Does Geographical Indication (GI) increase producer welfare? A case study of Basmati rice in Northern India

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Abstract

This paper contributes to the literature on geographical indication (GI) in two ways. First, this is one of the first empirical papers that provides evidence on the net benefits of GI production against a credible counter factual. Second, this paper concludes that GI adoption adds value to the household welfare. With a view to examine the likely welfare impacts of GI, a household survey consisting of 300 rice farmers has been undertaken in one of the Northern provinces of India namely Uttarakhand. The sample is designed following a stratified random sampling in which both the GI Basmati rice farmers as treatment group and non GI rice farmers as control group are included. The empirical strategy of the paper is three-pronged. First, a gross margin analysis is carried out to elicit the net benefits of GI Basmati rice as opposed to non GI rice and another competing crop in that region such as sugarcane. The findings show Basmati rice is more profitable than the non GI rice varieties but less so than the sugarcane. In the second stage, an econometric analysis is followed to present whether GI adoption by household have increased their net income. The results from the Heckman selection model confirm that there has been an increment of income from GI rice cultivation. Finally, an adoption model is estimated to learn about the possible motives of GI adoption. The determining factors are access to extension training facilities, a credible hedge against risk, and household labour.

Key words: Geographical indication, Basmati rice, Heckman selection model, self-selection bias, welfare gain

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I. Introduction

There has been a shift of power relations in the agri-food sector from producers to transnational trading corporations due to the increasing deregulation in the sector, changing consumption patterns, and evolving corporate strategies such as advertising, packaging, and marketing (Ponte, 2002). As a consequence, the vulnerability to poverty of small-scale producers of agricultural products has increased. This change not only has produced an unbalanced business relation between producers and trading companies in consuming countries; moreover, it has also threatened to change the social composition in rural developing countries that export the bulk of the agri-food. Relatively unprofitable agricultural sector has resulted in massive migration from rural areas to cities for search of jobs and in turn produced urban sprawls. To prevent the 'run to the city' phenomenon and to localize economic control, property rights to the producers of traditional goods have been strongly advocated in WTO summits. It has been argued that protection through geographical indications (GIs) can help promote rural socio-economic development and assure higher economic returns (Jena and Grote, 2010; Rangnekar, 2004).

Protection of GIs refers to protection of products originating from a certain geographical area. Thus, protection is provided against the use of GIs for products not originating from the geographical area to which the indication refers. Such protection has far-reaching implications for both producers and consumers. It helps consumers distinguish goods produced in a particular geographical region from goods produced elsewhere, thereby preventing them from being misled. So the idea is to provide protection for GIs, a kind of intellectual property right, which entitles the enterprises located in the designated area to exclude others from using the indication. Specific logos are used to differentiate GI products from non-GI products (some GI logos are shown in the Appendix).

GIs are expected to benefit producers by placing a premium on the good by pushing up its competitiveness and price, in other words, seeking trade and commercial advantage on legitimate grounds. In view of the fact that GIs generally draw upon products such as agricultural, fisheries, handicrafts, and artisanal products, any trade advantage obtained from GI rights is basically pro-poor. This is in contrast with the other forms of intellectual property rights such as patents and trademarks, where the gainers are mostly rich people (UNCTAD/ICTSD, 2003). Moreover, one important aspect of GI goods is that they relate to community engagement. The right is granted to a collective body of producers and not to an individual producer. Therefore, the whole community is going to benefit, and this in turn may spur the regional economy. Better protection and marketing of GIs could directly contribute to the reduction of absolute poverty through an increased local inflow of incomes and employment opportunities. GIs therefore have a role to play in reducing vulnerability to poverty, which refers to the first of the Millennium Development Goals (MDGs).

The existing literature about income and welfare impacts of GI on producers is limited in its scope and scale. There have been attempts by researchers to find and provide evidence on impacts of GI on farmers (Jena and Grote, 2010). The key issue however, in this

branch of research is to conceptualize the magnitude of impact and to distinguish it from other factors that may play a role in shaping the overall performance indicators. In this paper, we make an attempt to provide evidence about the likely impacts of producing a GI good on farmers' livelihood conditions. The specific research questions this paper addresses are – (i) are there significant price benefits to be earned by producing a GI good by producers? (ii) does producing a GI good contribute to welfare of producers? (iii) what factors determine farmers' decision to produce a GI good?

II. Literature Review

The economic impacts of GI have been well documented theoretically by various researchers (Moschini et al., 2008; Lence et al., 2007; Josling, 2006; Dinopoulos et al., 2005; Desquilbet et al., 2005; Rangnekar, 2004). In an earlier paper, the current authors have categorized the economic impacts of GIs according to their functions and economic implications under four sub-groups such as intellectual property rights, institutions, transaction costs, and economic development (Jena and Grote, 2010).

The major argument in favour of seeking property rights for GI goods is based on the fact that they are produced in a geographical region which has unique geo-climatic characteristics and uses traditional skills. These give a unique value to the product and make its replication elsewhere impossible. Since goods emanating from another region must, by definition, be different, there can be no justification for using the same geographical term for them. It will *ipso facto* be a misrepresentation to do so, and therefore a special right makes more sense than an action which requires proof of misrepresentation. In this way there is a much stronger link between the distinctiveness of a GI and the uniqueness of the underlying product, and an even stronger justification for *a priori* broad property rights. Lence et al. (2007) and Moschini et al. (2008) have shown in their papers that such property rights have significant implications for both consumers' and producers' decision in terms of reducing asymmetric information and product innovation respectively. In a market where there is an inequitable distribution of information, producers will be unable to differentiate their goods. Accordingly, being unable to inform customers of the superior qualities of their products, producers would cease to invest in improving quality, thereby impeding product innovation. The reputation theory builds logically on this basic hypothesis. It argues that a producer has the incentive to invest in the promotion of his/her products' reputation only if this can be effectively conveyed to the consumer. A regime seeking to protect geographical indications would therefore seek to bridge the asymmetry of information between the producer and his/her consumers, thereby allowing him/her to invest to the maximum in improving the quality and, indirectly, the reputation of the good

Although, empirical evidence on the socio-economic impacts of GIs is still wanting, there is evidence of price premia for GI products from developed countries. For example, Grote (2008) has shown that in two surveys conducted in 1996 and 1999 among over 16,000 consumers in the EU, compared with 11 percent in 1996, 20 percent of the consumers in the 1999 survey indicated they often bought GI products. Around 60 percent bought them sometimes. In the 1999 survey, the motivations for buying such

products ranged from the guarantee of origin (37 percent), quality (35 percent), place and method of production (32 percent) to, finally, tradition (16 percent). Furthermore, around 43 percent of EU consumers said they are ready to pay a price premium of 10 percent for a GI product – compared with 8 percent who said they are ready to pay a price premium of 20 percent (Berenguer, 2004). Further evidence on price premia has been found for many products from developed countries. French GI cheeses for example are sold at an average price premium of €2/kilo compared with French non-GI cheeses. French Poulet de Bresse has a market price four times higher than regular French chicken. Producers of milk used for Comté cheese receive a price premium of 10 percent. Producers of Italian Tuscano olive oil have managed to increase prices for their olive oil by 20 percent since it was registered as a GI in 1998 (Origenandino, 2008). In Mexico the GI product Tequila increased the price of agave and other domestic inputs, which resulted in increased profits for Mexican producers (Babcock and Clemens, 2004). For wine, several studies have established that the regional reputation influences the price (Cardebat and Figuet, 2004; Schamel and Anderson, 2003).

There is also evidence of a market for regional GI products in developing countries, even if they are not yet labeled as such. For 265 products, urban consumers in Vietnam associated a higher quality with the place of production (Tran, 2005). Suh and MacPherson (2007) conducted a case study on Boseong green tea in South Korea. Their results show that within only six years the GI has promoted the image of the product, resulting in increased production and development of the tea-related industry and region. In sum, production doubled, and the number of tourists visiting the Boseong region has tripled since the GI was introduced in 1999. Tea-related income derived from production, processing and tourism has also increased over time, with prices of the green tea growing by more than 90 percent.

The empirical literature discussed above reveals that there are price benefits on GI goods based on their place of origin. But, the literature still lacks evidence on the net benefits of a GI good since there could be significant costs involved in its production. Although, in many instances the GI registration cost and the costs of packaging and advertisement are borne by the exporters and trading companies, there may still be difference in the production cost between the GI good and a non-GI good. So, the pertinent question is whether the price premium earned from producing a GI good is sufficient to overcome the costs. Furthermore, there is very little information about whether such a property right system has induced improvements in the production system as a whole meaning increased productivity, more efficient land use, and environmental benefits.

Another issue on which the existing GI studies cast very little light is the welfare enhancing aspect of GI good producers. It has been discussed in the earlier sections in this paper that the GI goods are either agricultural or artisan goods based on traditional knowledge that are produced mostly by rural poor. So, the price benefits from such a certification should markedly improve their livelihood by providing a higher and continuous means of living. These likely welfare effects which offer a strong argument for GI property rights in the WTO spheres need to be substantiated by empirical evidence. Although, a global GI registry has not yet been founded there are bilateral and

multilateral GIs existing from developing countries. Welfare assessment on such existing GI goods is required to further substantiate the theoretical claim in favour of GI.

However, the reason why the current evidence has mostly focused on anecdotal evidence of benefits from GI certification is due to lack of a measurable impact assessment matrix. Although, conceptually, the impacts of GI institutions on the rural producers have been identified, the methodology to empirically measure these impacts need to be developed. Moreover, there are difficulties in isolating the effects of GI certification from effects caused by other factors, such as general technological progress in a sector, or other policy measures.

III. Data

Several issues have to be considered while attempting to assess the likely welfare impacts of a GI good on its producers. Firstly, the choice of a GI good is crucial since assessment on the basis of a particular GI good may not be considered for generalization for the whole range of GI goods because of their diversity in scale and scope. This diversity can arise from many sources. For example, some goods like Basmati rice are established brands in the international market and are known for its specific characteristics such as aroma and size of the grain in contrast to relatively recent GIs such as *Feni* liquor from Southern India that still needs marketing. This also means that the former has a large export market whereas the latter is yet to create its brand name (Jena and Grote, 2010). Moreover, some GI goods have higher employment opportunities than the others. Notwithstanding these diversity if a GI good satisfies certain major characteristics of GI, assessment based on it will render some generalization about GI goods. The criteria to select a representative GI good for this study are the following – (a) recognition of place of origin by the major importing countries and (b) significant international trade potential. Although, a global GI registry is still some way ahead, recognition of place of origin by major importing countries provides the good necessary authenticity and protects it from possible counterfeiting. On the other hand, high trade potential generates price incentives for the stakeholders and especially for the producers to specialize in production of the good.

This study takes Indian Basmati rice as a case study to examine the abovementioned impacts of GI. Basmati rice is considered as potentially one of India's most valued GIs. Nearly two-thirds of all Basmati rice produced in India is exported. Its total export earnings during 2006-7 were close to Rs. 28 billion (approximately US$617 million) which accounts for about 40% of total rice exports (see Table 1). Its share of total agricultural exports was about 5%, which is quite significant. Furthermore, Basmati trade has increased from 5.2% to 8.3% of all rice world trade from 2003 to 2008, with a record of 2.45 million tones on milled basis. Recent volatility of agricultural commodities' prices affects rice trade market, but Basmati price did not drop after spring 2008 increase and is still the highest on world rice market (APEDA, 2007).

Table 1: Share of exports of Basmati rice from India, 2006-7

Total national exports (Rs m.)	5,716,419
Total agricultural exports (Rs m.)	566,280
Total exports of rice (Rs m.)	70,389
Total exports of Basmati rice (Rs m.)	27,928
Share of Basmati in total agricultural exports (%)	5
Share of Basmati in total exports of rice (%)	40

Source: Own calculation based on data from CSO (2007), APEDA (2007).

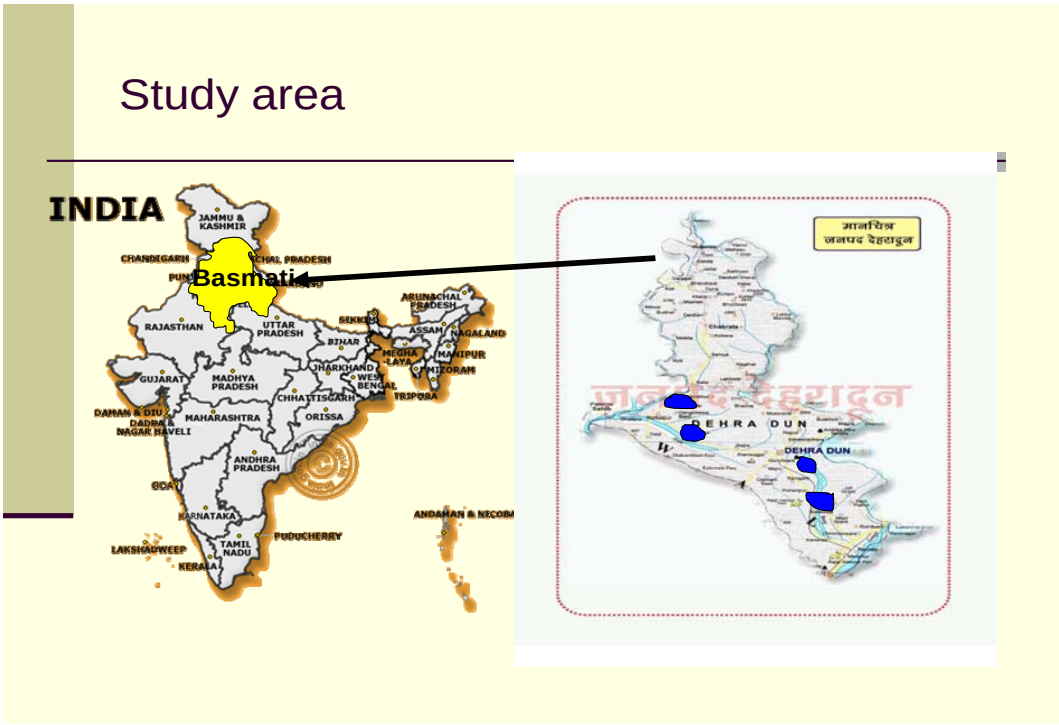
As per the demand for Basmati rice in the international market is concerned, it is rather concentrated unlike the demand for coarse rice. In 2007, the first five major importers of Indian Basmati rice had a share of 85% of total Basmati exported from India namely, Saudi Arabia, EU, Kuwait, UAE, and USA. The major importers of Basmati rice in international market are mostly located in the middle-east, EU being the other major importer. These countries recognize Basmati rice as the original rice variety from India and Pakistan which makes it a GI in practice.

Collection of data

Basmati rice is grown exclusively in the northern part of Western Punjab (on both sides of the Indo-Pakistan border), Haryana and Uttarakhand provinces of India. Haryana accounts for around 50% of the area under basmati rice in India, followed by Uttarnachal and Uttar Pradesh (earlier joint state of Uttar Pradesh) with 25% and Punjab with 18%. Some commonly known traditional basmati varieties in India are – Basmati-370, Basmati-386, Type-3, Taraori, Basmati (HPC-19), Basmati-217 and Ranbir Basmati (IET-11348). Evolved Indian Basmati varieties are – Pusa Basmati-1 (IET-1064), Punjab Basmati-1 (Bauni Basmati), Haryana Basmati-1 (HKQ-228/IET- 10367), Mahi Sugandhi, Kasturi and Super Basmati.

The survey for this study is undertaken in the Uttarakhand province where one of the traditional varieties of Basmati namely Type-3 is produced. Uttarakhand is considered as the birth place of Basmati rice and has a sizable number of small-scale farmers who predominantly depend on agriculture for their livelihood. Basmati rice is cultivated in four districts of Uttarakhand such as Dehradun, Rishikesh, Udhamsingh Nagar, and Nainital. A structured household survey is undertaken in the Dehradun district during August-September 2008. Out of the six blocks in Dehradun, Basmati rice is cultivated in four blocks namely, Vikasnagar, Sahaspur, Raipur, and Doiwala. A sample of 300 farmer households has been selected using a two-stage sampling procedure from these four blocks. In the first stage, 30 villages were randomly selected from the four Basmati producing blocks of the Dehradun district and in the second stage 10 households are randomly selected from each of the villages. Before the sampling, a pilot survey was conducted on 7 households to test the questionnaire (The questionnaire is available upon request). However, one interviewee had left in the middle of the interview, so the total sample size for this study is 299. It is to be noted that since each village differs in their household size the probability sampling weights are different for the households from one village from the other. Since we have randomly selected the households from each village

not all the households are Basmati farmers, some of them cultivate other varieties of rice. The empirical strategy is to treat the Basmati rice farmers group as the treatment group and the non-Basmati rice farmers group as the control group while comparing between these groups for assessing the impact of cultivating GI Basmati rice controlling for factors other than GI. Further, among the Basmati cultivators in the sample there are some farmers who have been organically certified. Since 2003, an organization named Uttaranchal Organic Commodity Board (UOCB) has been functioning in the state which promotes organic farming in Basmati rice and also provides organic certificates to the farmers who comply with the criteria of the board. This Board is an autonomous institution partly funded by state government and partly by other private industries such as *Birla* groups in India.



Source: National Portal of India, Government of India

In the map above the yellow-shaded area shows the Basmati cultivating areas of India which lies in four provinces. The study area is Uttarakhand which is at the Northern part of India on the foothills of Himalayas. The Northern part that lies on the banks of river Ganges are naturally very fertile due to the Gangetic plane and furthermore since the Ganges flows down through the Himalayas it carries organic materials that renders the land downstream naturally fertilized.

IV. Analytical Framework

While the broad objective of this paper is to measure the welfare impacts of GI on the rural producers, the empirical part is carried out in three steps in this paper. First, the

profitability of the GI production is examined which is followed by welfare estimation through econometric exercise in the second step and finally, we provide some insights about the determinants of adoption decision of the GI good by the producers.

4.1 Gross margin analysis

As it is mentioned in the earlier section that price premium on GI goods should be large enough to outweigh the costs of production and marketing of this good, in the first part of the empirical section, a comparative analysis of net income is undertaken to assess the relative profitability of GI. For this purpose, net incomes from producing a GI good is compared with that of a non-GI good which is used as a benchmark. Selecting a valid control group for benchmark is often a crucial aspect in such kind of analyses. An alternative way of measuring the impacts of GI is to compare the impact indicators before GI protection and after it which ideally requires a baseline survey and an impact survey to compare between them. However, this difference-in-difference method is not feasible in GI studies due to the fact that GI protection unlike other kinds of certification such as *Fairtrade* or *Organic* certification, is a very recent phenomenon. Most of the efforts to provide a quantitative measure of the impact of GI have started only after the GI certification is approved. Baseline surveys for most of the existing GIs are not available. Instead, the treatment vis-à-vis control approach is followed in which a representative GI good is compared with a valid control good.

4.2 Welfare analysis

In the second part, the paper examines whether producing the GI good increases the level of welfare of the producers. This question is at the heart of the GI debate regarding whether or not to promote GI at the global level since one of the major arguments in favour of GI is – producers of such goods are mostly smallholder agricultural farmers whose livelihood can be improved by providing the GI protection. The welfare analysis in this paper follows a livelihood approach in which firstly the general portfolio of livelihood of the sampled farmers is examined. The livelihood portfolio literature argues that diversification of portfolios reduces the risk of vulnerability to poverty. Those farmers who are specializing in one activity are more vulnerable to shocks and later on to chronic poverty as opposed to those who can diversify their activities into different income sources. Controlling for this diversification, GI's role as a positive intervention to this shock and risk is the focal point of the analysis. However, diversification into different activities need not always be a substitute for adoption of a GI good. If production of the GI good has substantial amount of risk involved in it, then diversification of income actually supports adoption of GI production. Very poor farmers may not adopt a risky GI good production in the absence of sufficient cushion which may come from other sources of income.

In microeconomics the individual welfare W is dependent on a bundle of goods, an array c, which also includes services and material and immaterial goods:

$$W_i = W_i(c_i) \tag{1}$$

This welfare function may differ among individuals and among circumstances. The same bundle of goods can produce different levels of welfare. Therefore the welfare function depends not only on the bundle of goods *c*, but in some cases also on age, health, employment status and other factors. If these characteristics are designated as x_i, then (1) can be formalized more accurately as:

$$W_i = W_i(c_i; x_i) \tag{2}$$

In (2) it is assumed that a socially-defined welfare function *W* exists which gives each individual *i* a value of individual welfare W_i for every bundle of goods c_i, under consideration of additional factors x_i.

Suppose that the relevant bundle of goods as well as the characteristics *x* can be observed, and that the individual welfare *Wi* can be calculated. Drawing conclusions from this with respect to poverty is still problematic. The leading opinion in poverty research is that the question of whether someone is poor is measured not by the observable living standard but by the possibilities, or resources, an individual has. If a lower standard of living (measured in terms of the socially-defined welfare function) is due (only) to preferences and not based on the restrictions an individual faces, then the individual generally is not considered to be poor. Accordingly, (2) can be rewritten as:

$$W_i = W\left(c_i^*(r_i); x_i\right) = W(r_i; x_i) \tag{3}$$

where, the resources of individual *i* are called r_i. Welfare then is directly dependent on a bundle of goods c_i*, which is dependent on resources r_i. The bundles of goods c_i* may not necessarily be identical to the observable bundle of goods c_i, as preferences of the individual may differ from those preferences implied by the welfare function *W* defined by society. c_i* is the result of maximizing the socially-defined function W_i subject to the available resources r_i. Relevant for poverty definitions is this value of W_i which depends on an optimization process theoretically restricted by available resources. This is the well-known resource definition of poverty (Hagenaars, 1986; Strengmann-Kuhn, 2000).

This paper does not aim to estimate the poverty ratios rather uses this resource based welfare definition to estimate the welfare impacts of GI certification, treating the latter as a positive resource intervention. The underlying hypothesis is that benefits from GI certification enhance the adopters' resource base. Controlling for other sources of income the GI producers are likely to experience a higher level of welfare compared to the non-GI producers who share almost the same level of socio-economic characteristics. The welfare function (3) is transformed into a reduced-form equation such as:

$$Y_i = \alpha_0 + \alpha_1 GI + \alpha_2 R_i + \alpha_3 H_i + \varepsilon_i \tag{4}$$

In (4) *Yi* is the net income of the households measuring their perceived welfare level. *GI* adoption is the positive shock that is hypothesized to increase the adopters' resources and in turn their income level while *Ri* is a vector of other resources that affect income. *Hi* is

a vector of household-specific characteristics which represents the social and cultural capital which can also affect the income level.
Following (4), the regression model that is estimated is the following –

$$Income = \alpha_0 + \alpha_1 GI + \alpha_2 Land_i + \alpha_3 Livestock_i + \alpha_4 Nonfarm + \alpha_5 remit + \alpha_7 education_i + \alpha_8 shock_i + \alpha_9 caste + \varepsilon_i \quad (5)$$

The specification in (5) needs to be explicitly defined in terms of the variables that are used for the estimation. First, the welfare indicator in (5) is an income variable. The data collected on income is at the household level. Data on income provides information on all possible sources of income such as farm income, non-farm income, and remittances from the migrated family members. We have used a part of total income in the regression that is income from rice. Since the objective in this paper is to examine the welfare effects of GI; GI is more likely to affect income from rice.

The GI variable is a dummy taking value 1 if the household is GI Basmati rice farmer and 0 if it is a non-GI rice farmer. If being a GI producer controlling for other factors, increases the income then the hypothesis that GI production increases producer welfare is supported. However, it can quickly be pointed out that there could be self-selection bias in the above specification. The causality in specification 5 which states that a GI farmer earns more income than a non GI farmer could be as well run in the reverse direction such as a relatively richer farmer could choose to adopt GI production. Such kind of self-selection bias is well documented in literature and is quite prevalent in cross section studies. To address self-selection bias, we have estimated Heckman selection model (Heckman *et al*, 1998).

The Heckman selection model can be explained as the following. Suppose the regression model is specified as –

$$Y_i = \beta_0 + \beta_1 d_j + \beta_2 X_i + u_i \quad \text{, where j = 0, 1} \quad (6)$$

d_j is the treatment variable, in this case GI dummy. X_i s are control explanatory variables and u_i is the stochastic error. The self-selection bias arises when d_j is correlated with u_i [$corr(d_j, u_i) \neq 0$]. This happens due to non-random selection of the sample and renders β_1 in (6) inconsistent. To correct this bias, Heckman suggests a two-stage estimation method. The correction involves a normality assumption, provides a test for sample selection bias and formula for bias corrected model.

4.3 Adoption decision model

Finally, in the following section, a formal analysis has been undertaken to learn more about the farmers' adoption decisions and the factors that influence the former. Over a period of time, the cropping pattern of farmers undergoes a change that depends on many factors such as market fluctuations, weather condition changes, government policies

towards certain crops, extension training programs which can inform farmers about seed varieties and other farming improvements. Furthermore, risk preference of a farmer will also play a crucial role in adoption decisions. A risk-averse farmer will probably choose a low-risk and low-return crop than a risk taking farmer. The non-adopters of GI Basmati rice have been asked as to why they did not decide to cultivate Basmati. The responses to this question ware varied, but one can summarize the general impression of the farmers as – Basmati is naturally a risky cultivation for several reasons.

To understand what explains the adoption decision, following characteristics have been considered in the regression model. They are – first, household characteristics such as age and education of the household head, household size, land ownership of the household, and livestock; second, land characteristics such as elevation and soil quality of the plots; third, institutional characteristics such as extension training provided by government and/or NGOs. The adoption model also includes land allocated to sugarcane as an explanatory variable since the gross margin analysis in 4.1 has revealed that sugarcane is the major competing crop with GI Basmati rice due to its higher productivity. Furthermore, the qualitative discussions with the farmers highlighted the fact that GI cultivation is prone to weather risks and also subject higher labour costs hence, a risky approach. Moreover, to examine the role of the risk attitude of the household, we have used percapita income as insurance in the event of crop loss. An alternative procedure would be to first measure the risk attitude of the households by an experimental risk game. However, such a game most often than not involves sophisticated games with several options that we considered would be beyond the general comprehensive power of the respondents of this survey. Hence, percapita income was used to capture this risk element in the adoption strategy. Higher per capita income allows households to take higher risk and hence they are more likely to adopt GI since in case of a crop loss scenario income from other off-farm activities will provide a coping mechanism.

Finally, the location dummies are included in the model to account for the remaining unobservable characteristics that may influence the adoption decision such as spatial heterogeneity. In total, the study area is comprised of four districts such as *Vikasnagar, Doiwala, Sahaspur*, and *Raipur*. Although these districts are not too different in terms of their socio-cultural background but have differences in the land use pattern. For example, the altitude of land in *Vikasnagar* district is more flat and therefore is favourable for rice cultivation; on the other hand, *Doiwala* district is upward sloping and is more suited for sugarcane cultivation. However, it is to be noted that these dummies are not fixed effects and hence are assumed to be not correlated with the explanatory variables.

The econometric specification of the model is the following –

$$land\_GI = \delta_1 + \delta_2 age + \delta_3 education + \delta_4 hh\_size + \delta_5 livestock + \delta_6 soil\_quality + \delta_7 elevation + \delta_8 training + \delta_9 land\_sugarcane + \delta_{10} percapincome + \delta_{11} location \quad (7)$$

Although, the dependent variable seems to be a continuous variable, it is not so since some respondents do not cultivate GI rice at all. To tackle with the 0's in *land_GI* variable, Tobit model is used to estimate eqn (7).

A Tobit model is applied to estimate specifications where the decision variable, y partly includes possibility of a corner solution as the optimal solution. In other words, y is an observable choice or outcome describing some economic agent such as an individual or a firm with the following characteristics: y takes on the value zero with positive probability but is a continuous random variable over strictly positive values (Wooldridge, 2002). In our case, many farmers have decided not to cultivate GI rice and others have allocated certain proportion of their land for GI rice. Hence, the decision variable, *land_GI* has two parts – 0's and then the continuous part.

Consider the following specification –

$$y_i^* = x_i\beta + u_i, \qquad u_i|x_i \approx Normal(0,\sigma^2) \tag{8}$$

$$y_i = \max(0, y_i^*) \tag{9}$$

These equations constitute a standard **Tobit** model.

V. Results

The results of this paper are presented in three parts following the objectives outlined in Section I. First the analysis of gross margins from GI production vis-à-vis non GI production is presented followed by the results from the econometric model. Finally, the supportive evidence from the field survey is discussed.

5.1 Gross margins from GI production

The distribution of land ownership in our study shows significant variation among the households ranging between 0.04 ha and 5.6 ha with the median land ownership being 0.88 ha per household while the percapita land ownership stands at 0.2 ha. There are generally two cropping seasons in India such as *Kharif* season (monsoon or summer) and *Rabi* season (winter). *Kharif* season spans from July to December and the *Rabi* season is from January to April. The farmers are found to have adopted a multi-crop cultivation pattern in the study area, rice being the major crop in the *Kharif* season followed by sugarcane, maize, pulses, and spices. On the other hand, wheat is the major crop in *Rabi* season with vegetables being the other crop that is cultivated in this season. However, unlike *Rabi* season which is predominantly a wheat-cropped one, *Kharif* season shows more variability in terms of the farmers' decision of crop adoption in our sample. Rice and sugarcane have the major shares in land allocation in the *Kharif* season. While rice is the major source of staple food, apart from wheat that provides food security to the farmers; sugarcane is cultivated mainly as a cash crop.

Since, this study is concerned with GI Basmati rice, a comparative analysis of gross margins from various crops cultivated in the *Kharif* season has been undertaken with a view to assess the relative profitability of Basmati rice as opposed to other competing crops. For the same purpose, three groups have been identified such as Basmati rice, other varieties of rice, and sugarcane. The land allocation pattern shows that GI Basmati rice is allocated a share of 37% of the total land cultivated followed by 25% for other

varieties of rice and 18% for sugarcane. The rest of the land is allocated among maize, spices, grazing land, and barren land.

It is interesting to compare the gross margins from Basmati rice cultivation with the same from other varieties of rice and sugarcane. Basmati is generally considered as a superior variety of rice due to its special characteristics of taste, aroma and long grain size which also fetches it a higher price in comparison to other varieties of rice in the international market. While from the demand side Basmati rice has a clear edge over other rice varieties due to its price premium, there are supply side constraints which need to be taken into account in order to arrive at the net gain from cultivating the former. Basmati is generally a low yield crop and prone to weather variability. It needs adequate irrigation as well as regular weeding during the growing months of the plants, which increases the labour cost significantly. Furthermore, the ripen plants are prone to heavy winds since they wilt under the wind and yield poor harvest for the farmer. Overall, Basmati cultivation involves a risk element which can sometimes decide whether a farmer decides to adopt it instead of other crops even though the prices are comparably higher for the former.

The yield of the crop per bigha[1], price per quintal, cost of cultivation per bigha, and gross margins are presented in Table 3. The figures in the Table show that the yield per *bigha* of Basmati rice is less than the non-Basmati rice; while non-Basmati rice yields 3.5 quintals of paddy per bigha, the same for Basmati rice is 2 quintals per *bigha*. Moreover, the cost of cultivation of rice is also higher in case of GI Basmati rice compared to non-GI rice. So, on the supply side GI rice is a low yielding and high cost rice variety than many other local varieties of rice that are cultivated in India. However, on the demand side the price of GI Basmati is much higher than the non GI rice varieties. For example, the price of GI Basmati rice is Rs 2100 per quintal of paddy in comparison to Rs 800 per quintal for the non GI rice.

The gross margins are calculated per bigha as the difference between the gross revenue which is yield times the price and the cost of cultivation per bigha. It is to be noted that the figures used in the calculation of gross margins such as yield, price, and cost are the sample averages. The gross margins earned by GI basmati farmers exceed that of non GI rice farmers significantly; the former earns Rs 3195 per bigha in one cultivation season whereas the same for the latter is Rs 2018 per bigha. However, although the comparison between GI Basmati rice and other varieties of rice yields the former to be more profitable, there are other competing crops such as sugarcane which can be potential alternatives not only because of it being a cash crop also due to the fact that it is a double-harvested crop. So, with one period plantation, a farmer can harvest twice from the sugarcane field. The gross margins earned from GI rice and sugarcane from Table 3 shows that the latter earns Rs 4800 per bigha, some Rs 1600 higher than the former. It is interesting to note that despite the fact that sugarcane is more profitable than the GI rice; the average land allocation to the latter is way higher than the former in the study area. There are both physical and economic explanations for such adoption decisions; for example climatically sugarcane requires more water. Moreover, rice is a staple grain and

[1] 1 hectare is 12.5 bigha and 1 acre is 5 bigha.

from the food security point of view, poor farmers allocate their land to rice rather than sugarcane.

The within-GI analysis of gross margins between organic certified GI and non-certified GI shows that the former incurs higher cost than the latter but fetches a higher price too (Table 4). For example, the price per quintal of paddy is Rs 2300 for organic certified and GI rice while the same is Rs 1800 for non-certified GI rice. However, these prices exceed the price for non GI rice by a fair margin and hence it is clear that there is a price premium to be earned on GI rice. Expectedly, the gross margins from certified GI are higher than the non certified GI. The gross margin analysis above highlights the fact that in the rice group GI rice fetches a higher price which makes it more profitable than the non GI rice varieties, however, sugarcane could be a potential alternative for farmers instead of rice and in fact sugarcane provides even more profitable choice for the farmers. But at the hindsight, farmers do allocate major part of their land for rice cultivation since it is a staple food and insulates the small farmers from food insecurity. So, clearly the substitutability between rice and other cash crops is less elastic. In the following section, we have carried on a welfare analysis by dividing the households on the basis of GI rice cultivation.

Table 2: Gross margins from GI rice, non GI rice, and sugarcane

Indicators	GI rice	Other variety rice	Sugarcane
Yield (per bigha in quintal)	2	3.5	50
Price (per quintal in Rs)	2100	800	121.5
Revenue (per bigha in Rs)	4475	3200	6000
Unit cost (per bigha in Rs)	1250	1145	1110
Gross margin (per bigha in Rs)	3195	2018	4800

Author's own calculation from the survey data

Table 3: Gross margins from certified and non-certified GI rice cultivation

Indicators	Certified GI rice	Non-certified GI rice
Yield (per bigha in quintal)	2	2
Price (per quintal in Rs)	2300	1800
Revenue (per bigha in Rs)	4600	4000
Unit cost (per bigha in Rs)	1260	1240
Gross margin (per bigha in Rs)	3370	3000

Author's own calculation from the survey data

5.2 Impact on Income

The descriptive summaries of some key variables across the GI rice and non GI rice groups are provided in Table 4. The sampled respondents selected for the interviews are categorized into two distinct groups based on whether they cultivate GI Basmati rice or other varieties of rice. The sample is random within the strata and do not show any clear-cut grouping as to whether the producer is a GI producer or not. Unlike certification schemes that certify an agricultural product, vegetables for example, on the basis of cultivation procedure such as organic; GI is a right of protection (or right on using the specified product name exclusively) on a specific product variety, Basmati rice in this case. So, to find two groups of farmers such as GI and non-GI would require some kind of criteria specified by the researcher. We have considered the land allocated for rice cultivation to set such a criteria. Those farmers having allocated more than half of their rice cultivating area for Basmati cultivation are grouped under GI and the others fall in the category of non GI producers. Hence, the unit of comparison is between GI rice cultivators and non-GI rice cultivators. From among the 299 households 183 (61%) are GI farmers and 116 (39%) are non-GI farmers.

Table 4: Descriptive statistics of key variables

Indicators	Total	GI Basmati	Non GI rice
Sample size	299	183	116
Household size (Adult male equivalent)	5.02 (2.01)	5.16 (2.23)	4.79 (1.56)
Education (number of years of education)	6.32 (4.83)	6.53 (4.91)	6 (4.69)
Land owned (ha)	1.32	1.36	1.26
Area under rice	0.62 (0.29)	0.63 (0.30)	0.61 (0.28)
Household annual income (Rupees)	85493 (53873)	93406 (53794)	73949 (52106)
Per capita household income (Rs)	49 (29.6)	55 (31)	40 (24.6)
Percapita daily consumption (Rs)	30.49 (15.5)	31 (15.67)	29.56 (15.27)
Household below poverty line	40	15	25

Standard deviation is in parenthesis

The mean differences of variables between GI and non-GI produced in Table 5 reveal that there is no significant difference in average household size and number of years of education of the household heads between the GI and non GI groups. Similarly, although the GI households own more land than the non GI households on an average with 1.36 ha per household for the former against 1.26 ha for the latter, this difference is not too large. Furthermore, both the groups allocate similar share of land for rice cultivation which is in the order of 62% of their total land. This indicates that rice is the major crop in the season. However, what is revealing is the significant difference between the groups in terms of both annual household income and daily per capita income. While the average

annual income for the GI groups stands at Rs 93,406 the same for the non GI group is Rs 73,949. On the other hand, the per capita income of the GI group is Rs 55 as opposed to Rs 40 for the non GI farmers. A further investigation of the different sources of income between these groups yields that the two groups mostly differ significantly in terms of income from rice cultivation and off-farm income (which does not include remittances). Intuitively, this indicates that controlling for off-farm income the income from rice cultivation affects the household income and hence requires to be analyzed whether GI certification plays any role in determining the household income. The per capita consumption between the GI and non GI groups does not vary significantly indicating that the households could manage to maintain their basic consumption level

Regression results for the welfare analysis

Following the regression specification 5, both the OLS and the Heckman selection models are estimated with the dependent variable being the net income from rice. The regression results are reported in Table 5 and 6. In each model, two specifications have been estimated using the same response variable and explanatory variables but with different numbers of observations. Specification 2 is estimated by excluding those observations where households are both GI and organic certified. This has been done firstly, to distinguish the effect of organic certification on income from the GI's effect on income and secondly, to check the robustness of the model. If the sign and significance of the variables do not change between these two specifications, then the models can be considered robust to the sample size.

A perusal at the estimated figures of OLS regression shows that there is a general consensus about the sign and significance of the variables of interest between the two specifications estimated. The GI variable has been statistically significant and positively promotes the income from rice cultivation. Since, the model controls for the likely impacts from explanatory variables on income, this difference of treatment effect that is estimated by the coefficient of GI variable (15.10) can be interpreted as the adoption of GI rice cultivation increases the income of the household by Rs 15,000. Of course, this result is credible only if the OLS qualifies the no-correlation between GI and the estimated residuals test. This can be readily verified from the results of the Heckman selection model. Heckman selection model produces a inverse-mills ratio. This mills ratio estimates the combined effect of all the relevant omitted variables in the OLS model. If the inverse-mills ratio is estimated to be statistically significant, firstly, it proves the hypothesis that there is self-selection bias in OLS model and hence justifies the need for Heckman selection model. Secondly, if the sign and significance of variables of interest remain unchanged between the OLS model and the Heckman selection model that will prove the robustness of the specification.

As we have discussed in the econometric specification section (Section IV), Heckman selection model is estimated in two-stages. In the first stage, the selection variable (which is generally a dummy variable and is constructed from the distribution of the outcome variable) is regressed upon the explanatory variables. Apart from the coefficients of variables, the inverse-mills ratio is estimated from this first-stage regression. The

outcome regression is estimated in the second stage where along with the other explanatory variables, mills ratio is used as an additional explanatory variable. Further, the selection model must contain a vector of instrumental variables that predict the probability of selection of the observation in outcome regression but are exogenous to the outcome variable.

A careful examination of the results in Table 6 shows that again most of the variables retain their sign and level of significance between the two specifications that is with the organic certified households and without the organic certified households. The selection regression has used a set of instrumental variables such as household size, home consumption of rice, and the location dummies that are likely to determine the selection of the observation but are exogenous to the amount of income earned. In both the specifications, the mills ratio is statistically significant (-7.16 in Col. 3 and -10.65 in Col. 4). Further, the GI variable is positive and highly significant with the coefficient of 15.12 (Col. 1). This can be compared to the coefficient of GI in OLS model that is 15.10. So, there is a fair consensus between both the models about the impact of GI on income. A household by choosing to cultivate GI rice over non GI rice earns an increment of Rs 15,000. Together with the findings from the descriptive statistics and from the regression results, it is evident that GI adoption adds more income to an average household.

Table 5: OLS Regression results

Explanatory variables	**With organic certification**	**Without organic certification**
Intercept	- 26 (6.48)*	-13.82 (6.7)**
Age	0.04 (0.06)	0.007 (0.07)
Education dummy 1	2.61 (2.71)	4.26 (2.68)***
Education dummy 2	3.10 (2.52)	1.54 (2.39)
GI	15.10 (2.16)*	10.62 (1.99)*
Yield of rice	5.21 (0.74)*	4.58 (0.8)*
Land size	1.81 (0.23)*	1.16 (0.25)*
Cost of cultivation	-0.006 (.002)*	-.005 (.002)**
Elevation of land	1.53 (2.21)	0.14 (2.38)
Idiosyncratic shock	-0.17 (1.93)	2.10 (2.24)
Covariate shock	-0.51 (2.96)	2.8 (2.88)
Household labour	1.37 (2.02)	-.87 (1.81)
Observations	237	159
R^2	0.62	0.48

The estimated standard errors are in parenthesis. *, **, and *** show level of significance at 1%, 5%, and 10% respectively. The standard errors are estimated using the robust standard error method.

Table 6: Heckman selection model

Explanatory variables	Outcome regression		Selection regression	
	With Org.cert.	Without Org.cert.	With Org. cert.	Without Org. cert.
	Col. 1	Col. 2	Col. 3	Col. 4
Intercept	-21.63 (7.24)*	-6.66 (7.27)	-1.93 (0.74)*	-2.39 (0.91)*
Age	0.04 (0.07)	0.02 (0.07)	-.008 (.009)	-.02 (.01)***
Edu dummy 1	3.01 (2.42)	5.21 (2.41)**		
Edu dummy 2	2.76 (2.5)	0.5 (2.53)		
GI	15.12 (2.26)*	10.55 (2.05)*		
Yield of rice	4.9 (0.96)*	4.05 (0.95)*	0.67 (0.14)*	0.73 (0.17)*
Land size	1.72 (0.11)*	1.00 (0.14)*	0.47 (0.07)*	0.62 (0.11)*
Cost of cultivation	-.007 (.002)*	-.006 (.002)*		
Elevation of land	1.12 (2.58)	-1.27 (2.83)	0.39 (0.29)	0.67 (0.38)***
Idiosyncratic shock	-.17 (1.94)	2.47 (2.04)	0.02 (0.27)	0.04 (0.36)
Covariate shock	-.56 (2.49)	3.04 (2.75)	-.07 (0.46)	0.19 (0.63)
Household labour	1.25 (1.34)	-1.52 (1.38)		
Household size			0.002 (0.07)	0.13 (0.09)
Vik			-0.23 (0.30)	0.16 (0.39)
Sah			-0.12 (0.35)	0.11 (0.46)
Rai			-0.07 (0.38)	-0.22 (0.47)
Rice consumed			-0.20 (0.04)*	-0.26 (0.47)*
Observations	292	201	292	201
Wald stat	283.01*	112.10*		
Inverse-mills ratio			-7.16 (3.84)***	-10.65 (3.49)*

The estimated standard errors are in parenthesis. *, **, and *** show level of significance at 1%, 5%, and 10% respectively. The standard errors are estimated using the robust standard error method.

5.3 Decision to adopt GI

The land allocation pattern discussed in Section 5.1 shows that farmers have two cropping seasons and in each season the land allocation has been diversified among different crops. Furthermore, farmers are also found to have allocated their land to both

GI Basmati rice and non GI varieties of rice. Hence, the adoption of GI will depend on the proportion of land that has been allocated to GI Basmati rice cultivation. This variable does not distinguish the adopters from the non adopters rather it measures the intensity of adoption among the rice farmers.

Both OLS and Tobit models have been estimated and the results are presented in Table 7. There is a similar pattern in terms of sign and significance of the variables in both the models. First, Access to extension training is positive and statistically significant in the decision to adopt GI. However, there could be an issue of endogeneity in this case since it can be argued that those households who have adopted GI cultivation are particularly attending the extension training. In defense of using this variable as exogenous in the regression, there has been a concerted effort by the state agricultural department and the local NGOs to provide training about Basmati farming in the survey area which is accessible to all the farmers. Hence, we rely upon the hypothesis that those farmers who have attended training programs are more likely to adopt GI. Secondly, the coefficient for the percapita income is positive and statistically significant which as expectedly suggests that households having access to higher income are more probable candidates to adopt GI.

Land under sugarcane cultivation is statistically significant but negative showing that farmers choosing sugarcane over GI rice are less likely to adopt GI as their major crop. This is not surprising since we have observed that sugarcane on margin is more profitable than GI rice. Rather, the interesting result is that the variable total land is negative and statistically significant meaning that those farmers having larger land are less likely to allocate more land to GI rice. However, this can be explained by the following fact that relatively larger land holders diversify their land among several crops to mitigate risk. On the other hand, relatively smaller land holders specialize more on one crop. In our sample, the smaller landholders prefer GI rice cultivation which is a positive and interesting finding since although GI rice cultivation is riskier it can provide higher income to small landholders and can improve their well-being.

Further, family size is significant and positive which is again expected since GI rice cultivation is labour intensive, larger family households are more suited for GI adoption. Finally, the livestock variable is positive and statistically significant. Both the soil quality and elevation variables are not statistically significant.

Table 7: Adoption decision results

Dependent variable = land under GI Basmati cultivation		
Explanatory variables	**OLS**	**Tobit**
Constant	0.42 (0.08)*	0.21 (0.16)
Soil quality	0.04 (0.04)	0.08 (0.08)
elevation	0.03 (0.13)	0.02 (0.17)
Per capita income	0.001 (0.000)*	0.002 (0.000)*
Training attendance	0.13 (0.07)	0.18 (0.09)**
Land	-0.05 (0.02)**	-0.05 (0.02)**
Land under sugarcane	-0.24 (0.05)**	-0.30 (0.06)*
Family size	0.008 (0.013)	0.02 (0.009)*
Education	-0.002 (0.001)	-0.001 (0.002)
Age	-0.002 (0.001)	-0.003 (0.003)
Livestock	0.009 (0.004)***	0.01 (0.003)*
Idiosyncratic shock	-0.1 (0.08)	-0.14 (0.12)
Covariate shock	0.001 (0.04)	0.004 (0.04)
Vik	-0.03 (0.04)	-0.03 (0.04)
Doi	0.009 (0.09)	-0.01 (0.13)
Rai	0.02 (0.08)	0.03 (0.1)
Obs	253	253
R^2/Pseudo R^2	0.27	0.16
σ		0.42 (0.03)

The estimated standard errors are in parenthesis. *, **, *** are level of significance at 1%, 5%, and 10% respectively.

VI. Conclusion

This paper is one of the first attempts in the literature on GI to provide evidence on the net benefits of GI production against a credible counter factual. There has been a lot of speculation in academia and WTO spheres about the impacts of GI. Against that backdrop, this paper has examined the income effects of GI production by using Basmati rice from the Northern India as a case study. Basmati rice is the most prized GI product in India with an export worth of Rs 28,000 million. Basmati is cultivated in the five North-western provinces of India and employs a significant number of small-scale agricultural households.

A household survey consisting of 300 rice farmers has been undertaken in one of the Northern provinces of India namely Uttarakhand. The sample is designed following a stratified random sampling in which both the GI Basmati rice farmers as treatment group and non GI rice farmers as control group are included. The empirical part in this paper follows three stages. In the first stage, a gross margin analysis is carried out to elicit the net benefits of GI Basmati rice as opposed to non GI rice and another competing crop in that region such as sugarcane. The findings show that gross margins from Basmati rice cultivation are higher than the same from the non GI rice cultivation. However, gross margins from sugarcane are higher than that of Basmati rice. We have also found

evidence that some farmers have allocated major part of their land to sugarcane cultivation. But the matter of the fact is that rice is a staple crop and small farmers will fall on it from the food security point of view. The land allocation pattern indeed showed that approximately 63% of the total land is allocated to rice on an average. Hence, rice still plays a major role in the region and GI Basmati cultivation may add welfare to the households' livelihood.

In the second stage, an econometric analysis is followed to present whether GI adoption by households have increased their net income. We have estimated both the OLS model and the Heckman selection model. Heckman selection model provides the correction for any self-selection bias that the OLS model may contain. The results confirm that there has been an increment of income from GI rice cultivation. This difference of income is in the order of Rs 15,000 annually. Finally, an adoption model is estimated to learn about the possible motives of GI adoption. The determining factors are access to extension training facilities, a credible hedge against risk, and household labour.

In conclusion, our paper supports the hypothesis that GI adoption enhances the welfare of the households. However, we do so with the following caveats. This study is a one-shot cross-section study and therefore lacks the precision of the panel study. Further, conceptually, it is difficult to generalize our results for the whole range of GI products since they vary in both scale and scope. Basmati being an old GI and having considerable export potentials proves to be a value-adding GI. This can not be automatically generalized for a recent GI. Nevertheless, being one of the first empirical papers to estimate GI's impact econometrically using a credible counterfactual, this study contributes to the literature and provides a passage for further research.

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