Displacement and Development: Partition of India and Agricultural Development*

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January 2016

Abstract

The partition of British India in 1947 resulted in one of the largest and most rapid migrations in human history. This paper examines how areas affected by the partition fare in the long run. Using migrant presence as a proxy for the intensity of the impact of the partition and district level data on agricultural output between 1957-2009, we find that areas that received more migrants have higher average yields, are more likely to take up high yielding varieties (HYV) of seeds, and are more likely to use agricultural technologies. These correlations are more pronounced after the green revolution in India. Using pre-partition agricultural data, we show that migrant placement is uncorrelated with soil conditions and agricultural yields *prior* to 1947; hence, the effects are not solely explained by selective migration into districts with a higher potential for agricultural development. Migrants moving to India were more educated than both the natives who stayed and the migrants who moved out; we therefore highlight the presence of educated migrants during the timing of the green revolution in India as a potential pathway for the observed effects.

*This draft has benefitted from comments by Latika Chaudhary, James Fenske, Bishnupriya Gupta, Takashi Kurosaki, and participants at the World Economic History Congress, 2015.

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1 Introduction

The end of the British Empire in India in 1947 was marked with the joyous celebration of independence, an unprecedented mass migration of nearly 17 million people, and a human rights disaster involving nearly a million deaths in the wake of the riots that ensued between Hindus and Muslims on either side of the newly created India-Pakistan border. The emergence from nearly a century of colonial rule left an indelible mark on Indian history. Historical events undoubtedly shape modern day institutions and development (Acemoglu, Hassan, and Robinson, 2011; Nunn, 2008; Banerjee and Iyer, 2005; Acemoglu, Johnson, and Robinson, 2002), and with India fast emerging as a major economic force, it is important to look back on her origins as an independent country and examine the legacy of the partition on an important aspect of economic progress – agricultural development.

Using migrant presence as a proxy for the intensity of the impact of the partition, this paper highlights important correlations between areas that received migrants and the subsequent agricultural development in those areas. Documenting these correlations is an important contribution as mass migrations, institutional upheaval, and partitions are a reality even today.[1] It is crucial therefore to understand how communities and areas develop long after such events take place. While affected areas suffer in the short run, it is critical to document whether the legacy of such events forever change the long run trajectory of these places.

We find that the partition had a statistically significant but moderate impact on agricultural development in the decades after India's independence. Between 1957 and 2009, areas that received migrants saw average annual wheat yields increase by 3.2% compared to areas that received no migrants. We find similar results when examining annual rev-

[1] The current (as of September 2015) refugee crisis in Europe is a relevant example of a mass migration with the potential to affect labor markets and economic development of receiving countries. The most recent example of a partition is that of Sudan where in a referendum held in January 2011 in the south showed that an overwhelming 98.8 percent of the population were in favor of secession. As a consequence, constitutional declaration of the independence of South Sudan took place on 9 July 2011. The other recent example is the Dayton peace agreement of November 1995, which led to the partition of Bosnia and brought an end to the Bosnian War. Yet another prominent example is the partition of Cyprus into Greek and Turkish speaking separate territorial units after the Turkish invasion and occupation of Northern Cyprus in 1974 (Christopher, 2011; Kumar, 2004; Kliot and Mansfield, 1997).

enue per hectare;[2] this measure is used so as to not be reliant on any specific crop for our productivity measures. In the case of wheat, we find that most of the effects of partition are concentrated after the green revolution occurs. The green revolution transformed Indian agriculture in the 1960s, making crops less susceptible to destruction via pests and droughts, increasing yields and increasing land based investments like irrigation. We find that migrant presence is also strongly correlated with the use of tractors (a 10% increase in migrants is correlated with a 2% increase in the use of tractors between 1957-1987) and fertilizers (phosphorous and nitrogen), which is in line with the idea that partition affected districts were more likely to adopt HYVs and other technologies related to the green revolution. These results are not just driven by migration into agriculturally suitable states like the Punjab – the results are robust to the inclusion of state fixed effects and state specific time trends. Finally, using agricultural data from before 1951, we show that migrant presence in 1951 is uncorrelated with yields or soil types, suggesting that selective migration at the district level cannot solely explain our results.

While we believe these results to be important, we want to be upfront about the scope and limitations of this paper. This research is motivated by the goal of linking partition to subsequent economic development (as measured by income, health, human capital, etc.); however, in this paper we specifically (and only) examine agricultural outcomes in the first few decades after the partition. There are two main reasons for this: first, agricultural outcomes are available at a yearly level, at fine levels of administrative disaggregation, and over a long period of time; and second, agriculture was, and still is, an important part of employment and economic output in India.[3]

A second limitation of this study is due to the fact that the partition was an event that resulted in many changes: migration, new governments, mass deaths, demographic changes, loss and restructuring of land, etc. It is difficult therefore to have a single variable that captures all of these forces, or even obtain data on these individual changes. Our way of measuring the intensity of the impact of partition is to use displaced person population in 1951. By this, we assume that areas (districts in our case) that received migrants due to partition were more "affected" (along various dimensions, some like the

[2]This measure uses data on the production of wheat, rice, sugar, jowar, maize, bajra, barley, cotton, groundnut, jute gram, potato, ragi, rapeseed, mustard, sesame, soybean, sugarcane, sunflower, tobacco, tur and other pulses.

[3]In 2014 approximately 17 percent of Indian GDP was made up of the agricultural sector and for the decade prior to that it fluctuated between 18 and 17 percent. In 2012 as much as 47 percent of the total Indian workforce was employed in agriculture (data from World Bank Economic Indicators).

ones we just mentioned) by partition than districts that did not receive any migrants. We want to be very clear that while we use displaced person population as our metric for the intensity of the impact of partition, we do not wish to interpret our results as solely the effects of partition induced *migration*. For example, districts with more migrants could have received more government aid in the years after partition, and our effects should be interpreted as capturing the effect of both, migration and government assistance. Finally, where displaced populations chose to settle was not, and could not plausibly be, random. While we make the case that migrant settlement was not correlated with the potential for agricultural growth, we have no illusions of making causal claims in this paper.

While it is imperative to uncover the precise mechanisms or governmental policies (or lack thereof) that led to these long run effects, we are unable to do so in this paper. Data limitations and the sheer magnitude of the event makes it nearly impossible to make precise statements about any *one* leading factor. We do, however, provide some preliminary evidence that the composition of migrants likely played a role in the future agricultural development of more affected areas. Migrants who moved to India were more educated than both the migrants leaving India and the natives who stayed behind (Bharadwaj, Khwaja, and Mian, 2009). Given the positive correlation between education and the take up of agricultural technologies (Feder, Just, and Zilberman, 1985), the demographic changes induced by partition could be a plausible mechanism for the effects seen. In line with such a mechanism, we document that migrants who moved to India were more likely to have been involved in money lending and other commercial aspects of farming. Credit is an important aspect of agriculture and especially so for the take up of newer technologies, and hence, it is likely that the presence of migrants during the green revolution helped along this dimension as well.

This paper contributes to the economics literature on the long term impacts of historical events in general (see Nunn (2009) for a review), and also to the literature more focussed on the impacts of history and colonization in India (Jha, 2013; Chaudhary and Rubin, 2011; Donaldson, 2010; Iyer, 2010). Most closely related is the work of Banerjee and Iyer (2005), who show that different institutions (specifically practices regarding land rights) during the colonial period had a profound impact on agricultural development long after the British left India. They find that these institutions played an important role after the green revolution, where individual rights to ownership of land were a crucial aspect of districts that were able to take advantage of HYV seeds, fertilizers, and other agricultural technologies. This paper also builds on and extends the research that is directly related to the partition of India (Bharadwaj, Khwaja, and Mian, 2009; Jha and Wilkinson, 2012; Bharadwaj and Fenske, 2012). While these papers contribute in important ways to our understanding of the event by analyzing the demographic consequences of partition, the role of combat experience during WWII on ethnic cleansing during the partition, and the impact of partition related migratory movement on jute cultivation, they do not examine long run consequences. Hence, the main contribution of this work is to examine how partition (as measured by the presence of displaced populations) impacted long run economic outcomes such as agricultural development.

2 Data and Empirical Framework

2.1 Post-Partition Data

For our post-partition analysis the data comes from three different sources: the 1951 census of India, the Indian Agriculture and Climate Dataset (i.e. IACD) and the Village Dynamics in South Asia Dataset (i.e. VDSA). The 1951 census data was used to construct a measure of displacement that was then related to measures of agricultural development from 1957 to 2009 that were constructed from data in the IACD and VDSA datasets.[4] An important task in relating the two measures was to make district boundaries comparable between 1951 and the first year for which data is available in the IACD (i.e.1957).[5] For those districts that were partitioned between 1951 and 1957 we used a mapping procedure to achieve such a task. Our procedure involved the following steps. We first identified the districts that were created between 1951 and 1957. We called these are our child districts. We then identified the 1951 districts from which our child districts were created between 1951 and 1957. We called these our parent districts. We then recorded the areas of all our child and parent districts. Next, we divided the area of child district with the area of its corresponding parent district to determine the proportion of the 1951 parent

[4] In constructing our agricultural development measures from 1957 to 2009 we combined the IACD data from 1957 to 1965 with the VDSA data from 1966 to 2009. For the period where there was an overlap between the IACD and the VDSA (i.e. 1966 to 1987) we carried out empirical exercises to show that the data contained in both of them were not significantly different from each other.

[5] The IACD panel keeps district boundaries constant for the period 1957 to 1987. Therefore, making the 1951 district boundaries comparable with those in the first year of the IACD panel (i.e. 1957) also makes them comparable with the boundaries in all the subsequent years of the panel (i.e. from 1958 to 2009).

district that was made up of its child district. Finally we use the resulting proportions to estimate 1951 numbers for the child districts that were created between 1951 and 1957.

2.1.1 1951 Census of India

The 1951 census of India was carried out in the last three weeks of February 1951 with enumerators revisiting households from the 1st to the 3rd of March of the same year. It is significant for having recorded the initial and the most substantial phase of migration inflows that resulted from partition. A total of 7.3 million displaced in-migrants were enumerated, of whom 4.7 and 2.55 million had come from West and East Pakistan, respectively, and 0.05 million did not specify their place of origin (Visaria, 1969). Information on the in-migrants was disaggregated by gender, age, occupation and region of origin. In the case of sex, separate inflows were recorded for both males and females. According to Bharadwaj, Khwaja, and Mian (2009) the percentage of men in the inflows was, on average, 1.09 percentage points lower then the residents. For age structure, the refugees were classified in ten-year age groups going from ages 5 to 74. The region of origin for each in-migrant was identified as being either West or East Pakistan. In addition to the demographic characteristics there was also data on the occupation of in-migrants. Appendix II of Table IV of the census provides a detailed occupational classification of the in-migrants. Here again according to Bharadwaj, Khwaja, and Mian (2009) the in-migrants tended to engage more in non-agricultural professions relative to the resident population.

The 1951 census provides the best estimate to date of the immigration from Pakistan into India due to partition. That said, it does have some drawbacks. Firstly, the data on region of origin does not provide enough granularity to identify the district of West or East Pakistan from which an in-migrant came from. Secondly, substantial changes in the administrative machinery and the relatively unsettled conditions in those districts that received in-migrants casts doubt over the quality and coverage of the data (Visaria, 1969). On the other hand the multiple counting of persons crossing the border into India more than once caused an over reporting of in-migrants (Visaria, 1969). Finally, the high mortality rate amongst the refugees who arrived between 1947 and 1951 meant that the true scale of partition related displacement could not be established (Visaria, 1969).

2.1.2 Indian Agriculture and Climate Dataset

The Indian Agriculture and Climate Dataset is a panel dataset that covers 271 districts across thirteen states of India and includes annual data on agricultural, economic, climate and edaphic variables for the period 1957 to 1987. The states covered are Haryana, Punjab, Uttar Pradesh, Gujarat, Rajasthan, Bihar, Orissa, West Bengal, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Madhya Pradesh. One of the key concerns that the compilers of the dataset addressed was to keep district boundaries constant between 1957 and 1987 so as to make the data comparable over time. They did so by taking into account all the changes in district boundaries that occurred between 1957 and 1987. More, specifically they preserved the original district boundaries by consolidating new districts created after the start date of the panel (i.e. 1957) into previous parent districts. For this reason the actual number of districts at the end of the panel period (i.e. 1987) is actually considerably larger than the 271 districts contained in it.

In particular, the dataset includes annual information on the quantity produced of each crop (in tons), the area planted to each crop (in hectares), the area planted to high yield varieties of each major crop (in hectares) and the price of each crop. The quantity and price of the various inputs used in agriculture such as bullocks and tractors and fertilizer consumption (in tons) is also given. The climatic variables included are average monthly rainfall (in millimetres) and average monthly temperature (in degree celsius) for the period 1957 to 1987. Data from the population census is available on the number of persons, literacy, number of cultivators and the number of agriculture laborers. Finally, there is a set of 21 indicator variables each specifying a different soil quality type in the dataset.

2.1.3 Village Dynamics in South Asia Dataset

The Village Dynamics in South Asia Dataset is a panel dataset that covers 594 districts across nineteen states of India and includes annual district level data on agricultural, socioeconomic, climate, edaphic variables and agro-ecological variables for the period 1966 to 2009. It builds and expands on the thirteen states given in the IACD by including the six additional states that are Assam, Himachal Pradesh, Kerala, Chhattisgarh, Jharkhand and Uttarakhand. The dataset uses 1966 as the base year for its districts. Hence, data from child districts formed after 1966 are given back to their respective parent districts to form a comparable sample of districts from 1966 to 2009 that is based on 1966 district boundaries. This is the same process of consolidating child districts into their parent districts that is used by the IACD dataset.

Specifically, the VDSA dataset includes annual information on crop area (in hectares) and production (in tons), price of crops (in rupees), area planted to high yield varieties of each major crop (in hectares), irrigated area, livestock, agricultural implements, average rainfall (in millimetres), fertilizer consumption (in tons) and operational holdings. It also contains population census data on number of persons, literacy, number of cultivators and the number of agriculture laborers.

2.1.4 Combining the IACD with the VDSA datasets

In constructing our panel we combined the data on the thirteen states contained in the IACD dataset from 1957 to 1965 to the data on the same thirteen states in the VDSA dataset from 1966 to 2009. A concern here was that for the period where the two datasets overlapped (i.e. 1966 to 1987) the data between them could be significantly different from each other. We carried out two empirical exercises to show that this is not the case. Firstly, in Figures A.1 and A.2 we show that the correlation between the data on the annual wheat yields and the annual proportion of wheat HYV in the two datasets are quite high. Secondly, in Appendix Table 4b we show regressions for annual wheat yields and annual proportion wheat HYVs that exclude observations that are zero in one of the datasets and non-zero in the other. As is clear from the results dropping observations that are not similar across the two datasets does not reduce the significance or the magnitude of our results.

2.2 Pre-Partition Data

2.2.1 Agricultural Statistics of British India

For our pre-partition analysis we use the Agricultural Statistics Reports of British India to extract information on yields for each of the major crops: Wheat, Rice, Sugar and Maize. The reports were produced on an annual basis by the Department of Revenue and Agriculture of the Colonial government. They contained information on yields for all major crops and most other crops for districts of British India and a select group of princely states. Although the reports came out on an annual basis the yield numbers were only revised after every five years. Therefore the pre-partition panel dataset we constructed contains information on yields for only fours years during the period stretching from 1910 to 1940.[6] The colonial government had started recording rough estimates of acreage and production of the major crops from as early as 1861. However, a concerted effort to systematically collect such information on most crops only began in 1891-92 (Heston, 1973). Our selection of 1910 as the starting point of our pre-partition panel was determined by the substandard quality of data prior to that date.

2.3 Empirical Specification

Our main estimating equation takes the form:

$$Y_{ist} = \beta D_{is}^{51} + \delta Pop_{is}^{51} + \gamma Den_{ist} + \mu Z_{ist} + \eta_{st} + \zeta_s + \alpha_t + \epsilon_{ist} \quad (1)$$

Y_{ist} represents the outcome of interest in district i, in state s, at time t. We examine 2 *crop specific* agricultural outcomes: yield and HYV adoption (defined as acreage using HYV seeds divided by the total amount of land under cultivation). In order to compare districts that grow different crops, we use an overall revenue based measure as well. This measure uses a single calendar year price (in our case 1960)[7] for each crop produced in the district, then dividing by the area under cultivation in that district to construct our "revenue per acre" measure. In some specifications we also use other measures of technology adoption like tractors and fertilizer use per acre, and pre-partition yields to examine the role of migrant placement based on land productivity prior to partition. While our main specification uses the data in panel form, an analogous specification would be to collapse the data at the district level (by taking averages for the entire period for which we have agricultural data, or for specific decades or years) and thus just using cross sectional variation. Not surprisingly, the results with the cross sectional approach are similar and presented in the appendix. The main advantage of the panel form is in our examination of the effect of displaced persons after the green revolution. In some specifications, we interact D_{is}^{51} with the calendar year in the district when the acreage under HYV exceeds 5% (our approximate measure of when the green revolution started in that district). The interaction thus represents the differential impacts due to partition on agricultural outcomes after the start of the green revolution

[6]To be more precise the exact years are 1911, 1921, 1932 and 1938.
[7]We do this to avoid the fact that production in any given year can affect prices.

D_{is} is the main independent variable of interest, the log number of displaced persons (in-migrants) in the district (this is measured at a single time period in 1951). In order to control for the overall size of the district in 1951 we also crucially include the log of the population of that district in 1951 (Pop_{is}). Z_{ist} is a control representing agricultural characteristics of the district like rainfall and soil types in the district (soil types do not vary over time in the district). As mentioned earlier, the IACD data contains information on soil types at the district level, and we control for these as soil conditions might play an important role in the adoption of agricultural technology and agricultural productivity. Finally, we control for broader time invariant characteristics at the state level with state fixed effects (ζ_s), for country level year specific effects with calendar year fixed effects (α_t), and also for state-specific time varying characteristics with state-time trends (η_{st}). Given the panel nature of the data, it is crucial that we cluster our standard errors at the district level.

Although we claim to not highlight a causal link between migration and agricultural development in this paper, it is useful (perhaps for future work in this area) to consider some of the biases that might be present when estimating equation 1. A leading candidate for a variable that we do not measure, but that could be correlated with both displaced persons and agricultural development is government intervention or aid for migrants. There were many programs set up by the government to help with refugee resettlement (land redistribution for example) and these programs could have had direct bearing on agriculture as well. Our estimates on displaced persons in the above estimating equation therefore represent a reduced form or "net" effect of migration and associated changes due to migration on agricultural development. It is important to bear in mind that such an interpretation is still useful as rarely in the world would a mass movement of people take place without other, simultaneous responses (either by governments or by people in receiving countries).

3 Results

The results from estimating equation 1 with different controls is presented in Table 2. The outcome variable in Table 2 is the revenue per acre using 1960 prices. As mentioned earlier, the data is in panel form and hence, we cluster the standard errors at the district level (comparable estimates from a cross section where the average over the entire period is used is presented in Appendix Table 1). In column 1 of Table 2, we estimate equation

1 with no controls for soil conditions and population density, but including controls for state and year fixed effects, as well as state specific time trends. So as to control for the size of the district, we include log of the population in 1951 in all our specifications as well. Column 1 shows that a 10% increase in migrants, is correlated with an increase in revenue by 1.4 Rupees per hectare. Given the average revenue per hectare of approximately 485 Rupees, this is a rather small increase. This average effect likely hides important heterogeneity since some districts had much larger inflows than others. In the Punjab for example, districts like Gurdaspur, Kapurthala and Jalandhar, after partition, were made up of 34, 28 and 25 percent migrants, respectively. On the other hand districts like Mysore, Banglore and Hassan in Karnataka all had close to 0 percent migrants.

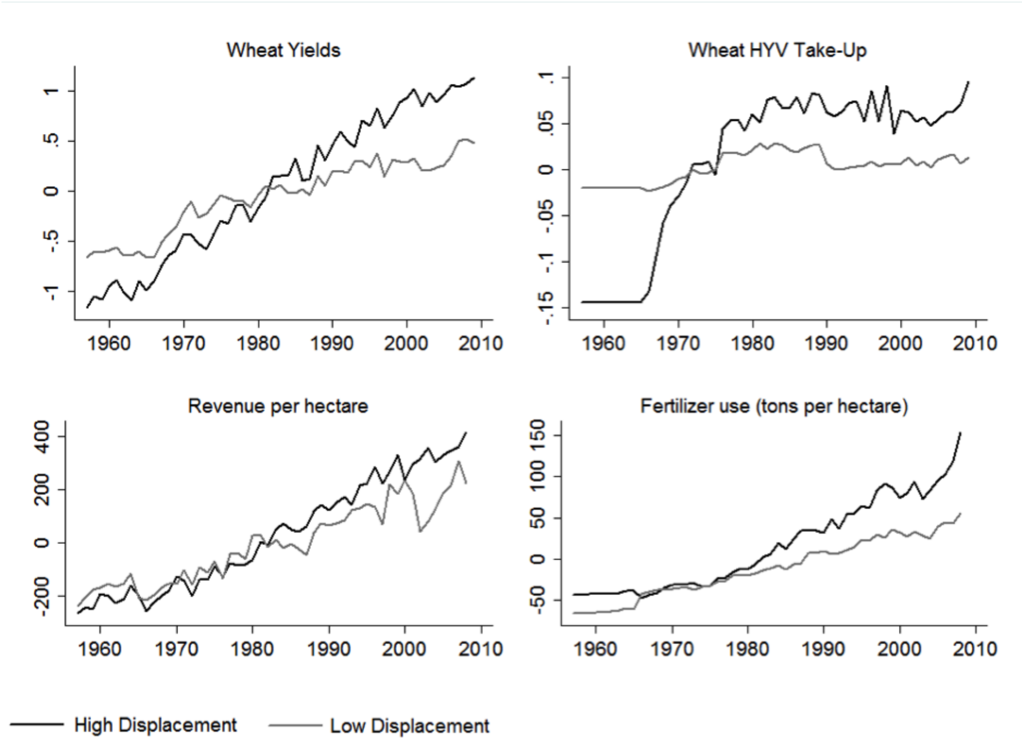
In Columns 2 and 3, we sequentially add the controls of soil quality, population density and rainfall. We do this primarily to asses whether migrant selection into districts was systematically correlated with these variables, which might also affect the outcome of interest. For example, the estimate on log migrants in Column 2 is very similar to the estimate in column 1 (indeed, they are not statistically significantly different from one another), suggesting that migrant selection on the basis of soil quality and suitability for agriculture is not a concern in our case. Similarly, adding population density and average rainfall keeps the results largely stable (although the estimates are not statistically significant in columns 2 and 3).

Table 3 examines whether the effects of migrant presence is greater after the green revolution starts in that particular district. We define the start of the green revolution as the calendar year after which 5% or more of acreage is under HYV seeds.[8] Note that we do not interpret the timing of the green revolution as exogenous. In fact, as we show in Table 4 migrant presence was correlated with the take up of HYV seeds. Instead, our preferred interpretation is that once a certain fraction of acreage is under HYV, the presence of migrants helps revenue from agriculture improve *even more*. The positive and significant coefficients in Table 3 on the interaction confirm this.

Table 4 examines wheat yields and the take up of HYV varieties of wheat as the dependent variable of interest. Both, yields and the take up of HYV are significantly correlated with migrant presence, and the effects are only larger once the green revolution occurs in that district (the cross sectional results for take up of HYV is presented in Appendix

[8]The results on take up of HYV varieties of wheat are similar if we define the green revolution timing to be based on a *national* level; i.e. defining green revolution start as the first year when more than 5% of crops nationally were HYV. These results are available upon request.

Figure 1: Migrant presence and agricultural outcomes



Notes: In High Displacement districts the proportion of in-migrants is either equal to or above the 75th percentile based on the full sample and in the Low Displacement districts it is either equal to or below the 25th percentile. The variable on the y-axis has been stripped of the state fixed effects. For instance in the case of the top left plot we first regressed the wheat yields on state dummies. We then predicted the residual values for wheat yields and plotted these residuals by year, distinguishing between High and Low Displacement districts. We employed the same procedure for all plots in this figure.

Table 2). Visually, this is confirmed in Figure 1. It is important to note here that the individual figures *do* take into account state fixed effects. The figures show that high displacement areas and low displacement areas were quite similar until the mid-late 1960s, after which the high displacement districts see greater revenue, wheat yields, tractor use, and acreage under HYV seeds. This is broadly consistent with the timing of the green revolution (Foster and Rosenzweig, 1996). Table 4 Column 1 suggests that compared to districts that received no migrants districts that received migrants saw yields go up 3.2% - as expected, this effects seems stronger after the green revolution occurs in that district. Column 3 of Table 4 suggests that districts with migrants saw an increase in HYV use of 6% compared to districts with no migrants. These results are similar when we specify the right hand side variable in terms of proportion migrants (rather than log of number of migrants) as shown in Appendix Table 4a. While Columns 1 and 3 are not statistically significant, the migrant proportion interacted with green revolution dummy is statistically significant. Appendix Table 4b shows that these results are also robust to exclusion of mismatching data across the overlapping years in the VDSA and IACD data sets.

Table 5 confirms the graphical result seen for tractor and fertilizer use in regression form - tractor use per acre is 20% higher in areas with migrants compared to areas without, and is even more so after the green revolution; nitrogen fertilizer use is 4.6% higher and phosporous fertilizer use almost 7% in districts with some migrants. Finally Tables 6a and 6b examines the yields of other important crops like rice, sugar and maize (cross sectional regressions are presented in Appendix Table 3). We find a significant correlation between migrant presence and the yields of all crops.

An important consideration here is whether migrant presence was correlated with characteristics of a district that made it predisposed to better agricultural development. For example, if a district had better access to waterways, or better soil, and if migrants concentrated in these districts, it would be difficult to separate the forces of selective migration to districts from the effects of migrant presence and other partition related forces on agricultural outcomes. We have shown earlier in Table 2 and 3 that soil conditions do little to change the overall estimates, suggesting that migrant presence is not correlated systematically in ways with soil conditions that matter for agricultural output. In Table 7, we conduct a more direct test by regressing *pre partition* agricultural output on migrant presence in 1951. While wheat yields appear significantly correlated with migrant presence, this result is not robust to dropping a few states where pre partition data on agricultural yields is considered questionable (Heston, 1973, 1978). Appendix Tables 5a and 5b confirm that even for this limited sample, our *post* partition results are statistically significant with the same sign.

4 Mechanisms

Our empirical analysis in the previous section has shown a positive correlation between the number of in-migrants and long-run agricultural development. In this section we will elucidate two channels through which such a relationship operated. Firstly, in-migrants were more literate than both the natives and the out-migrants, which in turn made them more likely to adopt newer agricultural technology and also enhanced their ability as farm managers and cultivators. Secondly, the occupations they were concentrated in prior to partition gave them a comparative advantage over the natives in skills that were crucial to agricultural development post partition. For instance, Hindu migrants had been engaged in money lending and provided a "much-needed source of credit for cultivation" in the districts from which they emigrated (Raychaudhuri, Habib, and Kumar, 1983). Similarly, the Sikh migrants were either moneylenders or skilled agriculturists whose ability as "husbandmen" and "yeomen" had been acknowledged time and again by the British colonial administrators.[9]

4.1 In-migrants and Education

Figure 2 compares the proxy for the literacy rate of in-migrants with the proxies for the literacy rate of the out-migrants and natives for the four pre-partition census years of 1901, 1911, 1921 and 1931. The proxy for in-migrant literacy is the literacy rate of Hindus and Sikhs in those districts that went to Pakistan and from where they came from. The proxy for native literacy is the literacy rate of Hindus and Sikhs in those districts that remained part of post-partition India. Out-migrant literacy is a proxy for the literacy rate of the persons that left as out-migrants for the pre-partition period. It is equivalent to the proportion of literates amongst Muslims in those districts where they formed a minority religious community in 1901, 1911, 1921 and 1931, respectively. The stark difference between the literacy rates is quite revealing. As can be seen the literacy

[9] Ideally, we would have liked to distinguish between the affect of Hindu and Sikh migrants in our paper. However, the 1951 census of India does not record the religion of the displaced migrants.

of in-migrants was much higher than that of the out-migrants and natives throughout the four pre-partition census years of 1901, 1911, 1921 and 1931. Such a trend is suggestive of the partition representing a positive shock to the human capital stock of the districts in which the migrants settled. It shows that the educational dominance of the in-migrants over the natives and the out-migrants was a phenomenon that was maintained throughout the pre-partition period. Simple correlations in Appendix Table 5a shows that migrant presence is indeed correlated with increased literacy at the district in subsequent years.

Colonial administrators in their observations on literacy also repeatedly acknowledged their superior educational achievements. The gazetteers of the western Punjab districts that went to Pakistan – and from where the in-migrants came from – included statements highlighting the above average literacy amongst the Hindu and Sikh communities. For instance in the 1907 gazetteer of the Attock district it was noted that literacy was "highest among Hindus and Sikhs, among the non-Christian population". The Lahore district gazetteer of 1883-84 deemed the pre-eminence of the Hindus in education as "remarkable" and noted that "considerable progress" had been made in education of Sikh males.

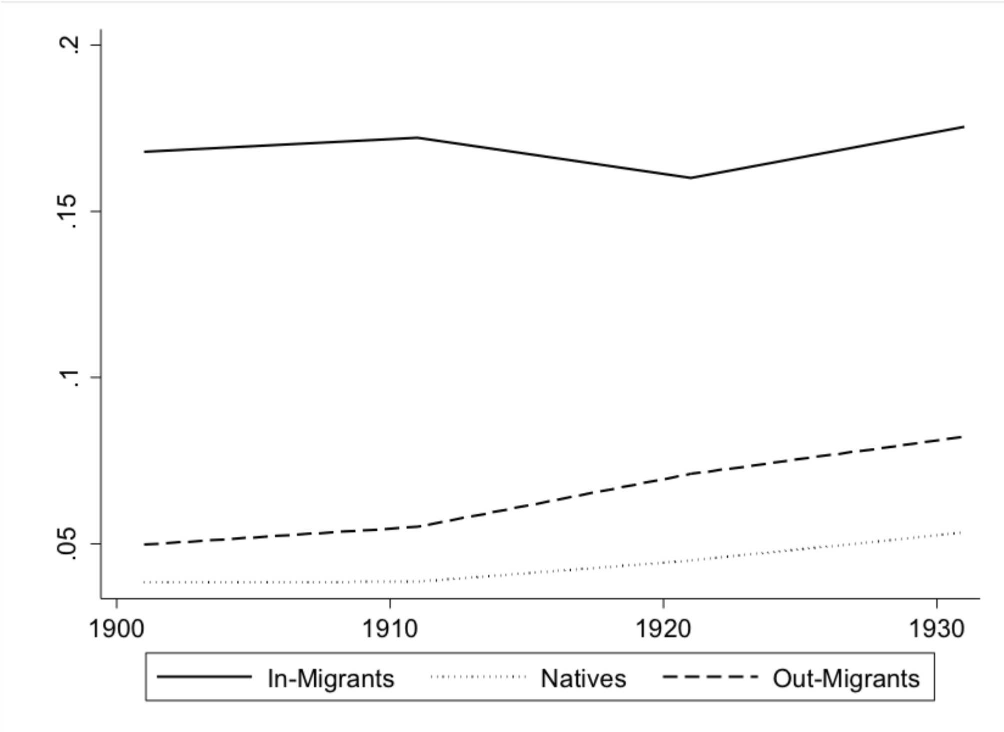
Interestingly, the 1929 Muzaffargarh district gazetteer went so far as to suggest that "no special measures were necessary in the case of Hindus and Sikhs" as they were "ready to take advantage of every opportunity" of providing education to their children. It is also clear from the statements that the higher literacy of the Hindus and Sikhs in the Western Punjabi districts was linked to their status as minority religious groups. The 1881 census of Punjab noted that "the proportion of Hindus at school or already educated" steadily rose "from one division to another as the generally Hindu character" of the population decreased. The same observation is made about the Sikhs.[10] Of course it is not possible to isolate the affect of minority status on education but still the relationship between the two could be important in explaining why the Hindus and Sikhs of western Punjab were highly literate.

4.2 Education and Agriculture

Both the trends in the literacy rates and the observations of British colonial administrators summarized in the previous section have shown that the in-migrants did indeed represent a net addition to the human capital stock of the districts in which they settled.

[10] Punjab (India), and Sir Denzil Ibbetson. Report on the Census of the Panjab Taken on the 17th of February 1881. Superintendent of Government Prtg., 1883. Text and Appendices. Page 138.

FIGURE 2: In-migrant, native and out-migrant literacy prior to partition.



Notes: The in-migrant literacy is a proxy for the literacy rate of the persons that arrived as in-migrants for the pre-partition period. It is equivalent to the proportion of literates amongst Hindus and Sikhs in those districts where they formed a minority religious community in 1901, 1911, 1921 and 1931, respectively. Native literacy is a proxy for the literacy rate of the persons that remained as natives for the pre-partition period. It is equivalent to the proportion of literates amongst Hindus and Sikhs in those districts where they formed a majority religious community in 1901, 1911, 1921 and 1931, respectively. Out-migrant literacy is a proxy for the literacy rate of the persons that left as out-migrants for the pre-partition period. It is equivalent to the proportion of literates amongst Muslims in those districts where they formed a minority religious community in 1901, 1911, 1921 and 1931, respectively.

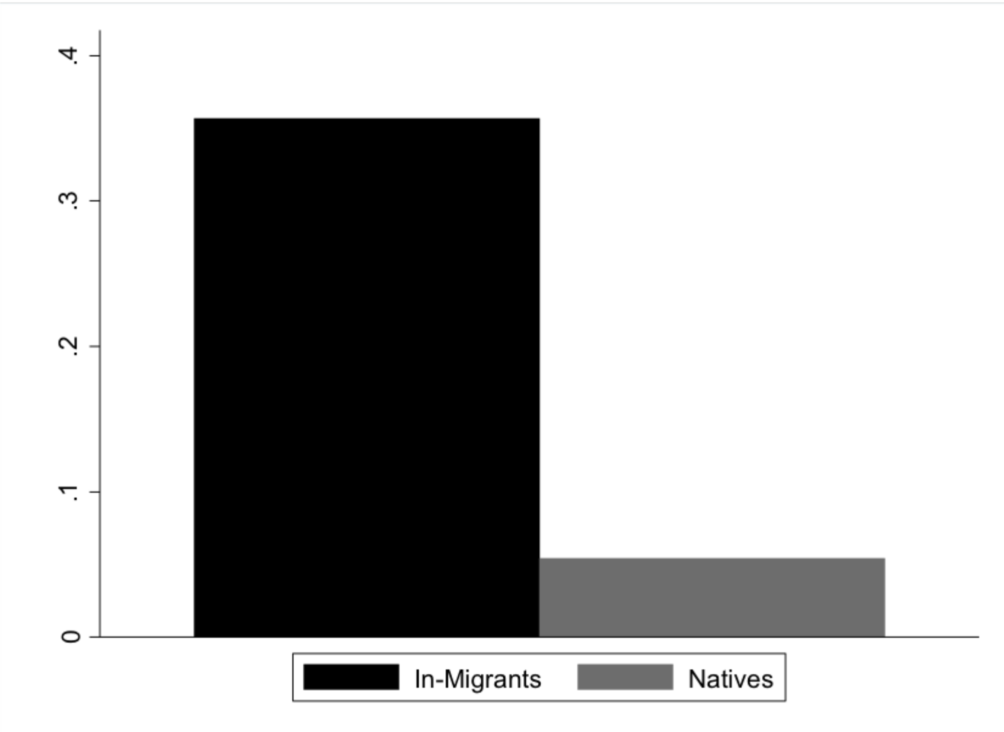
Although, it still remains to be shown how the additional human capital that the in-migrants possessed translated into greater adoption of agricultural technology and higher growth in agricultural yields during the post-partition period. Here we turn to that strand of the literature in agricultural economics that argues for the positive externalities of education in the shape of faster and more extensive agricultural technology adoption and higher agricultural yields. The earliest writings that established a link between human capital and agricultural technology adoption were by Schultz (1964). In an important review, Feder, Just, and Zilberman (1985) claim that Schultz (1964) argued that technology adoption required the "ability to perceive, interpret, and respond to new events in the context of risk" and that such ability was derived through human capital. The underlying hypothesis of Shultz's study and others like it was that education increased the ability of a farmer to "understand and evaluate the information on new products and processes" which in turn led to the earlier adoption of technology (Feder, Just, and Zilberman, 1985). Testing Schultz's hypothesis, Gerhart (1974) found that education increased the likelihood of adoption of hybrid maize amongst Kenyan farmers. In another study Rosenzweig (1978) found that the probability of adopting high yield varieties of grain in the Punjab was positively related to farmer education and farm size. Jamison, Lau, et al. (1982) found that in the case of Thailand education of farmers had a positive impact on the adoption of chemical inputs above a threshold level of 4 years of formal schooling. All these papers used a combination of panel data and discrete choice models to examine the empirical relationship between technology adoption and human capital. In our context, we show using simple correlations in Table 5b, that literacy at the district level is positively related to the take up of HYV variety of seeds.

In addition to papers cited above that show how farmer education leads to faster technology adoption there are others that show how it leads to higher agricultural yields. For instance Ram (1976) in a study on India found that the contribution of farm operators to production was positively related to their education. Sidhu (1976) in another study on the Indian Punjab found that farmers' education had a positive impact on both the yields as well as gross sales revenue from the lands they cultivated in the early stages of the Green Revolution.

4.3 In-migrants and Occupation

The other important dimension along which in-migrants differed from the native population was occupation. Large proportions of them belonged to traditional commercial castes that were involved in small-scale money lending to farmers for agricultural purposes.[11] This is evident when one examines the occupational choices of the Hindu and Sikhs in the western districts of Punjab that formed the bulk of the in-migrant community. Almost every village in the western Punjab had a traditional moneylender who was either a Hindu or Sikh and who provided a "much needed source of credit for cultivation" (Raychaudhuri, Habib, and Kumar, 1983). Figure 3 provides a snapshot at partition of the predominance of the in-migrants over the natives in commercial occupations. It compares the proportion of in-migrants engaged in commerce against the same proportion for the native population based on actual data on both groups from the 1951 census.

Figure 3: Proportion in the commercial sector at partition.



Notes: The bar for in-migrants is the proportion of the displaced persons that were previously engaged in commerce. This data is given in Appendix II of Table IV of the 1951 census of India. The bar for natives is the proportion of the non-displaced persons that were previously engaged in commerce. This data is available in the 1951 census of India.

[11]The commercial castes were the Khatris, Aroras and Baniahs

As was the case with their education the higher concentration of the in-migrants in commercial occupations was also noted in official publications dating from the pre-partition period. The notes, again, pertain to the minority Hindu and Sikh communities of Western Punjab that formed the bulk of in-migrants at partition. For instance, the (1881) census of Punjab states that the Hindus and Sikhs of the Western divisions were mostly traders.[12] According to the (1884) gazetteer of the south-western Muzzaffargarh district "almost the whole of the trade, moneylending, and banking" was in the hands of the Hindus from the Arora caste.[13] The Hindu Aroras were also considered as being the "chief moneylenders and capitalists" and the "chief creditors of the agriculturists" in the central-western Jhang district.[14] In the central-western district of Montgomery the Hindu and Sikh Aroras were identified as being the main moneylenders.[15] The three most numerically important Hindu castes in the north-western district of Attock were said to have divided amongst themselves "almost the whole trade and money-lending business".[16] These statements and others like them provide ample evidence for the fact that the in-migrant community had a substantial presence in commercial occupations such as moneylending and trade in the districts from which they came from prior to partition.

4.4 Occupation and Agriculture

Having established the high concentration of in-migrants in commercial occupations we now need to ask whether commerce is indeed important to agricultural development. Let us consider the arguments that link commerce with technology adoption. One of the main constraints that farmers in developing countries face in adopting new technologies is lack of credit. It is often the case that introducing a "high yield variety of a crop" or "purchasing a tractor" requires having access to loans because farmers simply do not have adequate savings to make such changes on their own. Access to credit then acts as a supplement to savings that can be used to invest in technology. The provision of credit can also reduce risks farmers face in their lives as it cushions them from extreme fluctuations in agricultural output. The reduction in risk in turn makes them more likely to adopt newer, more risky, technologies. Several papers in the literature on agricultural

[12] Report on the Census of the Panjab Taken on the 17th of February 1881. Page 125-138.
[13] Gazetteers, Punjab District. Gazetteer of the Muzaffargarh District, 1929. Page 78.
[14] Gazetteers, Punjab District. Gazetteer of the Jhang District, 1883-84. (1884). Page 68.
[15] Gazetteers, Punjab District. Gazetteer of the Montgomery District, 1883-84. (1884). Page 69-70.
[16] Gazetteers, Punjab District. Gazetteer of the Attock District, 1930. Page 115.

development correlate “differential access to capital” to “differential rates” of technology adoption. For instance, in a study of Indian agriculture Bhalla (1979) shows that “access to credit” could be “responsible for the gain in HYV area made by the large farmers”. Pitt and Sumodiningrat (1991) use farm level data from Indonesia to show that the adoption of HYV is positively associated with availability of credit. Lipton (1976) shows that rural credit increases the use of indivisible technologies that require large investments such as tractors and other machines.

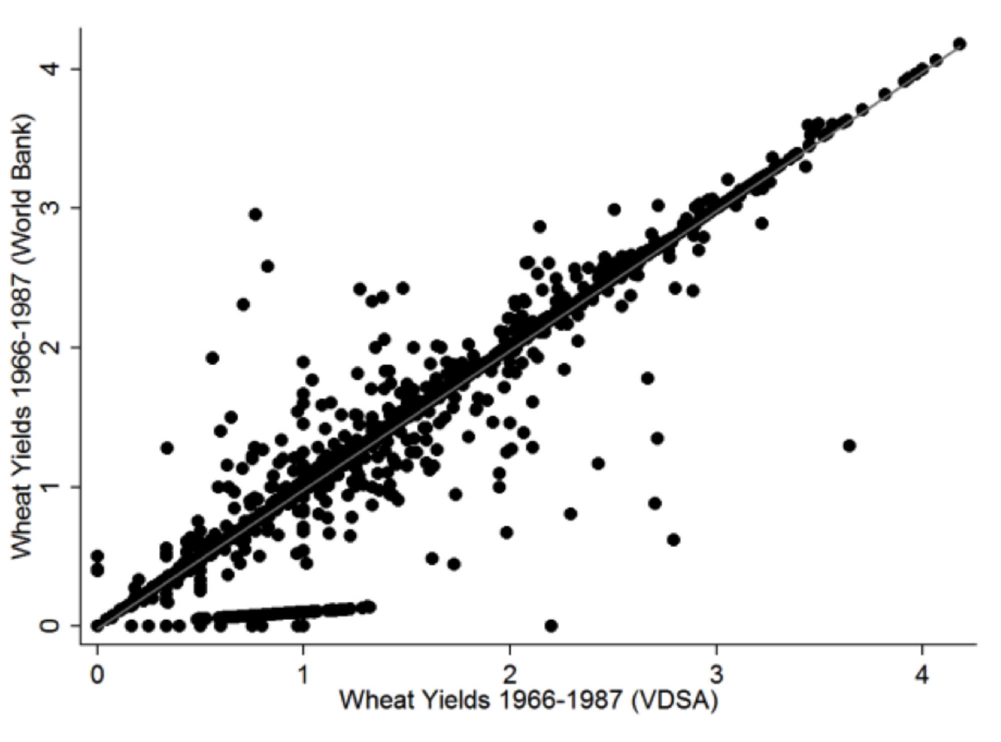
5 Conclusion

In this study we examine the impact of intensity of displacement at partition on agricultural productivity and the take up of agricultural technology post partition. Using migrant presence as a proxy for the intensity of displacement, we find that areas with more migrants have higher average yields, are more likely to take up High Yielding Varieties (HYV) of seeds, and are more likely to use agricultural technologies within the first 60 years after partition in India. We further show, using pre-partition agricultural data, that the effects are not solely explained by selective migration into districts with a higher potential for agricultural development. We then argue that the greater levels of education of the migrants and their higher concentration in commerce relative to both the natives who stayed and the migrants who moved contributed to agricultural development post partition.

While our work highlights important correlations in this area, it should not be interpreted as the causal effect of partition induced migration. The main reason for this is that the partition simultaneously resulted in many changes, migration being just one component. Hence, isolating the effect of migration alone is a rather impossible task. Despite these caveats, we believe this paper makes an important contribution towards understanding the long run trajectory of places affected by the partition in India. More studies are needed in this area as partitions accompanied by mass human movements are still very much a part of the current global political environment, and understanding their lasting impacts on growth and economic development will be crucial.

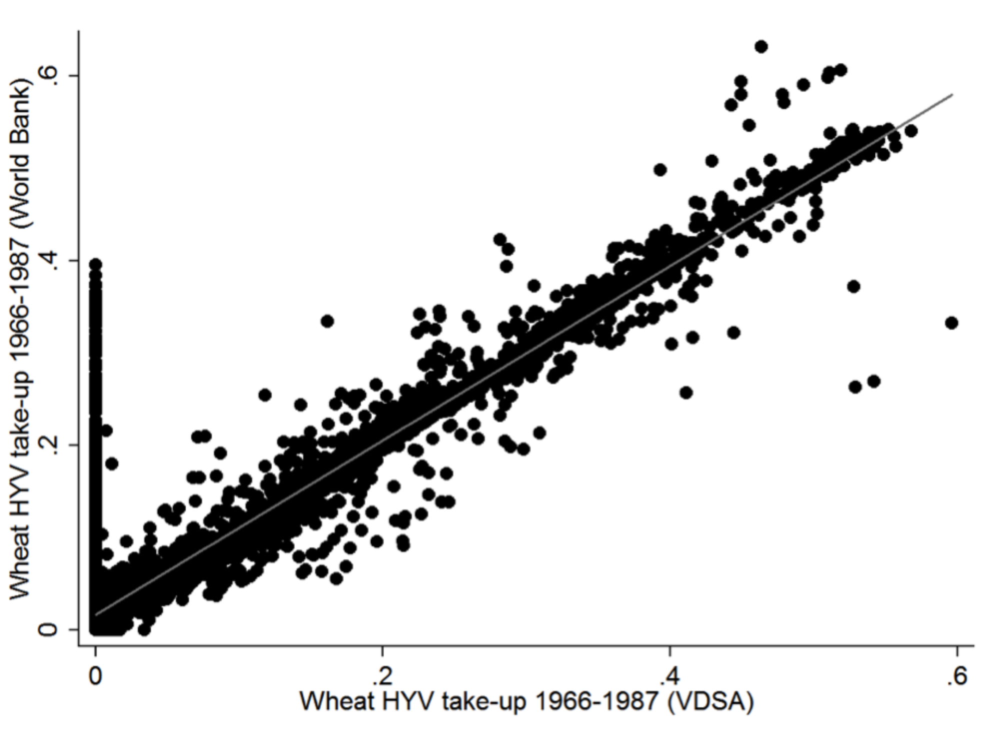
A Appendix

Figure A.1: IACD to VDSA Wheat Yields Comparison (1966-87).



Notes: There were 19 cases in which for the same year and district the annual wheat yield was zero in the World Bank dataset but was non-zero in the VDSA dataset. 68% of these cases came from the Andhra Pradesh state and 32% came from the Karnataka state. On the other hand there were 5 cases in which for the same year and district the annual wheat yield was zero in the VDSA dataset but was non-zero in the World Bank dataset. 80% of these cases came from the Karnataka state and 20% came from the Maharashtra state.

Figure A.2: IACD to VDSA Wheat HYV Take Up Comparison (1966-87).



Notes: There were 22 cases in which for the same year and district the annual fraction of HYV of wheat was zero in the World Bank dataset but was non-zero in the VDSA dataset. 82% of these cases came from the Maharashtra state, 9% came from the Gujarat state, 4.5% from Rajasthan state and 4.5% from Tamil Nadu state. On the other hand there were 475 cases in which for the same year and district the annual fraction of HYV of wheat was zero in the VDSA dataset but was non-zero in the World Bank dataset. 98.3% of these cases came from the Uttar Pradesh state, 0.9% came from the Andhra Pradesh state, 0.2% came from the Gujarat state, 0.4% came from the Madhya Pradesh state and 0.2% came from the Orissa state.

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Table 1. Summary Statistics

Variable	Mean	Median	Standard Deviation	Number of Observations
Annual Wheat Yields (1957-2009) (tons per hectare)	1.489351	1.291846	0.8928221	12763
Annual Take-Up of HYVs of Wheat (1957-2009)	0.0702903	0.0048164	0.1275124	11573
Annual Revenue per hectare based on 1960 prices (rupees per hectare)	493.3906	386.9451	356.9391	11500
Annual consumption of Nitrogen Fertilizer (tons)	40.24067	16.26249	118.8009	13001
Annual consumption of Phosphorus Fertilizer (tons)	15.81228	5.905565	50.42723	13001
Annual consumption of Potassium Fertilizer (tons)	10.2566	1.257571	99.38923	13001
Annual number of tractors per 1000 hectares (1957-1987)	1.811449	0.3952479	4.89581	8370
Log of Number In-Migrants (1951)	7.443211	7.548975	2.576294	270
Log of Population (1951)	13.79153	13.84592	0.638946	270
Average Annual Rainfall (1957-2009) (millimeters)	1039.807	945	573.9935	13971
Population Desnity (1961)	1.789214	1.250549	2.117194	270

Table 2. Annual Revenue Per Hectare based on 1960 prices and Log In-Migrants at Partition

	Annual revenue (in Rupees) per hectare based on 1960 prices		
	(1)	(2)	(3)
Log of In-Migrants (1951)	14.14289*	12.70319	11.2657
	(7.596672)	(8.480939)	(8.025915)
Mean Outcome	485.6402	484.6767	478.0706
No of observations	11194	11164	11008
Controls			
Soil Quality Dummies	No	Yes	Yes
Population Density (1961)	No	No	Yes
Annual Average Rainfall	No	No	Yes

Notes: This table shows regressions of annual revenue per hectare based on 1960 crop prices for the period 1957 to 2009 on the log number of In-Migrants in 1951. The unit in which revenue is measured is rupees. All the above models include the log of population in 1951, state fixed effects, year fixed effects and state-specific time trends. Additionally, Model 2 includes 21 dummies which caputre soil quality and Model 3 includes both the soil 21 quality dummies, annual average rainfall and population density in earliest available year which is 1961.* $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors (at the district level) in parentheses. Data used is a combination of IACD (1957 to 1965) and VDSA (1966-2009).

Table 3. Annual Revenue Per Hectare based on 1960 prices and Interaction between Log In-Migrants at Partition & Post Green Revolution Dummy

	Annual revenue (in Rupees) per hectare based on 1960 prices		
	(1)	(2)	(3)
Log of In-Migrants (1951)	9.69778	8.674226	7.378831
	(6.407303)	(7.448809)	(7.051833)
Log of In-Migrants (1951) X Green Revolution	7.242736*	6.599836*	6.333509*
	(3.851677)	(3.764309)	(3.66449)
Mean Outcome	485.6402	484.6767	478.0706
No of observations	11194	11164	11008
Controls			
Soil Quality Dummies	No	Yes	Yes
Population Density (1961)	No	No	Yes
Annual Average Rainfall	No	No	Yes

Notes: This table shows regressions of annual revenue per hectare based on 1960 crop prices for the period 1957 to 2009 on the interaction between the post green revolution dummy and log number of In-Migrants in 1951 and the green revolution dummy. The unit in which revenue is measured is rupees. All the above models include the interaction between the post green revolution dummy (defined as taking a value 1 on or after the first year in which the proportion of HYV area for all major crops exceeds 5% and 0 otherwise) and the log number of In-Mgrants in 1951, the log of population in 1951, the interaction of log of population in 1951 with post green revolution dummy, the post green revolution dummy, state fixed effects, year fixed effects and state-specific time trends. Additionally, Model 2 includes 21 dummies which caputre soil quality and Model 3 includes both the soil 21 quality dummies, annual average rainfall and population density in earliest available year which is 1961.* $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors (at the district level) in parentheses. Data used is a combination of IACD (1957 to 1965) and VDSA (1966-2009).

Table 4. Annual Wheat Yields, HYV take up and Log In-Migrants at Partition

	Annual yields		Take up of HYV Variety	
	(1)	(2)	(3)	(4)
Log of In-Migrants (1951)	0.0475549***	0.0198916**	0.0042033***	-0.0022683*
	(0.0115773)	(0.0098185)	(0.0013085)	(0.0013431)
Log of In-Migrants (1951) X Green Revolution		0.0476798***		0.0128309***
		(0.0090561)		(0.002222)
Mean Outcome	1.458711	1.458711	0.0707095	0.0707095
No of observations	12018	12018	10969	10969
Controls				
Soil Quality Dummies	Yes	Yes	Yes	Yes
Annual Average Rainfall	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes

Notes: Column 1 of this table shows the regression of annual wheat yields for the period 1957 to 2009 on log of In-Migrants in 1951. Column 2 adds the interaction between the post green revolution dummy (defined as taking a value 1 on or after the first year in which the proportion of HYV area for all major crops exceeds 5% and 0 otherwise) and the log number of In-Mgrants in 1951, the interaction of log of population in 1951 and post green revolution dummy and the post green revolution dummy to the regression model in Column 1. Columns 3 and 4 replace annual wheat yields with annual rice yields as the dependent variable. The unit in which yields are measured is tons per hectare. All the above models include the log of population in 1951, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality and population density in earliest available year which is 1961. * p < .10, ** p < .05, *** p < .01. Clustered standard errors (at the district level) in parentheses. Data used is a combination of IACD (1957 to 1965) and VDSA (1966-2009).

Table 5. Annual Use of Tractors and Log In-Migrants at Partition

	Tractors per 1000 hectares of land		Consumption of Nitrogen fertilizer per hectare		Consumption of Phosphorus fertilizer per hectare	
	(1)	(2)	(3)	(4)	(5)	(6)
Log of Number In-Migrants (1951)	0.379***	0.176***	1.533622**	0.1227316	0.9179847***	0.2577554
	(0.078)	(0.045)	(0.6611773)	(0.4772413)	(0.3017061)	(0.2262)
Log Migrants X Green Revolution		0.375***		2.541268***		1.215657***
		(0.093)		(0.697769)		(0.366134)
Mean Outcome	1.811	1.811	33.18667	33.18667	13.115	13.115
No of observations	8370	8370	12229	12229	12229	12229
Controls						
Soil Quality Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes	Yes	Yes
Annual Average Rainfall	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The annual use of tractors is measured as the number of tractors per thousand hecatares of the land that is planted in a given year. Tractor data is only avaialble in the IACD dataset, and hence available from 1958-1987. Data on fertilizers is available only in the VDSA data and available from 1966-2009. The annual consumption of Nitrogen and Phosphorus fertilizers is measured in tons. All the above models include log of population in 1951, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality and population density in earliest available year which is 1961.* p < .10, ** p < .05, *** p < .01. Clustered standard errors in parentheses.

Table 6a. Annual Yields of Other Crops

	Annual yields		
	Rice	Sugar	Maize
	(1)	(2)	(3)
Log of Number In-Migrants (1951)	0.0374357***	0.0794913***	0.0291112***
	(0.0134525)	(0.0280459)	(0.0108072)
Mean Outcome	1.313141	5.151847	1.318096
No of observations	12408	12035	11900
Controls			
Soil Quality Dummies	Yes	Yes	Yes
Annual Average Rainfall	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes

Notes: Column 1 of this table shows the regression of annual wheat yields for the period 1957 to 2009 on log of In-Migrants in 1951. Columns 2 and 3 replace annual rice yields with annual sugar yields and annual maize yields, respectively, as the dependent variable. The unit in which yields are measured is tons per hectare. All the above models include log of population in 1951, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality, annual average rainfall and population density in earliest available year which is 1961. * p < .10, ** p < .05, *** p < .01. Clustered standard errors (at the district level) in parentheses.

Table 6b. Annual Yields of Other Crops and the green revolution

	Annual yields		
	Rice	Sugar	Maize
	(1)	(2)	(3)
Log of Number In-Migrants (1951)	0.0170789	0.0787796***	0.0162703
	(0.0121191)	(0.0297444)	(0.011606)
Log of Number of In-Migrants (1951) X Green Revolution	0.0348261***	0.0016409	0.0216897**
	(0.0090525)	(0.0252829)	(0.0109214)
Mean Outcome	1.313141	5.151847	1.318096
No of observations	12408	12035	11900
Controls			
Soil Quality Dummies	Yes	Yes	Yes
Annual Average Rainfall	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes

Notes: Column 1 of this table shows the regression of annual wheat yields for the period 1957 to 2009 on on the interaction between the post green revolution dummy and log number of In-Migrants in 1951. Columns 2 and 3 replace annual rice yields with annual sugar yields and annual maize yields, respectively, as the dependent variable. The unit in which yields are measured is tons per hectare. All the above models include log of population in 1951, interaction between log of population in 1951 and post green revolution dummy, post green revolution dummy, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality, annual average rainfall and population density in earliest available year which is 1961.. * p < .10, ** p < .05, *** p < .01. Clustered standard errors in parentheses. Data used is a combination of IACD (1957 to 1965) and VDSA (1966-2009).

Table 7. Annual Yields for Rice and Wheat during pre-partition and Log In-Migrants at Partition

	Annual yields during pre-partition	
	Wheat	Rice
Log of Number In-Migrants (1951)	22.97*	15.01
	(12.69)	(17.31)
Mean Outcome	789.04	844.92
No of observations	295	282

	Annual yields during pre-partition, excluding Bihar and Orissa	
	Wheat	Rice
Log of Number In-Migrants (1951)	18.54	5.162
	(13.66)	(17.93)
Mean Outcome	813.28	858.29
No of observations	248	240

	Annual yields during pre-partition, excluing Bihar, Bengal and Orissa	
	Wheat	Rice
Log of Number In-Migrants (1951)	20.10	5.268
	(13.93)	(18.27)
Mean Outcome	810.09	849.29
No of observations	228	220

Notes: This table shows regressions of annual wheat yields for the pre-partition period 1911 to 1938 on the log number of In-Migrants in 1951. The unit in which yields are measured is lbs per acre. All the above models include log of population in 1951, state fixed effects, year fixed effects and state-specific time trends.* $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors in parentheses.

Appendix Table 1. Average Annual Revenue Per Hectare based on 1960 prices (1957 to 2009) and Log In-Migrants at Partition

	Average Annual Revenue Per Hectare Based on 1960 prices (1957 to 2009)		
	Model (1)	Model (2)	Model (3)
Log of Number In-Migrants (1951)	20.26255***	20.94112**	20.57974**
	(7.793148)	(9.135001)	(9.154504)
Mean Outcome	501.8108	501.9992	501.9992
No of observations	269	268	268
Controls			
Soil Quality Dummies	No	Yes	Yes
Population Density (1961)	No	No	Yes

Notes: This table shows regressions of annual revenue per hectare of from all crops averaged over the period 1957 to 2009 on the log number of In-Migrants in 1951. The annual revenue is measured in terms of Rupees. All the above models include state fixed effects. Additionally, Model 2 includes 21 dummies which caputre soil quality and Model 3 includes both the 21 soil quality dummies and population density in earliest available year which is 1961.* p < .10, ** p < .05, *** p < .01. Clustered standard errors in parentheses.

Appendix Table 2. Average Annual Take-Up of HYVs of Wheat (1957 to 2009) and Log In-Migrants at Partition

	Average Annual Take-Up of HYVs of Wheat (1957 to 2009)		
	Model (1)	Model (2)	Model (3)
Log of Number In-Migrants (1951)	0.0032294**	0.0040117***	0.0040259***
	(0.0013287)	(0.0013527)	(0.0013617)
Mean Outcome	0.0699886	0.0702446	0.0702446
No of observations	269	268	268
Controls			
Soil Quality Dummies	No	Yes	Yes
Population Density (1961)	No	No	Yes

Notes: This table shows regressions of annual take-up of High Yielding Varieties (HYVs) of wheat averaged over the period 1957 to 2009 on the log number of In-Migrants in 1951. The annual take-up of HYV of wheat is measured as the proprotion of total area planted to all crops in a given year that is devoted to HYVs of wheat. All the above models include state fixed effects. Additionally, Model 2 includes 21 dummies which caputre soil quality and Model 3 includes both the 21 soil quality dummies and population density in earliest available year which is 1961.* p < .10, ** p < .05, *** p < .01. Clustered standard errors in parentheses.

Appendix Table 3. Average Annual Yields for Rice, Sugar and Maize (1957 to 2009) and Log In-Migrants at Partition

	Average Annual Yields (1957 to 2009)			
	Rice	Sugar	Maize	Wheat
Log of Number In-Migrants (1951)	0.0306787**	0.105033***	0.0331484***	0.0455952***
	(0.0144964)	(0.0333062)	(0.0121921)	(0.0120571)
Mean Outcome	1.344365	5.242782	1.336976	1.388879
No of observations	265	263	266	264
Controls				
Soil Quality Dummies	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes

Notes: This table shows regressions of annual yields for rice, maize and sugar averaged over the period 1957 to 2009 on the log number of In-Migrants in 1951. The unit in which yields are measured is tons per hectare. All the above models include state fixed effects, 21 dummies which caputre soil quality and population density in earliest available year which is 1961.* p < .10, ** p < .05, *** p < .01. Clustered standard errors in parentheses.

Appendix Table 4a: Annual Yields and Proportion In-Migrants at Partition

	Annual Wheat Yields		Annual Rice Yields	
	(1)	(2)	(3)	(4)
Proportion In-Migrants (1951)	0.3658229	-0.2270385	0.4478584	-0.4987576
	(0.3056746)	(0.2487589)	(0.5415853)	(0.4628095)
Proportion In-Migrants (1951) X Green Revolution		0.8695663***		1.373403***
		(0.2539102)		(0.4325397)
Mean Outcome	1.458711	1.458711	1.313141	1.313141
No of observations	12018	12018	12408	12408
Controls				
Soil Quality Dummies	Yes	Yes	Yes	Yes
Annual Average Rainfall	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes

Notes: Column 1 of this table shows the regression of annual wheat yields for the period 1957 to 2009 on Proportion In-Migrants in 1951. Column 2 adds the interaction between the green revolution dummy (defined as taking a value 1 on or after the first year in which the proportion of HYV area for all major crops exceeds 5% and 0 otherwise) and Proportion In-Migrants in 1951 and the green revolution dummy to the regression model in Column 1. Columns 3 and 4 replace annual wheat yields with annual rice yields as the dependent variable. The unit in which yields are measured is tons per hectare. All the above models include state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality, annual average rainfall and population density in earliest available year which is 1961. * $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors (at the district level) in parentheses.

Appendix Table 4b. Annual Wheat Yields, HYV take up and Log In-Migrants at Partition - accounting for overlapping data

	Annual yields		Take up of HYV Variety	
	(1)	(2)	(3)	(4)
Log of In-Migrants (1951)	0.0480495***	0.0202865**	0.004287***	-0.0022836
	(0.0115738)	(0.0098704)	(0.0013767)	(0.0014496)
Log of In-Migrants (1951) X Green Revolution		0.047772***		0.0126167***
		(0.0091632)		(0.0022164)
Mean Outcome	1.460916	1.460916	0.0736552	0.0736552
No of observations	11999	11999	10528	10528
Controls				
Soil Quality Dummies	Yes	Yes	Yes	Yes
Annual Average Rainfall	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes

Notes: Column 1 of this table shows the regression of annual wheat yields for the period 1957 to 2009 on log of In-Migrants in 1951. Column 2 adds the interaction between the post green revolution dummy (defined as taking a value 1 on or after the first year in which the proportion of HYV area for all major crops exceeds 5% and 0 otherwise) and the log number of In-Mgrants in 1951, the interaction of log of population in 1951 and post green revolution dummy and the post green revolution dummy to the regression model in Column 1. Columns 3 and 4 replace annual wheat yields with annual rice yields as the dependent variable. The unit in which yields are measured is tons per hectare. All the above models include the log of population in 1951, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality, average annual rainfall and population density in earliest available year which is 1961. * $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors (at the district level) in parentheses. Data used is a combination of IACD (1957 to 1965) and VDSA (1966-2009). Additionally for those years that overlap between the IACD and VDSA (1966 to 1987) it excludes observations where the dependent variable was either zero in IACD and non-zero in VDSA or non-zero in IACD and zero in VDSA.

Appendix Table 5a. Annual Wheat Yields, HYV take up and Log In-Migrants at Partition

	Annual wheat yields		Take up of HYV Variety	
	(1)	(2)	(3)	(4)
Log of Number In-Migrants (1951)	0.0617377**	0.0374634	0.0068715**	-0.0042694
	(0.0296534)	(0.0270722)	(0.002891)	(0.0037026)
Log of Number of In-Migrants (1951) X Green Revolution		0.0377477**		0.0219015***
		(0.016656)		(0.0057222)
Mean Outcome	1.530777	1.530777	0.1210586	0.1210586
No of observations	3342	3342	2703	2703
Controls				
Soil Quality Dummies	Yes	Yes	Yes	Yes
Average Annual Rainfall	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes

Notes: The yields regressions in this table are based on the sample of 67 districts for which there was data available on wheat yields on a consistent basis for the pre-partition period 1911 to 1938. Column 1 shows the regression of annual wheat yields for the period 1957 to 2009 on the log number of In-Migrants in 1951. Column 2 adds the interaction between the green revolution dummy and log number of In-Migrants in 1951, the green revolution dummy and the interaction between the green revolution dummy and log of population in 1951 to the regression model in Column 1. The unit in which yields are measured is tons per hectare. Columns 3 and 4 replace annual wheat yields with the take-up of High Yield Varieties (i.e. HYV) of Wheat as the dependent variable. The wheat HYV take-up regressions in this table are based on the sample of 68 districts for which there was data available on wheat yields on a consistent basis for the pre-partition period 1911 to 1938. The HYV take-up of Wheat is measured as the proprotion of total area planted to all crops in a given year that is devoted to HYVs of wheat. All the above models include log of population in 1951, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality, average annual rainfall and population density in earliest available year which is 1961. * $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors in parentheses.

Appendix Table 5b. Annual Wheat Yields, HYV take up and Log In-Migrants at Partition (excluing Bihar, Bengal and Orissa)

	Annual wheat yields		Take up of HYV Variety	
	(1)	(2)	(3)	(4)
Log of Number In-Migrants (1951)	0.0796982**	0.0432584	0.0099287***	-0.0061794
	(0.03456)	(0.0314304)	(0.0026516)	(0.0039061)
Log of Number of In-Migrants (1951) X Green Revolution		0.0577688***		0.0314265***
		(0.019459)		(0.0057455)
Mean Outcome	1.541978	1.541978	0.1286519	0.1286519
No of observations	2650	2650	2287	2287
Controls				
Soil Quality Dummies	Yes	Yes	Yes	Yes
Average Annual Rainfall	Yes	Yes	Yes	Yes
Population Density (1961)	Yes	Yes	Yes	Yes

Notes: The yields regressions in this table are based on the sample of 52 districts (excluding those of Bihar, Bengal and Orissa) for which there was data available on wheat yields on a consistent basis for the pre-partition period 1911 to 1938. Column 1 shows the regression of annual wheat yields for the period 1957 to 2009 on the log number of In-Migrants in 1951. Column 2 adds the interaction between the green revolution dummy and log number of In-Migrants in 1951, the green revolution dummy and the interaction between the green revolution dummy and log of population in 1951 to the regression model in Column 1. The unit in which yields are measured is tons per hectare. Columns 3 and 4 replace annual wheat yields with the take-up of High Yield Varieties (i.e. HYV) of Wheat as the dependent variable. The wheat HYV take-up regressions in this table are based on the sample of 53 districts (excluding those of Bihar, Bengal and Orissa) for which there was data available on wheat yields on a consistent basis for the pre-partition period 1911 to 1938. The HYV take-up of Wheat is measured as the proprotion of total area planted to all crops in a given year that is devoted to HYVs of wheat. All the above models include log of population in 1951, state fixed effects, year fixed effects, state-specific time trends, 21 dummies which caputre soil quality and population density in earliest available year which is 1961. * $p < .10$, ** $p < .05$, *** $p < .01$. Clustered standard errors in parentheses.