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Time to remit: the effect of remittances on household consumption and dietary diversity in India

Abstract

India has enjoyed over twenty years of rapid economic growth. The benefits of this growth, however, have largely bypassed India's poor; around a quarter of the world's malnourished children reside in India, and their health poses a significant challenge for the Indian government. Although the growth in India's domestic economy did not result in many trickle-down benefits for the hungry poor, anecdotal evidence suggests that food security related indicators has benefited from another factor. Both rural or urban households have become increasingly reliant on remittances and used them to improve their food security. This paper explores the pattern of relationship between remittances and food consumption/diversity utilising data from the India Human Development Survey collected in 2005 and 2011-12. Using Heckman procedure and the instrumental variable approach to correct for selection and simultaneity bias, the paper finds that remittances increase total food expenditure (mainly the expenditure on protein-rich food such as meats, eggs, pulses, vegetables and fruits) as well as food diversity, measured using the Household Dietary Diversity Score, Shannon and Simpson Index. The results are robust to models' specification and support the existing evidence that remittances represent a mechanism by which households improve their food security.

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1 Introduction

Every year, millions of Indian men and women migrate to access better economic opportunities for themselves and their households. The money sent home by working migrants represents a significant source of income for those struggling with their everyday life. However, the Covid-19 pandemic prompted a massive reverse migration in India. The Indian Government's announcement of the country lockdown on the 25 March 2020 also caught millions of migrant workers - and a large part of the government bureaucracy - off-guard. Workers found themselves with no work and no income as industries shut down and construction projects were interrupted. While millions of migrants remained stranded far from home, many others started their journey home, only to be quarantined in temporary camps (Pandey, 2020). When finally able to reunite with their family, they found out that their households were facing food shortages due to the lack of remittances. In other words, it was not only the migrants themselves who became food-poor (and jobless) because of Covid-19; but also, their families in India - who had relied on regular remittances, and consequently faced severe liquidity constraints (Save The Children, 2020). The two months of 2020 lockdown in India resulted in an unprecedented humanitarian crisis. The significant decline in living conditions for millions of households drew the attention of economists, social scientists, and development practitioners. It highlighted the heavy reliance of the Indian economic system on remittances from both internal and international migrants.

This (unexpected) scenario reversed with the overall positive trends in macroeconomic aggregates which India had experienced before the Covid-19 pandemic hit. In the last two decades, India has witnessed a fast-paced economic growth. Nevertheless, the direct improvement resulting - in terms of food and nutritional security - has been minimal. The country's GDP has more than tripled in the last 15 years, but this increase in wealth has not directly benefitted a large majority of the Indian population. The number of poor in India is still remarkably high- 9 percent in urban areas and 23 percent in rural areas are classed as poor (Choithani, 2016) and the country has a quarter of the global undernourished population (Food and Agriculture Organisation, 2015). The available literature has referred to this negative correlation with the concept of 'food security enigma' (Gillespie & Kadiyala, 2012, and Pritchard et al., 2014), aggravated by the mix of social tension -i.e. castes, gender and religion discrimination. India's economic growth in fact offers several paradoxes: the average standard of living in India has increased over time and the country is home to a large number of millionaires and billionaires, but chronic undernourishment of Indian dwellers still remains.

The Food and Agriculture Organisation (2015) estimated that India has 194.6 million undernourished individuals. Additionally, malnutrition rates among children are alarmingly high in India. According to the Global Hunger Index (2020), which factors in undernourishment, mortality, stunting, and wasting among children, India ranks 94th out of 107 countries (Agoramoorthy and Hsu, 2021). Those statistics are echoed by the results coming from the fourth round of The National Family Health Survey (NFHS), conducted in 2015-2016, which found that the rates of underweight, stunted and wasted children under five was at 36, 38 and 21 percent respectively. The follow-up NFHS survey highlighted that out of the 22 states surveyed only nine showed any improvement in the rate of stunted, wasted and underweight children (Paul et al., 2019).

To better understand the magnitude of the reliance on remittances within the Indian economy, it is worth mentioning a few facts about the Indian migration phenomena. The predominant stream of migration within India has traditionally involved rural-to-rural migration of labour (Census of India, 2001). However, the low income earned in agricultural jobs, and the urban-centric nature of recent economic growth have both led to significant increases in rural to urban migration. During the years 2007 and 2008, total migration to urban areas grew at the rate of 3.5% while for the same period the rural-to-rural migration increased by 2.6% (National Sample Survey, 2010). Another feature of migration in India is its seasonal nature, which represents a significant bulk of migratory movements. Keshri and Bhagat (2012) computed -using National Sample Survey data- that temporary migration is a phenomenon that involves approximately 13 million people each year, although informal estimates suggest that temporary migration may be between 3 and 7 times more (Breman, 2010).

Migration -whether seasonal, long-term, domestic or international- invariably translates into remittances[1]. The World Bank estimated that total remittances to low and middle-income countries reached a record high of 554 billion USD in 2019; and even with the decline observed in 2020 due to the COVID-19 pandemic, remittances continued to constitute a vital source of external financing (The World Bank, 2020). The actual size of remittances may be even higher than estimated, as measurements of informal remittances is difficult. For India alone, in 2007–08 internal remittances amounted to 10 billion USD, and 30 per cent of all Indian household expenditure was financed by these transfers among remittance-receiving households (Tumbe, 2011). More recent estimates suggests that remittances increased by 83 billion of USD in 2020, just a small drop compared to the previous year estimate[2]. Despite the size of the remittance phenomenon in India, systematic studies on the direct role of remittances in influencing rural households' food consumption patterns are still rare. Studies on migrant remittances in India have focused on magnitude and flow of remittances, and investigated the impact of remittances on the Indian economy both at the macro level (see Bhagat et al., 2013 and Mahapatro et al. 2015) and at the household level. Dey (2014) and Mohanty et al. (2014) link remittances with development finding that both international and domestic remittances reduce the incidence of poverty of rural households and improve their well-being.

This paper looks at the nexus between remittances from migrant workers and the food consumption patterns of households in India. The household level data used here come from two rounds of the 'India Human Development Survey' (IHDS), collected in 2005 and 2011-12. The nutritional related indicators used are the (logarithm of the) food expenditure, household dietary diversity score (HDDS) and two indicators of food concentration, namely the Shannon Index and the Simpson Index. The HDDS -which indicates the sum of a number of food groups consumed over a given reference period- has been widely used in studies looking at household access to food (Swindale and Bilinsky, 2006). The other two indicators are originally used in ecological economics to give a standardised measure of abundance (Shannon index) and evenness (Simpson index) of the species present and could be used in nutrition related studies to indicate how rich and diversified a diet is (see for example Nguyen and Winters, 2011).

1 The available literature on migration and remittances is rather rich; 'Migration and remittances Factbook 2016' by Ratha et al. (2016) is a useful starting point on this issue.

2 For more information on the size of remittances in India, refer to the following website https://data.worldbank.org/indicator/BX.TRF.PWKR.CD.DT?locations=IN , lastly accessed the 25/05/2021.

The results of the analysis presented here indicate that remittances do increase expenditure on food and dietary diversity among the recipients. While these results are statistically significant and robust across different model specifications, the marginal effects are not large enough to suggest that remittances can solve the chronic undernutrition and dietary deficiencies that are largely experienced by Indian residents. The results also suggest that household receiving remittances are spending more on protein rich food such as meats, eggs and pulses, and less on cereals (inferior good).

The rest of the paper is organised as it follows. Next section will give the readers a background on the remittances-nutrition nexus. The description of the data used, the estimation strategy and a statistical summary of the data will be presented in section 3. The main body of the results is in section 4; the concluding remarks and the policy implications of this paper are in the final section.

2 Background on remittances and household consumption pattern

Migration is a common trait of several developing countries; the International Organisation for Migration has estimated that 272 million people migrated in 2019 (United Nations, 2019). The majority of those migrating are originally from countries and areas where prospects for works are low; remittances -associated to both domestic and international migration- do represent a non-negligible source of income for those members staying behind (Williams et al, 2020). Migration and -hence- remittances have become a key component in the livelihood strategies of an increasing number of households living in developing areas, with large numbers of people seeking better earning opportunities in richer countries or in more developed areas within their own country (Zezza et al., 2011). Global remittances have grown steadily over the past several years, to a point where the total remittances in 2003 were the second biggest capital flow into developing countries after the foreign direct investment (Ratha et al., 2010). Such an increase in the size of remittances has been driven by a dramatic rise of international and rural-to-urban migration, and they are seen as an important feature in reducing poverty and increasing the standard of living of those left behind.

Remittances have an impact on the economic growth of the recipient country and on poverty reduction. At a micro-level, remittances offer an extra income which help with routine household-related expenses (education, health, consumables for the household) as well as financial means for business activities (for a review of the impacts of remittances on development indicators see Ebadi et al (2020)). Recognising the importance remittances play, the Bill and Melinda Gates Foundation recommended that the G20 countries improve the ease of remitting funds back home to improve the health and nutrition of those who stayed in the country of origin (Gates, 2011).

Based on the neo-classical microeconomic theory, it is likely that remittances affect nutrition through their effect on total household available income (Thow et al., 2016). Remittances increase access to food purchased hence helping the consumption smoothing effect via reducing the vulnerability of households to crises. Thow et al. (2016) reviewed 20 studies to find support on the positive link between remittances and nutrition. However, remittances are not

intended to be a long-term source of income, which explains the lack of effect that remittances have on stunting - indicator of longer-term chronic undernourishment. It has been observed that it is not always the poorest strata of the population who migrate, and -as a result- remittances may not generate substantial long-term gains in reducing undernutrition at the nationwide level. Lastly, income coming from remittances may be directed by the remitter for specific uses and as it is not a consistent source of income- it may be used differently to other sources of income (Tolstokorova, 2012).

Discussions on the nutritional impacts of remittances focussed on the international more than on internal/domestic remittances (Choithani, 2016). The flow of international remittance to developing countries have increased three-fold from 1995 to 2014 (from 159 to 436 billion USD), and in 2015 the current levels of remittances received by developing countries was nearly three times as much as their receipts of official development assistance (World Bank 2015).

Citing all the studies on the link between international remittances and nutrition would be a long exercise; the evidence coming from studies published in the last thirty years agree on the existence of a positive nexus. The remittances-food indicator nexus has been relatively understudied in India, despite the high number of people migrating and the low-level of food security. Choitani (2017), using primary survey data from 392 rural Indian households in Western Bihar in India, finds that internal remittances contributed to 30% of the overall household expenditure and that migrants' remittances had a positive impact on food security. This evidence is corroborated by the study by Rahman (2020) who investigates the effect of non-farm income -including remittances- in 'ensuring access to food in India during the time during which cultivation has not been remunerative enough', and finds that remittances do have a positive impact on several food security indicators.

Moving away from India, the evidence in favour of a positive link is (almost) overwhelming. Adams (1991) found that in rural Egypt, the number of poor households declines by 10% when household income includes international remittances, and that remittances account for 15% of total income of less wealthy households. Jongwanich (2007) examined the impact of workers' remittances on growth and poverty reduction in developing Asia-Pacific countries using panel data over the period 1993-2003. The result showed that, while remittances do have a significant impact on poverty reduction through increasing income, smoothing consumption, and easing capital constraints of the poor, they have only a marginal impact on growth operating through domestic investment and human capital development. The evidence continues with the study presented by Lachaud (1999), who looked at remittances to Burkina Faso in 1994-1995 and found that they went mostly to rural households headed by farmers or inactive people. Remittances were measured to have rural poverty reduced by 7.2% and urban poverty by 3.2%. A similar finding was found in Lesotho, where Leliveld (1997) concluded that remittances play a very important role in giving households the means to achieve the least minimum food requirements. de Brauw (2011) found that in El Salvador during the food price shocks of 2007–08, young children in households with access to international remittances witnessed an improvement of their nutritional status compared to those of children in households not receiving remittances. A positive relationship between international remittances and nutritional -related indicators was found in Ghana (Quartey and Blankson, 2004), rural Mali (Generoso, 2015), Bangladesh (Regmi & Paudel, 2016, 2017) and Guatemala (Carletto et al., 2011).

The nexus between domestic migration and the effects that remittances may have on the nutrition related indicators of those staying at home has been less researched (Choithani, 2016). The link between domestic migrants and their family is even stronger, with migrants making periodic visits to places of origin, maintaining close relations with family, and sending home remittances that are crucial for the food security of members at places of origin (de Haan, 2002). Available evidence on the significance of domestic remittances suggests the same. For instance, a study by Castaldo et al. (2012) found that in India and Ghana internal migrants and domestic remittances outnumbered international migrants and their total receipts, with potentially significant human development impacts. For India alone, in 2007–08 internal remittances amounted to US$10 billion, and 30 per cent of all household expenditure was financed by these transfers among remittance-receiving households (estimated at 10 per cent of all rural households in India) (Tumbe, 2011). Systematic research on the direct role of remittances in influencing rural households' food consumption patterns is scarce, however.

This paper aims at providing more insights on the sign and size of the link between domestic remittances-nutritional status; as the next section explains, it does so by investigating how remittances contributed to the nutritional status of rural Indians in 2005 and 2011-12.

3 Data and estimation strategy

The data used in the paper comes from two rounds of the India Human Development Survey (IHDS), a nationally representative panel survey consisting of 42,152 households in 2011-12 and 41,554 households in 2005 collected from 1,503 villages and 971 urban neighbourhoods across India. The household survey covers a range of questions relating to economic activity, income, remittances, food consumption, migration, education, and health.

Four measures related to the household food consumption patterns will be used for the analysis -the amount of household expenditure for food (in logarithm), the HDDS, the Simpson index and Shannon index.

Food expenditure is the sum of the household expenditure for food in the recall period which for the two rounds of surveys amount to a month. The HDDS measures the number of food groups consumed by the household in the recall period. Different food groups provide various macro/micronutrients, hence a more diverse diet ensures proper nutrients intake (Kennedy et al., 2011). The HDDS indicator here takes value from 0 to 10 according to whether the household has consumed any food in the following ten groups: cereals, meat, vegetables, fruits, eggs, pulses, milk and milk products, oils and fats, sugar and miscellaneous.

The Simpson Index can be measured as it follows:

$$Simpson\ Index = 1 - \sum_i (w_i)^2 \tag{1}$$

where w_i indicates the expenditure share for food group *i*. The Simpson index ranges between 0 -indicating a diet with no diversification (all the budget spent on the same food group)- and 1 - more diversified diet (budget equally spent on several food groups).

The Shannon index, measures the concentration of food groups and it is measured in the following way:

$$Shannon\ Index = \sum_i w_i \log(w_i) \tag{2}$$

where w_i still indicates the expenditure share for food group i; the index takes values from 0 to the value of the log of the highest number of food groups. In the sample considered here, the Shannon index could vary between 0 and a maximum of 2.15 (2.25) in 2005 (2011-12).

Based on the information available on remittances we have classified two types of households; household who received remittances and household who did not. An estimated 4.95% of household in 2005 and 13.93% of household in 2011-12 received remittances. Table 1 reports summary statistics on the variables used in this paper; the statistics are disaggregated by the year of the survey and by households receiving (non-receiving) remittances.

Table 1 Summary statistics

	2005		2011–12	
	Without remittance	**With remittances**	**Without remittance**	**With remittances**
Household monthly food expenditure (in Rs)	3,296.266	3,212.52	4,179.17	3,816.94
	(2,087.07)	(2,037.30)	(2,455.38)	(2,430.49)
HDDS	7.25	7.45	7.25	7.24
	(1.67)	(1.68)	(1.66)	(1.56)
Simpson Index	0.84	0.84	0.85	0.85
	(0.07)	(0.07)	(0.05)	(0.05)
Shannon Index	2.15	2.15	2.26	2.24
	(0.31)	(0.30)	(0.25)	(0.24)
Household total yearly income (in Rs)	88,073.55	59065.04	139,220.79	93116.06
	(137,881.26)	(121,007.67)	(231,057.50)	(234,939.80)
Household total yearly consumption (in Rs)	94,157.97	109,348.62	127,006.89	119,839.74
	(178380)	(233,595.6)	(127,645.98)	(133,926.63)
Amount of remittances (in Rs)	0.00	33,561.81	0.00	48,323.84
	(0.00)	(29,429.99)	(0.00)	(70,908.84)
Meat and eggs expenditure	232.632	218.124	376.186	310.572
	(377.197)	(306.859)	(504.388)	(464.956)
Vegetables and fruits expenditure	417.841	395.517	684.783	610.678
	(409.864)	(376.679)	(542.362)	(499.544)
Pulses expenditure	164.777	169.184	226.766	211.504
	(172.757)	(184.273)	(186.105)	(168.845)
Cereal and cereal products	915.572	914.537	872.316	812.736
	(577.961)	(614.485)	(554.982)	(586.939)
Non-cereal total expenditure	2380.694	2298.089	3306.857	3004.212
	(1769.853)	(1700.029)	(2167.823)	(2097.036)

(*Continued*)

Table 1 (Continued)

	2005		2011–12	
	Without remittance	**With remittances**	**Without remittance**	**With remittances**
Households living in villages experiencing conflict amongst caste[3] (in %)	28	30	40	40
	(45)	(45)	(49)	(49)
Household size	5.21	4.72	5.07	4.58
	(2.47)	(2.67)	(2.33)	(2.75)
No of household members aged 0-14	1.65	1.51	1.32	1.28
	(1.56)	(1.68)	(1.41)	(1.60)
No of household members aged 15-19	0.74	0.67	0.63	0.55
	(0.97)	(0.89)	(0.86)	(0.81)
No of household members aged more than 19	2.80	2.53	3.11	2.74
	(1.37)	(1.42)	(1.44)	(1.48)
Dependency ratio (in %)	55	59	41	43
	(59)	(84)	(50)	(65)
Highest male education (in years)	6.93	5.41	7.89	5.67
	(5.14)	(5.49)	(5.19)	(5.58)
Highest female education (in years)	4.61	4.89	5.93	5.29
	(5.04)	(5.17)	(5.36)	(5.39)
Household owning land (in %)	41	53	40	55
	(49)	(49)	(49)	(49)
Household residing in urban area (in %)	36	25	39	25
	(48)	(43)	(49)	(43)
Number of rooms in the dwelling	2.51	3.06	2.83	3.21
	(1.61)	(1.98)	(1.69)	(1.92)
Caste				
Brahmin (in %)	0.05	0.07	0.05	0.07
	(0.23)	(0.25)	(0.22)	(0.25)
Forward castes (in %)	0.26	0.28	0.26	0.25
	(0.44)	(0.45)	(0.43)	(0.43)
Other backward classes (in %)	0.38	0.42	0.38	0.43
	(0.48)	(0.49)	(0.48)	(0.49)

(*Continued*)

3 Conflict amongst caste is a dummy variable where 0 means various castes get along well and 1 means there is somewhat or a lot of conflict among castes.

Table 1 (Continued)

	2005		2011–12	
	Without remittance	**With remittances**	**Without remittance**	**With remittances**
Dalit (in %)	0.20	0.17	0.20	0.18
	(0.40)	(0.38)	(0.40)	(0.38)
Scheduled tribes (in %)	0.08	0.04	0.09	0.06
	(0.27)	(0.20)	(0.28)	(24)
Number of observations	39,474	2,056	27,990	4,531

Notes: Authors' elaboration from IHDS 2005 and 2011-12. Standard deviation in parenthesis. Numbers refer to Rs; £1 is equal to Rs 103.45 (July, 2020). Expenditure and income variables are intended to be monthly and yearly, (as indicated) and at the household level.

The average food expenditure, yearly income (before remittances) and other consumption expenditure is lower for the household who receive remittances. Households with remittances live in a smaller size household, have lower level of education for male, are less likely to live in urban areas, have more rooms in their house, and are more likely to own land. The average remittance amounts to Rs 33,561 in 2005 and Rs 48,323 in 2011-12 (equivalent to 1,390 USD and 1,214 USD in April 2022). There are (almost) no difference in terms of the HDDS, Shannon and the Simpson index between those households (non) receiving remittances; while the Simpson index does not show an increase over time, the Shannon index does marginally increase across the two waves.

3.1 Estimation Strategy

To estimate a relationship between remittances and the three indicators related to the nutritional food status of the household, the equation in (3) is employed.

$$Y_{it} = \alpha + \delta_1 REMITTANCES_{it} + \delta_2 X_{it} + \varepsilon_{it} \tag{3}$$

where Y_{it} represents the dependent variable (log of total expenditure on food, HDDS[4], Shannon index and Simpson index) for the i_{th} household in the sample at the t_{th} time period, *REMITTANCES* is the log of the amount of remittance household received, X_{ij} is a vector of household characteristics, and is an error term.

To identify which empirical methodology – fixed effects or random effects model – is most appropriate, we perform the Hausman specification test (Hausman, 1978). A rejection of null hypothesis in the Hausman test statistic suggests that fixed effects estimates are more appropriate.

Another methodological issue which may arise when analysing the impact of remittances on food expenditure and diversity is the existence of endogeneity which can be caused by self-selection and simultaneity bias. Self-selection bias could occur when households with similar observable characteristics have different level of unobserved features (e.g. more or less

4 Since HDDS is in the form of count data, we use Poisson regression to analyse the impact of remittances on the dietary score.

motivated, more or less entrepreneurial) which may lead to different probability of receiving remittances. The self-selection is corrected by using the Heckman two-step procedure in the econometric analysis later presented. We correct for selection by including one (independent) variable that appears in the selection equation but not in the outcome equation – a variable that affects the selection but not the outcome (Sartori, 2003). Dependency ratio -measured as the ratio between the number of members under 14 years of age and the number of adults (15+) in the household- fills the requirement for being an appropriate variable for identification. As remittances -on top of providing cash to be used for food- could be used for household expenditure including health care for the elderly (Amuedo-Dorantes & Pozo, 2011), investments (Yang, 2008), housing (Osili, 2004), higher education (Arif, Raza, Friemann, & Suleman, 2019), the probability of receiving remittances is affected by the composition of the household or the dependency ratio[5]. Hence, a higher share of adult to children -lower values of the dependency ratio variable- may increase the probability of receiving remittances. However, the amount of remittances are largely determined by migrant's economic situation. The coefficient of dependency ratio is negative which suggests that households with the lower dependency ratio - i.e., more adults compared to young members- are more likely to receive remittances (Table 5 in the Appendix).

Simultaneity bias is caused by the presence of endogenous variables - income and remittances being two of them- which may cause reverse causality. Income and remittances influence food expenditure; at the same time, they can be influenced by food expenditure. We address this by adopting an instrumental variable (IV) approach. We use the educational status of the father of the head of the household as an instrument for household's income[6]. Research suggests that parents' education (both mother and father) can influence their children's level of income, among other variables (Blanden and Gregg, 2004, Tomul and Celik, 2009, Dahl and Lochner, 2012, Erola et al., 2016). Children of parents with a higher educational attainment tend to have higher income as they are likely to be benefited by parents' social networks and social status (Jaeger, 2007; Erola et al., 2016). This paper uses perception of conflict amongst caste as an instrument for remittance[7]. Caste based conflicts[8] between upper castes and lower castes - and sometimes within the same caste groups- are often caused by social, economics, and political reasons and constitute salient feature of Indian communities, particularly in rural areas (Borooah, Tagat, and Mishra, 2019). An increase in the presence of conflicts could reduce employment opportunities for those in a given caste and can lead to higher level of migration of those members involved in the conflict (Brottrager, Cuaresma, and Muttarak, 2019; Christensen, Onul, and Singh, 2018 & Naudé, 2008). Those who migrate - as unable to find an occupation at home- provide income support through remittances for those who are left behind. Although conflicts may deter remittances for investment and business purposes, they may increase the likelihood of remittances being sent for food related need.

5 Self-interested migrants are more likely to send remittances if they aspire to receive inheritance (Lucas and Stark, 1985).

6 Parental education has been used an instrument by Knight et al. (2009) for measuring determinants of happiness in China, and by Howley (2017) for measuring the well-being losses from health conditions.

7 Previous research have used various instruments for remittances including migration network (Acosta 2006; Carrington et al. 1996; Nguyen and Winters 2011), changes in population of the region, and relative level of overall human capital (Karamba et al., 2011).

8 We use conflicts in sense of distrust and disagreements within castes regarding allocation of resources and opportunities, not necessarily a violent conflict. This variable measure if various caste groups get along well or not.

In the first stage regression two separate regressions are being estimated. In one regression, the log of income is used as a dependent variable and the years of education of the father of the head of the household as an independent variable. Similarly, the logarithm of the amount of remittance is used as a dependent variable and the dummy variable on the presence of conflict among castes as an independent variable, along with mills ratio derived from a separate selection regression. In the second stage, the food expenditure and dietary related variables are estimated on the predicted values of the logarithm of income and of the remittances coming from the first stage regression. The first stage regressions show that the instrumental variables used here are strong determinant of two of the endogenous variable, ie. log of income and log of amount of remittances household received (see Table 6 in the Appendix). The second stage regression shows that remittances increase the expenditure on food and diversity of food (Table 2 and 3). The analysis looks at the relevance of the instrument in the first-stage regression. Staiger and Stock (1997) proposed a rule of thumb decision making process on the goodness of the instrumental variables, with the instruments considered weak when the first stage *F* statistic is less than 10. The F-statistic from the first-stage is sufficiently large, suggesting that the instrumental variable is appropriate in this context.

4 Econometric results

The IV and fixed effect model results for the impact of remittances on food expenditure are shown in Table 2 and 7 (Column 1) in the Appendix. Both models show that remittances have positive impact on total food expenditure. In addition, the analysis was extended to examine the impact of remittances on the expenditure on various food groups.

Using the IV approach in Table 2, it is found that one percent increase in the amount of remittances sent back home increases the expenditure on food by 0.67 percent. The estimated elasticity is consistent with recent literature in India[9]. Results indicate that a one percent increase in income increases the expenditure on food by 0.42 percent - a smaller coefficient compared

Table 2 IV estimate of the impact of remittances on expenditure on food.

Variables	(1)	(2)	(4)	(5)	(6)	(7)	(8)
	Food expenditure	Cereal	Non-cereal	Pulses	Meat and eggs	Vegetable and fruits	Non-cereal to cereal
Log of remittance	0.67***	-0.26***	0.95***	1.02***	2.03***	1.05***	5.88***
	(0.05)	(0.06)	(0.06)	(0.11)	(0.20)	(0.13)	(0.48)
Log of Income	0.42***	0.19	0.47***	-0.57***	-0.34	-0.29	1.19
	(0.09)	(0.13)	(0.12)	(0.21)	(0.37)	(0.24)	(1.01)
Highest education male	0.07***	-0.03***	0.10***	0.16***	0.26***	0.15***	0.62***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)	(0.07)

(*Continued*)

9 In a similar study, Rahman & Mishra (2020) found the income (from remittance) elasticity of food demand was 0.53.

Table 2 (Continued)

Variables	(1)	(2)	(4)	(5)	(6)	(7)	(8)
	Food expenditure	**Cereal**	**Non-cereal**	**Pulses**	**Meat and eggs**	**Vegetable and fruits**	**Non-cereal to cereal**
Highest education female	-0.06***	0.02***	-0.08***	-0.05***	-0.16***	-0.05***	-0.51***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.06)
Land ownership	0.03***	0.09***	0.02**	0.02	-0.05	0.12***	-0.41***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)	(0.12)
Urban/rural	-0.68***	-0.03	-0.87***	0.04	-1.24***	0.04	-3.73***
	(0.08)	(0.11)	(0.10)	(0.19)	(0.32)	(0.21)	(0.87)
HH members aged 0-14	0.31***	0.05*	0.38***	0.29***	0.65***	0.27***	1.67***
	(0.02)	(0.03)	(0.02)	(0.04)	(0.08)	(0.05)	(0.19)
HH members aged 15-19	0.44***	0.02	0.56***	0.66***	1.20***	0.65***	2.68***
	(0.03)	(0.04)	(0.03)	(0.06)	(0.11)	(0.07)	(0.27)
HH members aged>19	0.16***	0.03	0.21***	0.56***	0.72***	0.54***	0.89***
	(0.03)	(0.04)	(0.04)	(0.07)	(0.12)	(0.08)	(0.32)
Caste							
Brahmin	0.18***	-0.09**	0.26***	0.24***	-0.49***	0.27***	2.11***
	(0.03)	(0.04)	(0.04)	(0.07)	(0.14)	(0.08)	(0.35)
Forward Caste	0.12***	0.00	0.15***	0.18***	-0.09	0.17***	0.84***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.08)	(0.05)	(0.26)
Other backward classes	0.07***	-0.04**	0.10***	0.04	-0.10	0.06	0.77***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.07)	(0.05)	(0.25)
Scheduled tribe	0.09***	-0.05	0.13***	0.13*	0.33***	0.13*	0.62
	(0.03)	(0.03)	(0.03)	(0.07)	(0.11)	(0.08)	(0.69)
Dalits (reference group)	-	-	-	-	-	-	-
Constant	1.69*	4.77***	0.12	6.53***	1.10	4.58**	-21.93**
	(0.87)	(1.20)	(1.08)	(1.99)	(3.47)	(2.20)	(9.41)
R-squared	0.15	0.09	0.13	0.05	0.03	0.07	0.02
Number of observations	73,554	73,554	73,554	73,554	73,554	73,432	73,271

Notes: Authors' elaboration from IHDS 2005 and 2011-12. Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

to remittances- suggesting that remittances are used primarily for food consumption. Other factors that increased food expenditure are male education, landownership, number of adults, teens and children in the household whereas female education, and living in an urban area has a negative relationship with the dependent variables. Results show that remittances decrease

Table 3 IV estimate of the impact of remittances on food diversity

Variables	HDDS (1)	Simpson Index (2)	Shannon Index (3)
Log of remittance	0.473**	0.045***	0.312***
	(0.02)	(0.006)	(0.026)
Log of Income	0.063	0.017*	0.084*
	(0.04)	(0.010)	(0.046)
Highest education male	0.00	0.005***	0.035***
	(0.00)	(0.001)	(0.004)
Highest education female	-0.01**	-0.004***	-0.027***
	(0.00)	(0.001)	(0.003)
Land ownership	0.02***	-0.002*	-0.012**
	(0.00)	(0.001)	(0.006)
Urban/rural	-0.09***	-0.047***	-0.288***
	(0.04)	(0.009)	(0.040)
Household members aged 0-14	0.03***	0.013***	0.102***
	(0.01)	(0.002)	(0.010)
Household members aged 15-19	0.03**	0.023***	0.166***
	(0.01)	(0.004)	(0.015)
Household members aged more than 19	-0.00	0.007**	0.059***
	(0.01)	(0.003)	(0.015)
Caste			
Brahmin	-0.02*	0.013***	0.071***
	(0.01)	(0.003)	(0.015)
Forward Caste	-0.01	0.006***	0.038***
	(0.01)	(0.002)	(0.010)
Other backward classes	-0.02***	0.003	0.013
	(0.01)	(0.002)	(0.009)
Scheduled tribe	0.01	0.003	0.021
	(0.01)	(0.004)	(0.015)
Dalits (reference group)	-	-	-
		0.568***	0.559
		(0.095)	(0.423)
R-Squared		0.015	0.034
Number of observations	61,976	73,554	73,554

Notes: Authors' elaboration from IHDS 2005 and 2011-12. Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

the expenditure on cereals, however, increase the expenditures on non-cereal foods and the ratio of non-cereal to cereal food; protein rich food such as pulses, meat and eggs; and vegetables and fruits. This suggests that remittances are being used to consume highly nutrient and protein rich food groups.

The impact of remittances on food diversity is further explored using three indicators: HDDS, Simpson Index and Shannon Index. The results are shown in Table 3. In Column 1, the Poisson regression model using the 2SLS (see Rashid, Smith and Rahman, 2011 for the empirical specification for dietary diversity) is estimated to measure the impact of remittances on HDDS. It is found that a percent increase in remittances increases the HDDS by 0.473 unit,

Table 4 The impact of receiving remittances on food consumption and diversity using propensity score matching (average treatment effect on the treated estimator).

	2012				2005			
Variable	**Food exp**	**HDDS**	**Shannon**	**Simpson**	**Food exp**	**HDDS**	**Shannon**	**Simpson**
Remittances	0.084***	0.193***	0.010	-0.001	0.068***	0.234***	0.001	0.001
(1 vs 0)	(0.15)	(0.036)	(0.006)	(0.001)	(0.019)	(0.054)	(0.010)	(0.02)
Observations	31,671				40,499			

Notes: Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

significant at 5 percent. To understand the magnitude of this effect, at the population mean of 7.26 food groups, a percent increase in the remittances would increase the dietary diversity score to 7.73 food groups (an increase of 6.3 percent). The results in Column 2 show that remittances are positively associated with Shannon index. A percent increase in remittances increase the Simpson index by 0.045 unit (which represents a 6 percent increase in the index at mean) and Shannon index by 0.312 units (which represents 15 percent increase in the index at mean).

The results of the fixed effect analysis - Table 7, Column 2-4 in the Appendix- shows similar pattern; however, the coefficient stemming from the IV estimates are larger than the fixed effect model suggesting that the fixed effect model would underestimate the true effect remittances have on food expenditure and diversity.

To check the robustness of our result, a Propensity Score Matching method is estimated to measure the average treatment effect of remittances on food expenditure and diversity in 2005 and 2011-12 (Rosenbaum and Rubin, 1984). The results associated to this model specification are in Table 4. Results shows that households which received remittances increased their expenditure on food by 8.4 percent in 2012 and 6.8 percent in 2005; HDDS score by 0.193 unit in 2012 and 0.234 unit in 2005. However, no effect was found on Shannon and Simpson index. The marginal effects associated to this specification are consistent with the main results previously discussed and the existing literature on the nexus between remittances and food consumption patterns. For instance, in their research on Indonesia, Adams and Cuecuecha (2013) found that households receiving remittances increase their expenditures on food by 8.5 percent (see Zezza et al., 2011, for a comprehensive summary of the studies on the remittances-food consumption nexus).

5 Concluding remarks

India has witnessed a remarkable transformation of its economy in the past two decades: economic growth, declining overall poverty, expanding seasonal and permanent migration and change in the food consumption patterns. It is within this scenario that we examine the nexus between remittances and food consumption patterns (food expenditure, HDDS, Shannon and Simpson index).

Using household level data from two rounds of the IHDS for 2005 and 2011-12 and using conflict among caste in the respondent's region and educational status of the father of the head of the household as our instrumental variable for remittance and income, we find that

remittances positively affect expenditure on food and improve diversity of food, as results on the HDDS, Shannon, and Simpson index show.

In the context of India, these findings can be explained by looking at the following channels. First, an increase in the disposable income via remittances eases budget constraints and enhances the household to spend more on diversifying food and less on inferior food (e.g. cereals); second, along with remittances, migrants may also bring knowledge of health and nutrition which can improve food diversity; lastly, in the absence of the male head of the household (approximately 80% of the migrants are the male head of the household), female may spend more on food and less for entertainment (Quisumbing and McClafferty, 2006). Those results may not hold when external circumstances manifest which may affect the availability of food i.e. drought, flooding and other shocks of the kind.

This paper has several policy implications. Due to better economic opportunities in urban areas (in India, but not only there), there is an increase in the migration from rural to urban areas. This has made remittances an important source of income for the household's member who are left behind. Thus, there is a need for improving this channel by reducing the transaction cost of these remittances and providing resources for migration to the places of opportunities.

Food, nutrition and dietary diversification constitute complex issues and it is crucial that governments now start looking and thinking beyond the simple food production (quantity) to the quality and diversity of nutrition. The result from this paper suggests that there is a need for recognising the role that remittances play in affecting the food consumption patterns. We also acknowledge the fact that remittances are no silver bullet and any intervention for supporting remittances should also aim to fix the root cause of food insecurity in the first place.

As this paper and the relevant literature on the remittance-food pattern shows, remittances do influence the household food consumption patterns and have a positive impact on its dietary diversity; it is important to keep in mind that migration of (male) household member increases the livelihood burden on those members who are left behind -especially women. This could negatively impact the growth of those children in the household by reducing the available time and the quality of childcare. Policymakers and development practitioners need to further investigate on this possible link and strengthen the available safety nets (improving access to education, health care, credit market, labour markets, etc) in those regions with higher rates of migration.

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Appendix

Table 5 Fixed effect logit model

Variables	(1) Remit (1/0)
Dependency ratio	-0.21***
	(0.08)
Highest education male	-0.11***
	(0.01)
Highest education female	0.13***
	(0.01)
Land ownership	0.03
	(0.08)
Urban/rural	1.26***
	(0.24)
No. of household members aged 0-14	-0.71***
	(0.03)
No. of household members aged 15-19	-0.34***
	(0.04)
No. of household members aged more than 19	-0.30***
	(0.04)
Conflict among castes	0.11**
	(0.05)
Brahmin	-0.87***
	(0.25)
Upper Caste	-0.46***
	(0.17)
Other backward classes	-0.34**
	(0.16)
Scheduled tribe	-0.31
	(0.24)
Dalits	-
Number of observations	9330

Notes: Authors' elaboration from IHDS 2005 and 2011-12. Standard deviation in parenthesis. Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 6 First stage regression of IV model

Variables	(1) Log of Income	(2) Log of Remittance
Parental Education	0.01***	
	(0.00)	
Conflict amongst castes		0.12***
		(0.03)
Highest education male	0.05***	-0.12***
	(0.00)	(0.01)
Highest education female	0.03***	0.10***
	(0.00)	(0.02)

(*Continued*)

Table 6 (Continued)

Variables	(1) Log of Income	(2) Log of Remittance
Land ownership	0.03	0.04
	(0.02)	(0.06)
Urban/rural	0.67***	1.03***
	(0.05)	(0.21)
No of household members aged 0-14	0.06***	-0.60***
	(0.01)	(0.09)
No of household members aged 15-19	-0.09***	-0.38***
	(0.01)	(0.05)
No of household members aged more than 19	0.30***	-0.23***
	(0.01)	(0.04)
Caste		
Brahmin	-0.05	-0.42**
	(0.05)	(0.17)
Upper Caste	-0.01	-0.22**
	(0.03)	(0.11)
Other backward classes	-0.03	-0.15
	(0.03)	(0.10)
Scheduled tribe	0.05	-0.16
	(0.05)	(0.15)
Dalits	-	-
mills	-	0.10
		(0.15)
Constant	9.19***	2.36***
	(0.04)	(0.14)
Number of observations	71,777	73,968
R-squared	0.18	0.05
F-test	549.05	123.29

Notes: Authors' elaboration from IHDS 2005 and 2011-12. Standard deviation in parenthesis. Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 7 Fixed effect model without IV

Variables	(1) Log of food expenditure	(2) HDDS	(3) Simpson Index	(4) Shannon Index
Log of remittance	0.01***	-0.002**	0.00***	0.01***
	(0.00)	(0.001)	(0.00)	(0.00)
Log of income	0.15***	0.004*	0.01***	0.05***
	(0.00)	(0.002)	(0.00)	(0.00)
Highest education male	0.01***	0.002***	0.00***	0.00***
	(0.00)	(0.001)	(0.00)	(0.00)
Highest education female	0.01***	0.001	0.00***	0.00***
	(0.00)	(0.001)	(0.00)	(0.00)

(*Continued*)

Table 7 (Continued)

Variables	(1) Log of food expenditure	(2) HDDS	(3) Simpson Index	(4) Shannon Index
Land ownership	0.06***	0.019**	0.00	0.00
	(0.01)	(0.008)	(0.00)	(0.01)
Urban/rural	0.10***	-0.004	-0.00	0.02
	(0.02)	(0.021)	(0.00)	(0.01)
No. of household members aged 0-14	0.06***	0.007***	-0.00***	-0.01***
	(0.00)	(0.002)	(0.00)	(0.00)
No. of household members aged 15-19	0.09***	0.008***	-0.00	0.00
	(0.00)	(0.003)	(0.00)	(0.00)
No. of household members aged more than 19	0.10***	0.005*	0.00*	0.01***
	(0.00)	(0.003)	(0.00)	(0.00)
Caste				
Brahmin	-0.06**	-0.041**	-0.00	-0.04***
	(0.02)	(0.020)	(0.00)	(0.01)
Upper Caste	-0.00	-0.016	-0.00	-0.02**
	(0.02)	(0.013)	(0.00)	(0.01)
Other backward classes	-0.02	-0.031**	-0.00*	-0.03***
	(0.01)	(0.012)	(0.00)	(0.01)
Scheduled tribe	0.01	0.004	-0.00	-0.02
	(0.02)	(0.020)	(0.00)	(0.01)
Dalits	-		-	-
Constant	5.76***		0.77***	1.66***
	(0.03)		(0.00)	(0.02)
Number of observations	72,170	59,584	72,170	72,170
R-squared	0.22		0.03	0.06

Notes: Authors' elaboration from IHDS 2005 and 2011-12. Standard deviation in parenthesis. Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$