter this segment. Emission trading, CDM and JI are major mechanisms to manage the GHG gases. However, there is no effective carbon reduction in the atmosphere. These mechanisms lead to reduce carbon in one place and results carbon emission in some other place. Finally, there is a need to promote global carbon market to address climate change rather than seeking financial interest by the investment firms.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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