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Disentangling the Impact of International Migration on Food and Nutrition Security of Sending Households

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Abstract

This paper explores the linkages between international migration and the food and nutrition security (FNS) of sending households from both the conceptual and the empirical viewpoint using Bangladesh as a case study. It pursues three specific objectives. First, building on the limited previous literature, the paper develops a unifying conceptual framework for identifying the main microeconomic channels through which international migration can affect household FNS. Second, by adopting an encompassing definition of migrant households, it estimates the overall impact of international migration on the FNS of Bangladeshi households. Third, by disentangling the overall effect of international migration on household FNS, the paper assesses the importance of the various microeconomic channels, i.e. the change in the household structure, overseas remittances and the presence of returned migrants.

The empirical strategy is based on a multiple treatment counterfactual framework, using a linearized propensity score matching technique. On the one hand, the estimates indicate that international migration has a positive impact on all FNS dimensions, allowing households to consume more food, to have access to more expensive food and to shift towards a more diversified, high-protein and micronutrient-rich diet. On the other hand, the disentanglement of the impact corroborates the validity of the conceptual framework and supports the conclusion that the average effect of international migration on household FNS through all the identified microeconomic channels is always non-negative.

Finally, the paper contributes also to the literature on the so-called 'Bangladesh paradox' suggesting that international migration may have contributed to the exceptional health and nutritional progress achieved by Bangladesh during a period of relatively poor economic growth.

Keywords: Food and nutrition security; International migration; Propensity score matching; Bangladesh

JEL Code: F22; I1; I3; O15

1. Introduction

International migration has become one of the most relevant phenomena worldwide. Official statistics show that the number of international migrants almost tripled over the last thirty-five years, rising from about 93 million in 1980 to about 244 million in 2015 (United Nations, 2016). International remittances have also grown steadily, rapidly becoming the developing countries' second largest source of external finance after foreign direct investments (World Bank, 2015). Not surprisingly, these two phenomena have been followed by a substantial increase in the number of theoretical and empirical works exploring the linkages between international migration and economic development. Albeit still lacking a unanimous consensus among scholars (Hanson, 2010), since the beginning of the 1990s the literature has tended to stress the development potential of international migration (de Haas, 2010).

Despite the increasing number of studies exploring the effects of international migration on migrant-sending countries, only few directly investigated the nexus between migration and food and nutrition security (FNS). In particular, while some country-level studies explored the effects of migration and remittances on different forms of household investment (Mendola, 2008; Yang, 2008; Adams and Cuecuecha, 2010; Giannelli and Mangiavacchi, 2010), several others focused on the impact of international migration (Jimenez-Soto and Brown, 2012; Bertoli and Marchetta, 2014; Möllers and Meyer, 2014) and remittances (Barham and Boucher, 1998; Lokshin *et al*., 2010; Adams and Cuecuecha, 2013) on poverty, emphasizing their positive contribution in migrants' countries of origin. However, although poverty is closely related to undernourishment and malnutrition, they are indeed different concepts (Sen, 1981). It is, therefore, somehow surprising that the literature on migration and development has paid so little attention to FNS issues (Zezza *et al*., 2011) and that, symmetrically, migration issues have been largely absent from the FNS debate (Crush, 2013).

This paper investigates to what extent international migration impacts household FNS and, by doing so, aims to bridge the gap between these two distinct strands of literature, contributing from both a theoretical and an empirical perspective. First, it provides a general and unifying conceptual framework that allows to identify and interpret the microeconomic channels through which international migration can affect the different dimensions of household FNS. Second, by adopting an encompassing definition of migrant households that includes remittance-recipient households as well as households currently having a member migrated abroad or with a returned migrant, the paper estimates the overall effect of international migration on six household FNS indicators and, in detail, on the diet of Bangladeshi households. Third, the paper represents an original attempt to disentangle the overall effect by assessing the stand-alone effect of each transmission channel.

The empirical findings indicate that international migration produces a positive and statistically significant effect on household FNS. Thanks to migration, households have access to more (and more expensive) food and shift towards a more diversified diet, richer in protein and micronutrients. These results hold also after the disentanglement and may have important implications for the design of both migration and FNS policies.

Finally, the results of the empirical analysis contribute also to shed some further light on the so-called 'Bangladesh paradox' (Chowdhury *et al.*, 2013). In fact, given the well-established correlation between FNS and health outcomes, the paper identifies international migration as additional driver that may have contributed to the exceptional improvements in several health and nutrition outcomes achieved by Bangladesh during a period characterized by relatively slow economic growth.

In pursuing the objectives above, the remainder of the paper is organized as follows. Section 2 develops the conceptual framework, emphasizing the most relevant channels linking migration and FNS. Section 3 introduces the case study, Bangladesh, with a specific reference to the trends of economic growth, migration and FNS. Section 4 provides a brief overview over the data and methods.

Section 5 discusses the empirical strategy. Section 6 reports the empirical findings, focusing, first, on the overall impact of international migration and, second, on its disentanglement. Section 7 concludes.

2. A Conceptual Framework for Analyzing the Impact of Migration on FNS

Concluding the introductory essay of the *Food Policy* special issue on 'Assessing the impact of migration on food and nutrition security', Zezza et al. (2011: 5) pointed out that 'the more thorny methodological challenges are, however, those around the identification of causal relationships and the unpacking of the mechanisms through which the impacts of migration materialize.' Capitalizing on the scanty literature (Levitt, 1998; Azzari and Zezza, 2011; Karamba *et al*., 2011; Crush, 2013; Warner and Afifi, 2014), this section outlines a conceptual framework that allows to identify and interpret the direct and indirect channels through which international migration can affect the four dimensions of household FNS (Table 1). The starting point is acknowledging that household FNS has a multidimensional nature and can be influenced by migration in several ways.[1]

First, the departure of a member leads to a new equilibrium within the household. Specifically, a change in household composition implies a change in the relative prices of household labor and a modification of the internal hierarchies. Depending on the migrant's individual characteristics and on the household's assets, it can influence food availability, food access and food utilization. The migrant's departure entails a reduction of aggregate household food requirements but also of total (potential) household labor supply. For instance, in a context like the over-populated[2] rural Bangladesh, which is only recently approaching to the Lewis turning point (Zhang *et al.*, 2014), the ease of the demographic pressure may play a relevant role in increasing per capita food availability

[1] According to the World Food Summit definition, food security is a situation in which 'all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life' (FAO, 1996). This definition links food security to four separate dimensions: food availability, access, utilization and stability (Gross *et al*., 2000).

[2] Bangladesh has more than 1,200 inhabitants per squared kilometer and is – by far – the most densely populated country in the World.

(especially for large subsistence farming households). In addition, if migration implies a shift in the household headship (often from the migrant husband to his wife), it can significantly influence the intra-household distribution of labor and consumption, affecting food security at both the household and the individual level.[3]

Table 1. Conceptual framework: how migration affects food and nutrition security

FNS DIMENSIONS		MICROECONOMIC TRANSMISSION CHANNELS		
		Changes in household composition	Remittances	Returned migrants
		↓	↓	↓
Availability	←	Changes in self-consumption (depending on household assets)	In-kind remittances	
Access	←	Less total (potential) household labor supply; compensation of migration investment	Monetary remittances	
Utilization	←	New hierarchies within the household; different opportunity cost of labor	Social remittances (non-returned migrants)	Social remittances (returned migrants); new hierarchies within the household
Stability	←	Less total (potential) household labor supply	More income diversification / Hedging against idiosyncratic shocks	

Source: Authors' elaboration.

Second, households can receive overseas remittances. Even though in most cases remittances are received from a migrant member of the household, the sender can also be a friend or a relative who is not part of the household. Remittances can produce a direct impact on all the dimensions of food security. Whereas in-kind remittances increase food availability, monetary remittances enhance food access. Both types of remittances – if correlated with negative shocks – can enhance food stability. Indeed, as pointed out by the new economics of labor migration literature (NELM), migration can be interpreted as a household risk-diversification strategy when insurance and capital markets are

[3] This can happen whenever female and male household heads exhibit systematic differences in their resource allocation preferences (Buvinic and Gupta, 1997).

incomplete or missing (Stark and Bloom, 1985). Finally, migrants might influence the utilization dimension by transferring new food habits through social remittances (Levitt, 1998).

Third, consumption patterns of the household may be influenced by the presence of a returned migrant. Indeed, the returnee can introduce food habits acquired abroad, thereby influencing the household food utilization dimension: this is another, and possibly stronger, mechanism of social remittances. Moreover, the prolonged absence of a member may irreversibly alter the hierarchies within the household and, after his return, the internal equilibrium may substantially differ from the one prior to migration. The migrant return may or may not alter the equilibrium existing while he was abroad.

The overall effect jointly produced by the above-mentioned transmission channels depends on the specific circumstances in which every migration episode takes place and, in most of the cases, it cannot be determined *a priori*. For example, if the migrant is not able or not willing to remit, the negative effects may offset the positive ones. On the other hand, anticipating an increase in their future income, some households may be induced to smooth consumption and to increase their living standard even before receiving remittances.

3. The 'Bangladesh Paradox': Social Progress with Moderate Economic Growth

Over the last twenty-five years South Asia has experienced remarkable achievements in terms of poverty reduction and food security improvement. The regional economic growth has been sustained, averaging 6.5 percent per year (World Bank, 2016b), and the Millennium Development Goals targets 1A (halving the proportion of the poor) and 1C (halving the proportion of the hungry) have been achieved for the region as a whole.

Among South Asian countries, Bangladesh recorded the best performance in terms of the improvement of several health and FNS indicators and managed to close the gap with its neighbouring countries. The per capita caloric intake gap, which stood at 200 kcal/day in early 1990s, disappeared by the second half of the 2000s and the proportion of undernourished people rapidly declined from 37 to 16 percent. Similarly, over the last twenty-five years, the prevalence of stunted and underweight children fell by more than one third, child mortality dropped by two thirds and life expectancy at birth increased by about ten years (World Bank, 2016a).

Considering the initial size of the gap, the pace of the improvements and the circumstances under which they occurred, Bangladesh's socio-economic achievements appear truly remarkable. In fact, a distinctive feature of Bangladesh's health and FNS improvements is that they occurred during a period in which the economy underperformed relatively to the rest of the region. These two concomitant and apparently conflicting circumstances – relatively slow economic growth and rapid social progress[4] – attracted the attention of several scholars who tried to find an explanation for this 'Bangladesh paradox' (Chowdhury *et al*., 2013). Asadullah *et al*. (2014), for example, emphasized the role played by private stakeholders committed to inclusive development such as local and international non-governmental organizations and, especially for improvements in schooling and education, religious organizations. Alternatively, Headey *et al*. (2015) identified the markedly pro-poor economic growth[5], the improvement of the status of women, the rapid increase of children's schooling as well as the improvements in sanitation and changes in neo- and antenatal care practices as the five major drivers of the above-mentioned progress in health and nutrition.

Surprisingly, the debate on the Bangladesh paradox seems to have overlooked international migration. However, migration has literally reshaped Bangladesh's society over the last two decades and recent data show that in 2010-2011 about one out of nine Bangladeshi households has been

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[4] Using cross-country regressions and a wide set of health, education and demographic indicators, Asadullah *et al*. (2014) show how, controlling for the level of per capita income, Bangladesh systematically underperformed in each of the regressions in 1980 and, symmetrically, significantly outperformed twenty-five years later.

[5] Bangladesh economic growth was markedly pro-poor on the back of rapid agricultural growth, labor-intensive manufacturing and the recent upsurge in overseas remittances. In particular, agricultural growth played a key role. The marked-oriented agricultural policies implemented during the 80s and the early 90s (Ahmed *et al*., 2000) and the concomitant diffusion of high yield varieties of rice paved the way for a remarkable increase in the cereal production (Hossain, 2010) and, consequently, for the improvement of the physical availability of food.

directly affected by international migration, i.e. by sending household members abroad and/or by receiving overseas remittances. Indeed, even though the diaspora of migrant workers can be traced back to the 1970s, it scaled up and gained macroeconomic relevance only since the mid-1990s. According to the United Nations (2013), Bangladesh has been the country that recorded the highest number of emigrants during the 2000s and in 2015 the estimated stock of Bangladeshi international migrants was the fifth largest in the world (UN, 2016). Similarly, the value of officially recorded remittances increased by a factor of seven since year 2000. According to Bangladesh Bank's estimates (2014), they were worth $15 billion in 2014 – about 10 percent of the country's GDP and almost half of the total export value (Table 2).

At the same time, the potential positive effect of international migration on FNS is intuitively supported by the descriptive statistics in Table 3, showing that migrant households perform systematically better than households without experience in international migration. Hence, Bangladesh represents a very interesting case study to analyze the relationship between migration and FNS. On the basis of the conceptual framework outlined in Table 1, the following sections estimate the effect of international migration on the FNS of migrant households.

Table 2. Trend in overseas remittances, Bangladesh (1993-2014)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Remittances (million USD)	1,009	1,154	1,202	1,355	1,525	1,599	1,807	1,955	2,071	2,848	3,178
Remittances growth	n/a	14.31%	4.16%	12.80%	12.52%	4.87%	12.97%	8.21%	5.94%	37.51%	11.58%
As % of GDP	3.04%	3.42%	3.17%	3.33%	3.60%	3.63%	3.95%	4.15%	4.41%	5.99%	6.12%
As % of total export	33.74%	37.95%	29.15%	30.07%	30.05%	27.21%	29.97%	29.67%	28.65%	41.93%	46.21%

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Remittances (million USD)	3,565	4,250	5,484	6,563	8,979	10,718	11,005	12,168	14,164	13,832	14,926
Remittances growth	12.20%	19.20%	29.04%	19.67%	36.82%	19.36%	2.68%	10.57%	16.40%	-2.34%	7.91%
As % of GDP	6.30%	7.05%	8.86%	9.59%	11.29%	11.99%	10.97%	10.87%	12.21%	10.65%	9.95%
As % of total export	49.13%	42.52%	46.69%	48.50%	55.49%	61.74%	59.57%	47.48%	52.68%	47.20%	45.46%

Source: Authors' calculation on Bangladesh Bank (2014) and World Bank (2016a) data.

Table 3. Household FNS achievements conditional to household size and total per capita expenditure

		Migrant households			Non-migrant households			
		Total p.c. expenditure			Total p.c. expenditure			FNS indicator
		25th percentile	50th percentile	75th percentile	25th percentile	50th percentile	75th percentile	
Household size	25th percentile	39.50	48.73	65.33	31.24	40.93	54.99	P.c. food expenditure (tk)
		2,328	2,492	2,838	2,093	2,438	2,720	P.c. caloric intake (kcal)
		68.78	75.05	80.82	66.40	70.61	77.49	Shannon index (food exp.)
		52.64	60.59	67.51	47.21	51.86	60.43	Shannon index (cal. Intake)
		76.81	80.87	83.61	73.47	76.65	81.49	Gini-Simpson index (food exp.)
		50.80	57.06	62.03	45.00	48.84	56.22	Gini-Simpson index (cal. Intake)
		54.7	51.2	48.0	65.0	62.4	57.4	Food share in household budget (%)
	50th percentile	39.16	51.50	62.05	31.14	40.17	51.63	P.c. food expenditure (tk)
		2,197	2,506	2,670	2,079	2,365	2,618	P.c. caloric intake (kcal)
		70.73	77.34	80.31	66.36	71.64	77.17	Shannon index (food exp.)
		53.74	61.48	66.32	46.68	51.95	58.69	Shannon index (cal. Intake)
		77.83	81.74	83.13	72.79	77.06	80.52	Gini-Simpson index (food exp.)
		50.92	57.38	60.57	43.97	48.38	53.67	Gini-Simpson index (cal. Intake)
		54.7	53.8	45.1	64.7	61.2	53.9	Food share in household budget (%)
	75th percentile	38.40	52.01	63.81	31.85	39.52	49.58	P.c. food expenditure (tk)
		2,230	2,624	2,577	2,108	2,333	2,461	P.c. caloric intake (kcal)
		71.92	79.12	76.85	66.29	71.83	76.88	Shannon index (food exp.)
		52.33	59.33	60.66	44.98	50.57	57.42	Shannon index (cal. Intake)
		77.28	81.51	81.18	72.16	76.60	80.32	Gini-Simpson index (food exp.)
		48.59	53.74	55.24	41.64	46.35	52.22	Gini-Simpson index (cal. Intake)
		54.3	55.0	47.6	65.8	60.1	52.1	Food share in household budget (%)

Source: Authors' calculation on HIES 2010 data (BBS, 2012).

4. Material and Methods

4.1. Data

The dataset of this study is the fifteenth round of the Bangladesh Household Income and Expenditure Survey (HIES 2010), a joint effort of the Bangladesh Bureau of Statistics (BBS) and the World Bank. The survey gathers information on 12,240 households distributed across 612 primary sampling units and 16 strata. It is nationally representative and collects a wide range of socio-economic information at both the individual and the household level.

Since the first waves, HIES surveys have been the primary source of information on Bangladeshi households. The consumption modules of HIES 2010 include information on quantity, monetary value and origin of 145 different food items aggregated into seventeen main categories. These data, collected through seven interviews over fourteen consecutive days, can be used to compute quantitative indicators of food security, such as per capita food expenditure or daily caloric intake, as well as measures of dietary diversity, such the Gini-Simpson and normalized Shannon indices, that can be used as proxies of the quality of the household diet.

Differently from the previous survey waves, HIES 2010 also includes detailed information on migration and remittances. Specifically, for each migrant, it provides individual information regarding his socio-demographic status (e.g. age, sex, literacy), migration and remittances. Moreover, the survey provides an estimation of the total monetary value of the remittances received by the household from friends and relatives living abroad over the previous twelve months. Finally, with specific reference to international migration, the survey asks if any of the members present at the time of the interview has been abroad for at least six consecutive months during the previous five years and, if so, the reason why he/she returned home.

In total, the number of households directly affected by international migration is 1,445 or 11.8 percent of the sample population. These households can be further disaggregated into four different subgroups according to the transmission channels by which international migration can influence household FNS: households with a migrant member currently abroad, households receiving remittances, household with returned migrants, and households having a member currently abroad and receiving remittances (cf. section 4.2). The sample size and the summary statistics of each group are reported in Table 4.

4.2. Definition of the Treatments

The evaluation of the impact of international migration on household FNS is carried out within the counterfactual framework of the Rubin causal model, generalized to a multiple treatment setting (Lechner, 2002) for the second part of empirical the analysis (more details in Appendix A1, A2).

The empirical analysis pursues two objectives, each of them relying on a different definition of the treatment states. Specifically, while it is appropriate to define a binary treatment for the estimation of the overall effect of international migration on household FNS, disentangling the different microeconomic transmission channels requires the definition of multiple active treatments.

The overall impact of international migration on household FNS can be evaluated by defining an active treatment that includes all households that have been affected directly by international migration. More specifically, the households exposed to the active treatment are identified as those households that, at the time of the survey, satisfied at least one of the following conditions: (*i*) a member of the household was abroad, (*ii*) the household received monetary remittances from abroad over the previous twelve months, (*iii*) a member of the household has been abroad for at least six consecutive months over the previous five years.

Table 4. Summary statistics of different household groups

Household characteristics	Total Sample	Overall impact of intl. migration		Microeconomic transmission channels of intl. migration			
		Migrant	Non-migrant	A. Migrants	B. Remittances	C. Returnees	A∩B. Migrants & Remittances
P.c. food expenditure (taka/day)	45.11	55.76	43.69	54.53	49.66	52.98	57.46
Gini-Simpson (food exp.)	76.61	80.03	76.15	80.41	79.53	80.68	79.87
Norm. Shannon (food exp.)	71.66	75.86	71.09	76.12	75.82	77.25	75.47
P.c. caloric intake (kcal/day)	2387	2582	2361	2441	2503	2412	2647
Gini-Simpson (cal. intake)	49.29	54.66	48.57	56.72	52.84	54.84	54.58
Norm. Shannon (cal. intake)	53.29	59.47	52.46	61.58	57.66	60.17	59.27
Household size*	4.65	5.74	4.51	5.90	4.48	5.07	5.90
Children (0-5)	0.54	0.60	0.53	0.58	0.45	0.59	0.60
Kids (6-17)*	1.29	1.40	1.27	1.35	1.37	1.29	1.45
Female adults (18-45)*	1.02	1.17	1.00	1.12	1.05	1.16	1.16
Female adults (46-65)*	0.30	0.42	0.29	0.48	0.27	0.28	0.44
Male adults (18-45)*	0.98	1.49	0.91	1.66	0.78	1.19	1.57
Male adults (46-65)*	0.34	0.41	0.33	0.47	0.32	0.33	0.42
Elders (66+)*	0.19	0.25	0.18	0.24	0.24	0.22	0.26
Schooling, female adults (years)*	3.63	4.55	3.50	4.65	4.96	5.75	4.28
Schooling, male adults (years)*	4.36	4.34	4.36	4.26	4.84	6.61	3.87
Religious belief (Islam)	0.88	0.95	0.87	0.94	0.94	0.93	0.95
Entrepreneurship (formal)*	0.06	0.05	0.06	0.05	0.08	0.07	0.04
Entrepreneurship (informal)*	0.18	0.10	0.19	0.07	0.19	0.24	0.07
Access to electricity network	0.58	0.76	0.55	0.80	0.71	0.81	0.75
Urban	0.36	0.32	0.37	0.27	0.35	0.41	0.31
Landless	0.07	0.03	0.07	0.04	0.03	0.02	0.03
Number of observations	12,234	1,445	10,789	153	154	123	952

Note: * information on migrant members absent at the time of the survey data collection is taken into account.
Source: Authors' calculation on HIES 2010 data (BBS, 2012).

The empirical assessment of the microeconomic transmission channels requires the definition of four active treatment states:[6]

- Treatment group 'A', meant to capture the 'pure' effect of the change in household structure, includes those households that reported to have a migrant member currently abroad but did not receive monetary remittances[7] over the past twelve months and did not have previous experience[8] in international migration (153 obs.);
- Treatment group 'B', meant to capture the net effect of receiving monetary remittances, encompasses the households that, although having neither migrants currently abroad nor previous experience of international migration, did receive remittances from abroad over the past twelve months (154 obs.);
- Treatment group 'C', meant to capture the net effect of returned migrants, includes the households that have previous experience in international migration but currently do not have any members abroad and have not received monetary remittances over the previous twelve months (122 obs.);
- Treatment group 'A ∩ B', meant to capture the joint effect of migration and remittances, encompasses the households that have received monetary remittances over the previous twelve months and currently have a migrant member but do not have any returned migrant among its members (952 obs.).

Finally, the passive treatment state contains that large pool of non-recipient households without any current or past experience in international migration (10,795 obs.).

[6] The definition of the five (4 active + 1 passive) mutually exclusive treatments leaves out some marginal case like the intersections 'A ∩ C', 'B ∩ C' and 'A ∩ B ∩ C'. These cases are of minor interest and, given their small size (63 households in total), they have not been considered in the analysis.

[7] Unreported (but not under-reported) remittances might be an issue. In order to increase the size of the groups 'A' and 'C', households in the 5th percentile of the remittances/income ratio distribution has been considered as not receiving remittances. A sensitivity analysis shows that this manipulation does not affect the results except for the significance of treatment 'A' on per capita caloric intake.

[8] A household is considered having previous experience in international migration if at least one of the members present at the time of the interview has been abroad for six consecutive months over the past five years.

By defining five alternative treatments, it is theoretically possible to estimate twenty different ATT. However, since the aim of the study is to assess the impact of the various channels relative to a no-migration counterfactual scenario, the analysis focuses on the evaluation of the four active treatments vis-à-vis the passive one. Following Lechner (2002), the impacts are estimated performing a series of binary comparisons. Compared to the adoption of a multiple-choice model, the main advantage of this strategy is its relative simplicity and its higher robustness to model misspecification.

4.3. Definition of the Outcome Variables

FNS is an inherently multi-dimensional construct and cannot/should not be summarized by a single measure. Over the years, the literature has proposed several indicators, each of them capturing some of the dimensions of the food security problem (Masset, 2011; de Haen *et al*., 2011; Carletto *et al*., 2013). In general, however, the appropriateness of an indicator needs to be assessed on a case-by-case basis with regard to the purpose of the analysis (Habicht and Pelletier, 1990). Moreover, given a set of theoretically suitable indicators, the final choice is often constrained by the availability of data. The present study makes no exception and, given the lack of available anthropometric measures, it relies on indicators that can be computed using household-level information on nutritional inputs and consumption behavior. Specifically, household FNS is measured estimating food-category-wise ATTs and using a set of different indicators. The indicators are the daily per capita food expenditure, the daily per capita caloric intake, the normalized Shannon index and the Gini-Simpson index. The two diversity indices are computed for both household food expenditure and sources of caloric intake.

Per capita food expenditure and per capita caloric intake are computed from HIES consumption modules. Whereas the estimation of food expenditure is straightforward, the computation of the caloric intake requires some assumptions. Indeed, even though the BBS provides the caloric conversion factor for each food item quantity, some of them are reported in units (e.g. the number of eggs, chocolate snacks, cups of chai, etc.) for which the weight/volume has been assumed.[9]

The Shannon index and the Gini-Simpson index are two of the most common measures of diversity that, in the context of migration and food security studies, have already been employed by Nguyen and Winters (2011). Formally, they are defined as

$$I_{ShannonNorm} = \frac{\sum_{c=1}^{C} s_c \, ln(s_c)}{\max\left(\sum_{c=1}^{C} s_c \, ln(s_c)\right)} \times 100 \quad (1)$$

$$I_{Gini-Simpsozon} = (1 - \sum_{c=1}^{C} s_c^2) \times 100 \quad (2)$$

with $c = \{1, 2, \ldots, C\}$ indexing the food categories and s_c describing their relative share of either total food expenditure or total caloric intake. The two indices range from 0 to 100 with a higher value being associated with a higher degree of diversity. The measurement of dietary diversity is relevant because diet diversification has proven to be a robust proxy for households' food security as well as for child nutritional status (Hoddinott and Yohannes, 2002; Arimond and Ruel, 2004; Thorne-Lyman *et al*., 2010). In particular, Arimond and Ruel (2004) found that dietary diversity is significantly correlated with children's height-for-age *z*-score, a correlation that remains significant also after controlling for the socio-economic status of the household.

In conclusion, whereas food expenditure and caloric intake can be considered proxies for food access and food availability dimensions, dietary diversity measures can be regarded as proxies of the food utilization dimension. Unfortunately, the cross-sectional nature of data does not allow capturing food stability.

9 However, they are relatively few and represent a negligible share of the total caloric intake. For instance, eggs represent on average only 0.44 percent of daily caloric intake.

5. Evaluation Strategy

5.1. Methodological Issues in Microeconomic Migration Studies

Since it is not possible to observe the same unit under more than one treatment state, the problem of causal inference can be conceived as a problem of missing data (Morgan and Winship, 2007). Aside from this general problem, valid for any causal model estimation, the microeconomic assessment of the impact of migration raises a series of specific methodological issues. Following Adams's (2011) taxonomy, the main obstacles can be identified as those arising from (*i*) the simultaneity of the migration decision with other decisions, such as household labor supply and fertility, which may also influence the outcome of the variable(s) of interest, (*ii*) the self-selection of migrants, who differ systematically from the stayers, (*iii*) the reverse causality nexus between FNS and migration, and (*iv*) the presence of relevant omitted/unobservable variables. For the purpose of this analysis, all these points, except for (*iii*), are relevant. In fact, since the paper aims to estimate the impact of migration and not the motives behind the migration decision, reverse causality is not a cause for concern. Within non-experimental settings, the other issues can be addressed by means of instrumental variable (IV) estimators, even though limitations of available data and/or concerns regarding the validity of the exclusion restriction may limit the scope of this approach.

In the absence of credible instruments, matching methods represent a valid alternative. Indeed, matching methods have increasingly been used in a number of migration studies (Ham et al., 2011; Jimenez-Soto and Brown, 2012; Bertoli and Marchetta, 2014; Möllers and Meyer, 2014) because, if the quality of the data allows to argue for the plausibility of selection on observables, they are able to overcome the aforementioned issues. In the context of migration studies, by comparing the results obtained using a set of commonly-used non-experimental estimators with the benchmark unbiased ATT estimates obtained by taking advantage of a natural experiment (i.e. the New Zealand's visa lottery for Tongan migrants), McKenzie *et al.* (2010) showed that matching methods perform reasonably well and that they can be considered the best non-experimental solution after IV. However, they also pointed out that matching is not always able to fully remove the bias introduced by (*i*)-(*iv*) and argued that selection on observables might still represent an issue. Anyway, it is worthwhile to note that McKenzie *et al.* (2010) only include matching covariates that are related to the individual migrant. Neglecting the relevance of household characteristics in determining individual outcomes and migration decision, however, is not consistent with one of the essential features of the NELM approach. Vice versa, the specification adopted in this study (cf. Section 5.3) includes several variables related to the socio-demographic composition of the households that can be considered exogenous to the treatment(s) with a reasonable degree of confidence and that, at the same time, are significantly correlated with both the outcome variables and the probability of migration.

5.2. Matching Strategy

The identification assumption of matching methods is that it is possible to estimate counterfactual outcomes by finding untreated units similar to the treated ones under every relevant aspect except for the exposition to an alternative treatment state (Holland, 1986). The two assumptions on which they rely are selection on observables and stable unit treatment value (SUTVA) (cf. section A2 of the appendix).

In general, the impact evaluation literature that employs matching methods has relied on propensity score (for migration studies: Cox-Edwards and Oreggia, 2008; Ham *et al*., 2011; Jimenez-Soto and Brown, 2012; Bertoli and Marchetta, 2014). This study departs from this tradition and, following Rubin (2001), performs the matching on the linearized propensity score (*lps*), i.e. the logarithm of the odds of the propensity scores (for further details, see appendix A3). The adoption of *lps* has two main advantages: first, it guarantees the consistency of the matching estimators based on the linear distance between individual scores and, second, it allows a clearer identification of the region of common support. The linearized propensity score is a straightforward and theoretically consistent method to address the problem of the non-linearity of a propensity score: by removing the non-linearity of the propensity score, it makes the distances between observations comparable (Imbens and Rubin, 2015).

When applying matching methods, the analyst should be very careful in interpreting the various explanatory variables, clearly distinguishing between (*i*) treatments, (*ii*) intrinsic characteristics of the analytical units and (*iii*) non-specific identifying features (Cox, 1992), e.g. the region in which a household lives. Accordingly, in the assessment of the overall impact of international migration on households' FNS the sample has been split into four strata on the basis of the regional food poverty lines provided by the Bangladesh Bureau of Statistics (BBS, 2012) and matching has been performed within each stratum. The final results have then been computed by adding up the estimates of each stratum and by re-estimating the standard errors for the entire population. This procedure allows to properly address part of the heterogeneity stemming from households' non-specific identifying features and to estimate the *lps* on the households' individual characteristics only: this turns out to be particularly relevant when the outcome variables are expressed in monetary terms and price levels exhibit a significant geographical variability.

The within-strata matching procedure has not been implemented in the second part of the empirical analysis, i.e. the assessment of the impact of different microeconomic transmission channels, because of the absence of an adequate proportion of treated units within each stratum. Hence, the estimates have been obtained by performing matching on the entire sample and the problem of non-specific identifying features has been partially addressed by including regional dummies among the covariates. Even though this is the standard procedure followed by the literature (cf. Bertoli and Marchetta, 2014; Möllers and Meyer, 2014; Jimenez-Soto and Brown, 2012), it should be considered the second-best solution. Given this limitation, the outcome variables based on food expenditures have been dropped in this second part of the analysis.

5.3. Choosing the Conditioning Variables

The choice of covariates used to estimate the balancing score is a crucial step of the estimation strategy, since they represent the variables that are supposed to ensure the conditional independence of potential outcomes. In order to be eligible, a variable needs to influence both the probability of migration and the outcome variable. At the same time, however, it should not itself be influenced by the treatment (Caliendo and Kopeinig, 2008). As a general rule of thumb, a variable can be considered exogenous if its value is determined prior to the exposition to the treatment.

The final set of conditioning covariates X includes six variables meant to describe the demographic structure of the household, two variables describing the educational attainment of the adult members and other five variables related to households' religion, non-agricultural business activities, land assets, access to the electricity network and urban/rural status (Tables A.1 and A.2). Moreover, following Zanutto (2006), the specification of the probability model also included sample weights. In order to avoid matching distortions, all variables related to education and to the households' demographic composition have been computed taking into account all the migrant members not present at the time of the survey.

The specification of the probability model partially departs from previous works that employed matching methods in the context of migration studies. On the one hand, the present model is consistent with the NELM approach because it emphasizes the importance of the household structure for migration decisions by including six pre-treatment variables describing the demographic structure of the household. On the other hand, the specification excludes some demographic variables that have been employed in previous works but raise concerns regarding their exogeneity. For example, departing from Bertoli and Marchetta (2014) and Möllers and Meyer (2014), the age dependency ratio has not been included because migration is likely to influence household's fertility choices and, in turn, the ratio itself. For the same reason, no information on children below the age of six is included.

The education attainment of male and female adults, both included in the *lps* specification, are two reasonably exogenous pre-treatment variables and are correlated with the pre-migration economic status of the household and with the members' individual ability. Conversely, the educational level of younger members has not been taken into account because of its potential endogeneity.

The specification also includes two pre-treatment dummy variables indicating the household's involvement in either formal or informal business in the non-agricultural sector.[10] These variables are correlated with the pre-migration economic status of the household and, very likely, with some unobservable characteristics of the household head that affect the economic behavior (and therefore the economic outcome) of the households (Welter, 2011). The households' assets could be considered endogenous to migration but, given the shallow land market of Bangladesh (Mendola, 2008), the 'landless dummy' can be considered a proxy for households' pre-migration income.

Finally, departing from Möllers and Meyers (2014), Jimenez-Soto and Brown (2012) and Calero *et al*. (2009), the matching covariates do not include any variable directly related to the household head. Even though some characteristics of the head may well influence the household's choices, the headship is endogenous to migration and matching on household head characteristics would be misleading. In fact, female-headed households are significantly more frequent among migrant households but, at the same time, almost all migrants are male and one out of three is registered as husband of the head, suggesting that the headship shifted to the wife after the husband's migration.

A last comment is in order about the specification of the probit model for treatment 'C', in which also the household-level per capita expenditure has been included. Such inclusion is justified by the fact that the treatment group 'C' is related to a different stage of the migration process and without

[10] In the case of migrant households, the dummies take value 1 only if the business was already running before migration.

conditioning for the level of per capita expenditure the treatment effect would capture the long-term cumulative effect of migration, possibly remittances, and the presence of returnees rather than only the latter. It should be noted that only in this case, given the definition of treatment 'C', the expenditure can be considered exogenous.

5.4. Matching Robustness

Matching estimates based on a balancing score are robust only if the score itself is effectively able to ensure an adequate balance in the distribution of the covariates among the treatment and the matched control groups. Table 5 reports some post-estimation statistics. After matching, both the mean and median bias of the covariates are significantly reduced. Specifically, the mean bias is always below the five percent threshold except for stratum number 4, in which it decreases from 24.0 to 6.8 percent. However, in the case of the overall impact analysis it was necessary to drop 40 observations (2.8 percent of the treated households) in order to reach a satisfactory level of balance. Following Sianesi (2004), in order to test for the orthogonality of the treatment and the covariates, Table 5 also reports the pseudo-R^2 and the p-value of the likelihood ratio test for joint significance of the coefficients of the probit regression on matched and unmatched samples. In all cases, the goodness of fit of the matched probit is not substantially different from zero and the hypothesis of joint significance is always rejected.[11]

For computational ease, the counterfactual scenario has been estimated employing a nearest neighbor matching (NNM) caliper estimator (n = 3) with replacement. The caliper is approximately 0.1 standard deviations of the *lps*. All results prove to be robust to different specification of the same estimator (n = 1, 2, 4) and to a radius estimator.

[11] Figure A.1 and A.2 in the Appendix provide a visual assessment of the matching procedure in the case of the four blocks of the overall impact analysis and in that of the four treatment states in the analysis aiming at disentangling the aggregate impact of migration, respectively.

Table 5. Balance checks

Overall impact						
Stratum	Sample	Mean Bias	Median Bias	Pseudo-R2	LR test	Out of common support
1	Before matching	28.1	25.7	0.211	0.000	5 out of 225
	After matching	4.9	5.8	0.012	0.953	
2	Before matching	24	22.3	0.189	0.000	8 out of 428
	After matching	3.4	3.3	0.006	0.966	
3	Before matching	29	25	0.25	0.000	21 out of 554
	After matching	3	1.9	0.004	0.985	
4	Before matching	24	20.2	0.229	0.000	6 out of 238
	After matching	6.8	7.2	0.016	0.752	
Impact of microeconomic transmission channels						
Treatment group	Sample	Mean Bias	Median Bias	Pseudo-R2	LR test	Out of common support
A	Before matching	28.8	24.9	0.252	0.000	0 out of 153
	After matching	4.9	3.7	0.014	0.999	
B	Before matching	14	10	0.065	0.000	0 out of 154
	After matching	2.9	2.2	0.004	0.999	
C	Before matching	23.2	20.6	0.103	0.000	0 out of 122
	After matching	4.5	4.5	0.018	0.999	
A∩B	Before matching	25.8	20.6	0.271	0.000	1 out of 952
	After matching	2.7	1.9	0.005	0.926	

Source: Authors' calculation on HIES 2010 data (BBS, 2012).

6. Results

6.1. Aggregate Impact of International Migration on Household FNS

This section reports and discusses the estimates of the overall impact of international migration on household FNS. The concerns regarding potential heterogeneity of the effects are mitigated by the descriptive statistics of Table 3, which show quite stable differences in FNS indicators between migrant and non-migrant households across their size and level of expenditure. The results are largely consistent with previous findings (Azzari and Zezza, 2011; Ngouyen and Winters, 2011; Böhme *at al.*, 2015) and indicate that international migration produces a positive and statistically significant impact on all the indicators considered in the study (Table 6).[12] Specifically, migrant households' diet increases both in terms of quantity (+276 kcal/day per capita, +11.9 percent) and variety (Shannon and Gini-Simpson indexes rise from 72.44 to 75.77 and from 77.05 to 79.99, respectively). The impact of international migration on food expenditure is qualitatively similar but higher in relative terms.

Table 6. ATT of international migration on household food and nutrition security

FNS Indicator	Observed	Counter-factual	ATT	% change	Standard Error	p-value
Caloric intake						
P.c. caloric intake (kcal)	2587	2312	276	11.9%	34.41	0.000
Norm. Shannon Index (caloric intake)	59.48	53.19	6.29		0.51	0.000
Gini-Simpson index (caloric intake)	54.71	48.80	5.91		0.45	0.000
Food expenditure						
P.c. food expenditure (taka)	55.85	44.84	11.01	24.6%	1.07	0.000
Norm. Shannon Index (food exp.)	75.77	72.44	3.33		0.39	0.000
Gini-Simpson index (food exp.)	79.99	77.05	2.94		0.28	0.000

Source: Authors' calculation on HIES 2010 data (BBS, 2012).

From a FNS viewpoint, the results indicate that international migration allows households to consume more food and to have access to a more diversified diet. In addition, consistently with consumption theory, they also show that the average quality of food increases. In fact, the percentage increase in per capita food expenditure (+24.6 percent) turns out to be larger than the corresponding increase in caloric intake (+11.9 percent), suggesting that, on average, migrant households shift their consumption towards superior food goods. However, since the ATT refers to an unweighted basket of different goods, this last point can be consistently assessed only by comparing the changes within each food category, i.e. estimating food-category-specific ATTs.

[12] Among the few works that studied the nexus between migration and FNS, only Crush (2013) found, *prima facie*, 'more food secure households in the non-migrant group'. However, Crush's results probably reflect the specificity of the Southern African region, characterized by wars and conflicts (with specific reference to Angola and DRC) or major economic shocks such as the collapse of the Zimbabwean economy. Moreover, his primary focus is on rural-urban migration, which differs from international migration, as considered in this paper.

The estimation of the overall impact of international migration on the consumption of specific food categories (Table 7) provides a deeper insight into the changes in migrant households' dietary habits. In general, caloric intake records a significant two-digits increase for all the categories except for 'Food grains' and 'Dining out'.[13] 'Food grains' remain, by far, the primary source of calories, recording a modest increase in the quantity consumed (+4.0 percent) but decreasing their relative share in the average households' food basket by 4.9 percentage points. Notably, the three largest increases in food consumption indicate a switch towards animal protein rich foods such as 'Milk & Dairy' (+75.2 percent), 'Meat' (+66.7 percent) and 'Eggs' (+56.7 percent). Similarly, the changes in the consumption of foods like 'Vegetables' (+15.5 percent), 'Fruits' (+33.0 percent) and 'Oil & Fats' (+35.9 percent), reveal a significant increase in the intake of fundamental vitamins and micronutrients.

The impact of international migration on item-wise food expenditure (Table 8) largely mirrors the one on caloric intake. More precisely, the impact is always positive except for 'Dining out' and 'Tobacco and Tobacco products', whose ATT exhibit a negative sign although the latter is not significant at conventional confidence levels.[14] In relative terms, 'Meat', 'Milk and Dairy' and 'Fruits' are the food items showing the highest increase.

Comparing the effect on caloric intake with the effect on food expenditure gives an insight about the changes in the quality of food consumed by migrant households. In fact, the difference between the percentage changes in expenditure and in quantity approximates the percentage change in the

[13] 'Dining out' is the only food category whose results are negatively affected by migration (-16.8 percent). The interpretation of this result is difficult in absence of more specific information on household eating behavior. However, considering that 98.3 percent of migrants are males (and in at least 36.6 percent of the cases the male migrant is, very likely, the former household head) and the cultural Bangladeshi environment, we tend to interpret this as a consequence of the fact that male migration translates into a reduced opportunity to go out for the rest of the family, especially for women. Also, the negative effect of consumption of tobacco products, typically consumed by male adults, can be interpreted along similar lines. The fact that, in some circumstances, eating out might be cheaper (due to wholesale prices for ingredients, more efficient use of fuel and very low wages for the people cooking) but less healthy (lower quality and hygienic standards) can be considered a complementary explanation.

[14] Other food categories whose impacts result to be not statistically significant are 'Sweetmeat', 'Drinks' and 'Miscellaneous Food'.

prices of the products, which can be used as a proxy for changes in the average quality of each food item consumed by the household. This exercise confirms the intuition behind the comparison of the two 'aggregated' treatment effects. For example, migrant households shift their consumption toward more expensive varieties of 'Fruits' and 'Pulses' products whose average prices are 15.4 percent and 14.4 percent higher than those of non-migrant households, respectively.[15]

Finally, Figure 1 provides a visual comparison between the observed and the counterfactual distributions of migrant households' (log) per capita food expenditure (left panel) and the Gini-Simpson index calculated on food expenditure (right panel). On the one hand, it is evident that, by shifting the two distributions to the right, migration contributes to an improvement of household FNS. On the other hand, the semi non-parametric nature of the estimates allows to gauge the risky nature international migration. Indeed, even though the two distributions shift to the right, they have (slightly) fatter left tails, indicating that for some households, migration 'went wrong' and induced a deterioration of households' FNS.

The results of this first part of the analysis are relevant for two reasons. Generally, they provide further and more detailed evidence confirming the positive impact of international migration on the FNS of migrant households. On a more specific ground, they contribute to shed some further light on the determinants of the 'Bangladesh paradox'. Indeed, considering the well-established relation between an adequate intake of micronutrients, vitamins and proteins and physical growth, mental development and health status of household members – and of children and pregnant women in particular (Hoddinott and Yohannes, 2002; Arimond and Ruel, 2004; Headey, 2013) – the surge of international migration could be seen as a missing piece of the 'Bangladesh paradox' puzzle. In fact, through its effect on household FNS, international migration may have positively contributed to the remarkable health improvements experienced by the country in the 1990s and 2000s.[16]

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[15] However, a word of caution in drawing these conclusions is needed because the standard errors are not available.

[16] The hypothesis of a positive link between improved food and nutrition security – specifically, an increase in per capita

Table 7. Food-specific ATTs of international migration on household food intake (kcal/day)

Food item	Observed		Counterfactual		% change	ATT	Standard Error	P- value
	Absolute value (kcal)	As % of total intake	Absolute value (kcal)	As % of total intake				
Food Grains	1,663.1	64.3%	1599.4	69.2%	4.0%	63.7	23.4	0.007
Pulses	64.4	2.5%	56.6	2.4%	13.7%	7.8	2.2	0.000
Fish	95.8	3.7%	72.5	3.1%	32.2%	23.3	2.2	0.000
Eggs	14.4	0.6%	9.2	0.4%	56.7%	5.2	1.0	0.000
Meat	35.7	1.4%	21.4	0.9%	66.7%	14.3	2.0	0.000
Vegetables	176.0	6.8%	152.4	6.6%	15.5%	23.6	2.9	0.000
Milk & Dairy	45.2	1.7%	25.8	1.1%	75.2%	19.4	2.0	0.000
Sweetmeat	14.7	0.6%	10.2	0.4%	44.3%	4.5	1.4	0.002
Oil & Fats	253.4	9.8%	186.5	8.1%	35.9%	67.0	5.1	0.000
Fruits	41.9	1.6%	31.3	1.4%	33.8%	10.6	2.2	0.000
Drinks	2.8	0.1%	1.9	0.1%	52.1%	1.0	0.3	0.003
Sugar & Molasses	70.2	2.7%	47.2	2.0%	49.0%	23.1	2.9	0.000
Miscellaneous Food	2.8	0.1%	1.6	0.1%	71.8%	1.2	0.3	0.000
Dining out (Food outside)	22.8	0.9%	27.4	1.2%	-16.8%	-4.6	2.2	0.038
Spices	74.2	2.9%	59.7	2.6%	24.3%	14.5	1.5	0.000
Betel leas & Chewgoods	10.0	0.4%	8.6	0.4%	16.2%	1.4	0.5	0.006

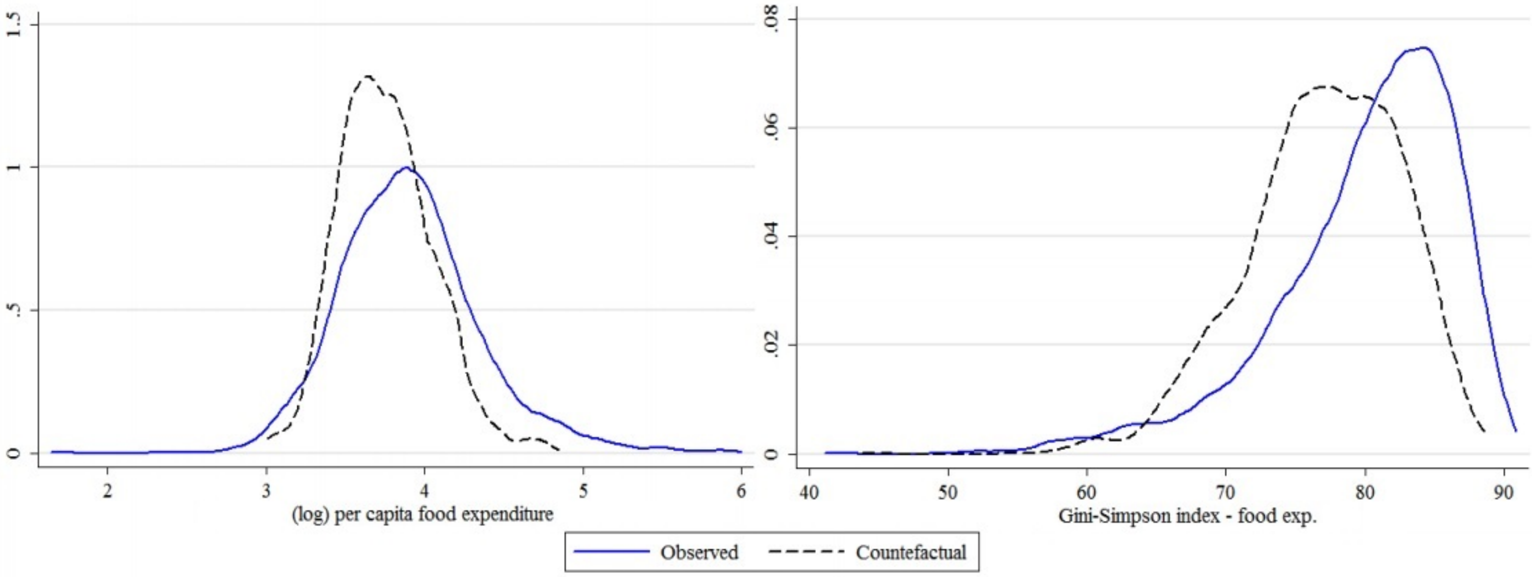
Source: Authors' calculation on HIES 2010 data (BBS, 2012).

Table 8. Food-specific ATTs of international migration on household food expenditure (Taka/day)

Food item	Observed			Counterfactual			% change	ATT	Standard Error	P- value
	Absolute value (tk)	As % of food exp.	As % of total exp.	Absolute value (tk)	As % of food exp.	As % of total exp.				
Food Grains	16.68	29.9%	13.6%	15.67	34.9%	18.3%	6.5%	1.01	0.08	0.000
Pulses	1.51	2.7%	1.2%	1.18	2.6%	1.4%	28.1%	0.33	0.09	0.000
Fish	9.08	16.3%	7.4%	6.63	14.8%	7.7%	36.9%	2.45	0.08	0.000
Eggs	1.03	1.9%	0.8%	0.70	1.6%	0.8%	47.6%	0.33	0.10	0.000
Meat	5.97	10.7%	4.9%	3.58	8.0%	4.2%	66.9%	2.39	0.01	0.000
Vegetables	4.21	7.5%	3.4%	3.47	7.7%	4.0%	21.4%	0.74	0.04	0.000
Milk & Dairy	2.31	4.1%	1.9%	1.28	2.9%	1.5%	80.4%	1.03	0.04	0.000
Sweetmeat	0.41	0.7%	0.3%	0.34	0.8%	0.4%	22.6%	0.08	0.14	0.588
Oil & Fats	2.59	4.6%	2.1%	1.93	4.3%	2.2%	34.3%	0.66	0.05	0.000
Fruits	2.91	5.2%	2.4%	1.95	4.3%	2.3%	49.2%	0.96	0.05	0.000
Drinks	0.56	1.0%	0.5%	0.38	0.8%	0.4%	48.0%	0.18	0.10	0.074
Sugar & Molasses	0.94	1.7%	0.8%	0.64	1.4%	0.7%	47.6%	0.30	0.08	0.000
Miscellaneous Food	0.11	0.2%	0.1%	0.06	0.1%	0.1%	76.4%	0.05	0.37	0.895
Dining out (Food outside)	1.19	2.1%	1.0%	1.43	3.2%	1.7%	-16.9%	-0.24	0.05	0.000
Tobacco & Tobacco products	0.76	1.4%	0.6%	1.07	2.4%	1.2%	-29.2%	-0.31	0.23	0.171
Spices	4.28	7.7%	3.5%	3.37	7.5%	3.9%	26.8%	0.90	0.05	0.000
Betel leas & Chewgoods	1.32	2.4%	1.1%	1.18	2.6%	1.4%	12.2%	0.14	0.24	0.551

Source: Authors' calculation on HIES 2010 data (BBS, 2012).

Figure 1. Distribution of (log) per capita caloric intake and Gini-Simpson index



6.2. Microeconomic Transmission Channels Linking International Migration to Household FNS

The results of the second part of the empirical analysis, the disentanglement of the impact of international migration on households FNS, are presented in Table 9.

Having a member currently abroad and receiving remittances (treatment group ‘A ∩ B’) is by far the most frequent case (cf. Table 4). As expected, this treatment turns out to produce a positive and statistically significant effect on both the quantity and the variety of the food consumed by household members. Specifically, the households exposed to this treatment are those that exhibit the highest increase in per capita caloric intake, both in relative and absolute terms. The effect on dietary diversity is also positive, substantial and statistically significant.

The second largest treatment group consists of recipient households that do not have any current or previous experience of international migration (treatment group 'B'). Considering that in this case the treatment consists in a simple income transfer, the signs of the ATTs are expected to be non-negative. They are indeed positive but the effect is statistically significant only for the diet variety indicators. This result can be partly explained by the relatively high counterfactual caloric intake of this treatment group: starting from an already adequate level of caloric intake, these households may prefer to use part of their additional income to increase the variety and the quality of their diet rather than just consuming more food than they used to. Secondly, it must be considered that the average value of remittances received by this group of households is lower (about one third) than the value received by households belonging to the '$A \cap B$' group. Thirdly, since these remittances come from friends or relatives who are outside the inner circle of the household, they are more likely to be *una tantum* transfers, made for specific reasons (e.g. a gift, debt repayment), and used by the recipient household for purposes other than food consumption.

Group 'A' is the third largest treatment group and consists of households that currently have some members abroad but have no returnees and do not receive remittances. The effect of this treatment is not statistically significant in terms of per capita caloric intake[17] but is positive and strongly significant for the normalized Shannon and the Gini-Simpson indexes. These findings suggest that a stand-alone change in households' internal hierarchies is enough to produce, on average, a positive tangible effect on dietary diversity, a proxy for the utilization dimension of FNS.

The last group (treatment group 'C') comprises those households that have been exposed in the past to international migration but, at the time of the survey, did not have any migrant member abroad and did not receive remittances over the previous twelve months. Consistently with the theoretical framework, the presence of returned migrants does not produce any significant impact on per capita

[17] Removing the 5th percentile cut-off threshold for remittances/income, the impact of migration turns out to be positive and significant. This is the only result that is not robust to changes in the cut-off threshold.

caloric intake but significantly increases the dietary diversity, again a tangible effect on the utilization dimension likely due to the new knowledge/information brought back home by the returnees.

In general, the findings are largely consistent with the conceptual framework. For instance, it is interesting that the 'pure' migration effect (treatment 'A') and the effect of returned migrants (treatment 'C') influence only dietary diversity. This somehow confirms the significance of the effect on the utilization dimension due to the change in household composition and to the presence of retuned migrants.

Table 9. The disentanglement of the effect of migration on household FNS

Treatment group	Observed	Counterfactual	ATT	% change	P-value
		Per capita caloric intake			
A. Migrants	2456	2402	54	2.25%	0.548
A∩B. Migrants & Remittances	2643	2282	361	15.82%	0.000
B. Remittances	2503	2394	109	4.54%	0.171
C. Returnees	2412	2350	62	2.63%	0.354
		Normalised Shannon index (caloric intake)			
A. Migrants	61.77	52.63	9.14		0.000
A∩B. Migrants & Remittances	59.25	51.65	7.62		0.000
B. Remittances	57.66	54.60	3.05		0.010
C. Returnees	60.17	57.07	3.10		0.024
		Gini-Simpson index (caloric intake)			
A. Migrants	56.86	48.10	8.76		0.000
A∩B. Migrants & Remittances	54.57	47.31	7.28		0.000
B. Remittances	52.84	50.58	2.26		0.028
C. Returnees	54.84	52.35	2.49		0.041

Source: Authors' calculation on HIES 2010 data (BBS, 2012).

7. Conclusion

This paper contributes to the literature by analyzing the linkages between migration and household FNS. After developing a unifying conceptual framework for interpreting how international migration can affect household food security, the paper empirically estimates the overall impact of international migration on Bangladeshi households' FNS using a within-strata matching estimator based on the linearized propensity score. Then, by disentangling this overall effect and relying on the multiple-treatment counterfactual framework, it assesses the impact of the various microeconomic transmission channels described in the theoretical framework.

The estimation of the overall effect indicates that international migration produces, on average, a significant and positive impact on all household FNS dimensions, enhancing food availability, access and utilization. Specifically, the analysis shows that thanks to international migration households have access to a more expensive, more diversified, calorie-richer and higher-quality diet. In addition, the item-wise disaggregation of the treatment effect shows that the increase in migrant households' food consumption is concentrated among higher-quality products, particularly those richer in animal proteins and micro-nutrients.

The assessment of the microeconomic transmission channels on the various dimensions of FNS is consistent with the predictions of the conceptual framework and indicates that the average effect of international migration on household FNS through all the identified microeconomic channels is always non-negative. In particular, even though the joint effect of 'migration' and 'remittances' turns out to be the most beneficial, all the stand-alone microeconomic channels contribute to household FNS either by increasing food consumption or by improving diet variety.

The analysis finds that international migration produces important effects on the FNS of migrants' households in their home countries and, accordingly, this effect should be adequately considered in the design of both migration and FNS policies. Migration – and specifically international migration – should be mainstreamed into the FNS agendas of international organizations and governments. Likewise, FNS implications should inform any meaningful discussion on migration and development. Taking proper account of the effects of migration on FNS can, for instance, contribute to design more effective policies aimed at achieving the UN-SDG 2 'Zero hunger'.

The disentanglement of the effect dissipates the concern regarding possible negative effects of migration on the FNS of sub-groups of migrant households but the analysis also shows that migration may not be an option for several small and potentially vulnerable households. Hence, on one hand, FNS policy interventions should include measures aimed to reduce, when possible, the costs that may weaken the bond between migrants and their households of origin and that could partially jeopardize part of the beneficial effects. On the other hand, information regarding the migration status of the households may be used as a targeting criterion for pro-poor FNS policies in favor of those family units (e.g. small rural households) for which, because of their individual characteristics, migration does not represent a viable strategy.

Finally, with specific reference to Bangladesh, the empirical findings contribute to shed further light on the 'Bangladesh paradox'. Indeed, recalling the linkages between FNS and several important health outcomes, the proven positive effect of international migration on household FNS suggests that international migration could have been an important determinant of Bangladesh's remarkable improvements in health and nutritional indicators during a period of relatively weak economic growth.

References

Adams, R.H. (2011). Evaluating the Economic Impact of International Remittances on Developing Countries Using Household Surveys: A Literature Review. *Journal of Development Studies* 47(6): 809-828.

Adams, R.H., and Cuecuecha, A. (2010). Remittances, Household Expenditure and Investment in Guatemala. *World Development* 38(11): 1626-1641.

Adams, R.H., and Cuecuecha, A. (2013). The Impact of Remittances on Investment and Poverty in Ghana. *World Development* 50(Oct): 24-40.

Ahmed, R., Haggblade, S., and Chowdhury, T.E.E. (eds.) (2000). *Out of The Shadow of Famine: Evolving Food Markets and Food Policy in Bangladesh*. Washington, D.C.: IFPRI.

Arimond, M., and Ruel, M.T. (2004). Dietary Diversity Is Associated with Child Nutritional Status: Evidence From 11 Demographic and Health Surveys. *The Journal of Nutrition* 134(10): 2579-2585.

Asadullah, M. N., Savoia, A., and Mahmud, W. (2014). Paths to Development: Is there a Bangladesh Surprise?. *World Development* 62(Oct): 138-154.

Azzarri, C., and Zezza, A. (2011). International Migration and Nutritional Outcomes in Tajikistan. *Food Policy* 36(1): 54-70.

Bangladesh Bank (2014). Major Economic Indicators (Vol 12/2014). Available at: www.bb.org.bd/econdata.

Barham, B., and Boucher, S. (1998). Migration, Remittances, and Inequality: Estimating the Net Effects of Migration on Income Distribution. *Journal of Development Economics* 55(2): 307-331.

BBS (2012). Bangladesh Bureau of Statistics – Report of the Household Income and Expenditure Survey 2010. Available at: www.bbs.gov.bd/WebTestApplication/userfiles/Image/LatestReports/HIES-10.pdf.

Bertoli, S., and Marchetta, F. (2014). Migration, Remittances and Poverty in Ecuador. *Journal of Development Studies* 50(8): 1067-1089.

Böhme M.H., Persian, R., and Stöhr, T. (2015). Alone But Better Off? Adult Child Migration and Health of Elderly Parents in Moldova. *Journal of Health Economics* 39: 211-227.

Buvinić, M., and Gupta, G.R. (1997). Female-Headed Households and Female-Maintained Families: Are They Worth Targeting to Reduce Poverty in Developing Countries? *Economic Development and Cultural Change* 45(2): 259-280.

Calero, C., Bedi, A.S., and Sparrow, R. (2009). Remittances, Liquidity Constraints and Human Capital Investments in Ecuador. *World Development* 37(6): 1143-1154.

Caliendo, M., and Kopeinig, S. (2008). Some Practical Guidance for The Implementation of Propensity Score Matching. *Journal of Economic Surveys* 22(1): 31-72.

Carletto, C., Covarrubias, K., and Maluccio J.A. (2011). Migration and Child Growth in Rural Guatemala. *Food Policy* 36(1): 16–27.

Carletto, C., Zezza, A., and Banerjee, R. (2013). Towards Better Measurement of Household Food Security: Harmonizing Indicators and the Role of Household Surveys. *Global Food Security* 2(1): 30-40.

Chowdhury, A.M.R., Bhuiya, A., Chowdhury, M.E., Rasheed, S., Hussain, Z., and Chen, L.C. (2013). The Bangladesh Paradox: Exceptional Health Achievement Despite Economic Poverty. *The Lancet* 382(9906): 1734-1745.

Cox-Edwards, A., and Rodríguez-Oreggia, E. (2009). Remittances and Labor Force Participation in Mexico: An Analysis Using Propensity Score Matching. *World Development* 37(5): 1004-1014.

Cox, D.R. (1992). Causality: Some Statistical Aspects. *Journal of the Royal Statistical Society. Series A (Statistics in Society)* 155(2): 291-301.

Crush, J. (2013). Linking Food Security, Migration and Development. *International Migration* 51(5): 61-75.

De Haas, H. (2010). Migration and Development: A Theoretical Perspective. *International Migration Review*, *44*(1), 227-264.

De Haen, H., Klasen, S., and Qaim, M. (2011). What Do We Really Know? Metrics for Food Insecurity and Undernutrition. *Food Policy* 36(6): 760-769.

FAO (1996). Rome Declaration on World Food Security. Available at: www.fao.org/WFS.

Giannelli, G.C., and Mangiavacchi, L. (2010). Children's Schooling and Parental Migration: Empirical Evidence on the ‘Left‐behind’ Generation in Albania. *Labour* 24(s1): 76-92.

Gross, R., Schoeneberger, H., Pfeifer, H., and Preuss, H.J. (2000). The Four Dimensions of Food and Nutrition Security: Definitions and Concepts. Available at http://www.fao.org/elearning/course/FA/en/pdf/P-01_RG_Concept.pdf.

Habicht, J.P., and Pelletier, D.L. (1990). The Importance of Context in Choosing Nutritional Indicators. *The Journal of Nutrition* 120(11): 1519-1524.

Ham, J.C., Li, X., and Reagan, P.B. (2011). Matching and Semi-Parametric IV Estimation, A Distance-Based Measure of Migration, and The Wages of Young Men. *Journal of Econometrics* 161(2): 208-227.

Hanson, G.H. (2010). International Migration and The Developing World. In Rodrik, D., and Rosenzweig, M. (eds.). *Handbook of Development Economics*, vol. *5*. Amsterdam: North-Holland. Pp. 4363-4414.

Headey, D.D., (2013). Developmental Drivers of Nutritional Change: A Cross-Country Analysis. *World Development* 42(2): 76-88.

Headey, D.D., Hoddinott, J., Ali, D., Tesfaye, R., and Dereje, M. (2015). The Other Asian Enigma:

Explaining the Rapid Reduction of Undernutrition in Bangladesh. *World Development* 66(2): 749-761.

Hoddinott, J., and Yohannes, Y. (2002). Dietary Diversity as A Food Security Indicator. Food and Nutrition Technical Assistance Project. Washington, D.C.: Academy for Educational Development. May 2002.

Holland, P. W. (1986). Statistics and Causal Inference. *Journal of the American Statistical Association* 81(396): 945-960.

Hossain, M. (2009). The Impact of Shallow Tubewells and Boro Rice on Food Security in Bangladesh. IFPRI Discussion Paper 00917. 2020 Vision Initiative. Washington, D.C.: IFPRI. November 2009.

Imbens, G.W., and Rubin, D.B. (2015). *Causal Inference in Statistics, Social, and Biomedical Sciences*. Cambridge: Cambridge University Press.

Jimenez-Soto, E.V., and Brown, R.P. (2012). Assessing the Poverty Impacts of Migrants' Remittances Using Propensity Score Matching: The Case of Tonga. *Economic Record* 88(282): 425-439.

Karamba, W.R., Quiñones, E.J., and Winters, P. (2011). Migration and Food Consumption Patterns in Ghana. *Food policy* 36(1): 41-53.

Lechner, M. (2002). Program Heterogeneity and Propensity Score Matching: An Application to The Evaluation of Active Labor Market Policies. *Review of Economics and Statistics* 84(2): 205-220.

Levitt, P. (1998). Social Remittances: Migration Driven Local-Level Forms of Cultural Diffusion. *International Migration Review* 32(4): 926-948.

Lokshin, M., Bontch-Osmolovski, M., and Glinskaya, E. (2010). Work-Related Migration and Poverty Reduction in Nepal. *Review of Development Economics* 14(2): 323-332.

Masset, E. (2011). A Review of Hunger Indices and Methods to Monitor Country Commitment to Fighting Hunger. *Food Policy* 36(1): S102-S108.

McKenzie, D., Stillman, S., and Gibson, J. (2010). How Important Is Selection? Experimental Vs. Non-experimental Measures of The Income Gains from Migration. *Journal of the European Economic Association* 8(4): 913-945.

Mendola, M. (2008). Migration and Technological Change in Rural Households: Complements or Substitutes? *Journal of Development Economics* 85(1): 150-175.

Morgan, S.L., and Winship, C., (2007). *Counterfactuals and Causal Inference: Methods and Principles for Social Research, 2nd ed*. Cambridge: Cambridge University Press.

Möllers, J., and Meyer, W. (2014). The Effects of Migration on Poverty and Inequality in Rural Kosovo. *IZA Journal of Labor and Development* 3(1): 16.

Nguyen, M.C., and Winters, P. (2011). The Impact of Migration on Food Consumption Patterns: The Case of Vietnam. *Food policy* 36(1): 71-87.

Rubin, D.B. (2001). Using Propensity Scores to Help Design Observational Studies: Application to The Tobacco Litigation. *Health Services and Outcomes Research Methodology* 2(3): 169-188.

Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Oxford University Press.

Sianesi, B. (2004). An Evaluation of The Swedish System of Active Labor Market Programs in the 1990s. *Review of Economics and statistics* 86(1): 133-155.

Stark, O., and Bloom, D.E. (1985). The New Economics of Labor Migration. *American Economic review* 75(2): 173-178.

Thorne-Lyman, A.L., Valpiani, N., Sun, K., Semba, R.D., Klotz, C. L., Kraemer, K., Akhter, N., de Pee, S., Moench-Pfanner, R., Sari, M., and Bloem, M.W. (2010). Household Dietary Diversity and Food Expenditures Are Closely Linked in Rural Bangladesh, Increasing the Risk of Malnutrition Due to The Financial Crisis. *The Journal of Nutrition* 140(1): 182S-188S.

United Nations (2013). International Migration Report 2013. ST/ESA/SER.A/346, United Nations, Department of Economic and Social Affairs, Population Division. New York: United Nations. December 2013. Available at http://www.un.org/en/development/desa/population/migration/publications/migrationreport/docs/MigrationReport2013.pdf.

United Nations (2016). International Migration Report 2015: Highlights. ST/ESA/SER.A/375. United Nations, Department of Economic and Social Affairs, Population Division. New York: United Nations.

Warner, K., and Afifi, T. (2014). Where the Rain Falls: Evidence From 8 Countries on How Vulnerable Households Use Migration to Manage the Risk of Rainfall Variability and Food Insecurity. *Climate and Development* 6(1): 1-17.

Welter, F. (2011). Contextualizing Entrepreneurship – Conceptual Challenges and Ways Forward. *Entrepreneurship Theory and Practice* 35(1): 165-184.

World Bank (2015). Migration and Remittances: Recent Developments and Outlook. Special Topic: Financing for Development. Migration and Development Brief 24. Washington, D.C.: The World Bank. Available at: http://pubdocs.worldbank.org/en/773611444756855376/MigrationandDevelopmentBrief24.pdf.

World Bank (2016a). World Development Indicators. Available at: http://databank.worldbank.org/data.

World Bank (2016b). Global Monitoring Report 2015/2016: Development Goals in an Era of Demographic Change. Washington, D.C.: The World Bank.

Yang, D. (2008). International Migration, Remittances and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks. *The Economic Journal* 118(528): 591-630.

Zanutto, E. L. (2006). A Comparison of Propensity Score and Linear Regression Analysis of Complex

Survey Data. *Journal of Data Science* 4(1): 67-91.

Zezza, A., Carletto, C., Davis, B., and Winters, P. (2011). Assessing the Impact of Migration on Food and Nutrition Security. *Food Policy* 36(1): 1-6.

Zhang, X., Rashid, S., Ahmad, K., and Ahmed, A. (2014). Escalation of Real Wages in Bangladesh: Is It the Beginning of Structural Transformation? *World Development* 64, 273-285.

Appendix

A1. Multiple-treatments counterfactual framework

According to the multiple treatment generalized setup (Lechner, 2001), each analytical unit of a given population (in this context, the surveyed households) has, in principle, a different potential outcome under each set of mutually exclusive causes to which it can be exposed. It follows that, given a treatment support $T = \{t_1, t_2, \dots, t_n\}$ of n different treatments, each analytical unit i will have a set of n potential outcomes given by $Y_i = \{Y_i(t_1), Y_i(t_2), \dots, Y_i(t_n)\}$. At the individual level, the effect of a treatment t_j with respect to an alternative treatment t_k is defined as

$$\tau_i(k,j) = Y_i(t_j) - Y_i(t_k) \quad \text{with } t_j, t_k \in T,\ j \neq k \qquad \text{(A1)}$$

where $Y_i(t_j)$ and $Y_i(t_k)$ are the potential outcomes of the individual i under the treatment states t_j and t_k respectively. Since the effect of a treatment necessarily needs to be evaluated in relation to the exposure to an alternative treatment state, the number of possible individual treatment effects, given by all the $D(n, 2)$ possible pairwise dispositions, tends to explode with the increase of the number of treatments. Similarly, moving from the individual to the aggregate level, the average treatment effect (ATE) is formally defined as

$$ATE(t_k,t_j) = E[\, Y(t_j) - Y(t_k) \,] \qquad \text{with } t_j, t_k \in T, j \neq k. \qquad \text{(A2)}$$

It follows that, given a sample of size N, the total number of individual and the number of average treatment effects will be $N \times D(n, 2)$ and $D(n, 2)$ respectively. However, since both the individual and the average treatment effect are symmetric, e.g. $ATE(t_k,t_j)$=-$ATE(t_j,t_k)$ and $\tau_i(k,j)$=$\tau_i(j,k)$, the number of the effects can be respectively reduced to $N \times C(n, 2)$ and $C(n, 2)$, respectively.

Rather than estimating the ATE, the present research is interested in estimating the treatment effect on a particular subset of the population, namely those households that effectively received the treatment. This is the average treatment effect on the treated (ATT) and can be formally defined as

$$ATT(t_k,t_j) = E[\, Y(t_j) - Y(t_k) \mid D_j(t) = 1 \,] \text{ with } t_j, t_k \in T, j \neq k \qquad \text{(A3)}$$

where $D_j(t)$ is an indicator function for $t = t_j$. It can be noted that ATE and ATT asymptotically converge only in the case of random treatment assignment. Vice versa, if treated and non-treated units systematically differ in their attributes, ATT and ATE are likely to differ (this happens when the attributes do not influence only the treatment assignment but also the outcome variable).

A2. On Selection on Observables, Conditional Independence and Stable Unit Treatment Value Assumptions

For a generalized multiple-treatments setting, CIA and SUTVA can be formally expressed as:

$$Y_i(t_1), Y_i(t_2), \ldots, Y_i(t_n) \perp\!\!\!\perp D_i \mid X_i \qquad \text{(A4)}$$

where n is the number of treatments and D_i the treatment assignment vector. CIA requires that, after conditioning for a set of relevant characteristics X, individual potential outcomes are independent to the treatment assignment. In practice, however, CIA is not a sufficient condition for matching. Indeed, for practical utilization, matching methods further require the observable nature of X, a condition known as 'selection on observables'. In practice, the observable covariates should not be necessarily conceived as the 'real' conditioning variables but rather as proxy variables that are correlated with the (possibly latent) factors governing the process of selection into the treatment.

SUTVA, implicitly made by imposing the number of individual potential outcomes equal to the number of treatment states, requires that the potential outcomes of each unit be not affected by other units' treatment assignment (Rubin, 1986). In economic terms, this corresponds to the absence of general equilibrium and spillover effects: if it does not hold, the estimates can be considered robust only for the marginal unit.

A3. Matching, Balancing Scores and Linearized Propensity Score

The ideal matching procedure entails to find one or more perfectly corresponding matches for each of the treated units. Implementing a direct matching on the vector X_i, however, turns out to be problematic because the probability of finding exact matches rapidly falls with the number of the covariates. Rosenbaum and Rubin (1983) demonstrated that if the potential outcomes are orthogonal to the treatment assignment after conditioning for X_i (CIA holds for X_i), then they are orthogonal also conditioning on a balancing score $f(X)$, defined as function of the original covariates (f: $\mathrm{R}^n \rightarrow \mathrm{R}^m$, $n>m$). In the economic literature, the most frequently used balancing score is the propensity score, a scalar function of X_i that represents the unit-level probability of being assigned to the treatment. However, as explained in section 5.2, if the matching estimator is based on the linear distance between scores (as for NN, caliper and kernel estimators) rather than on their order (as in stratification matching), the adoption of propensity score – that is not linear – is inappropriate and might lead to wrong matches. The magnitude of the bias largely depends on the distribution of the covariates among the treatment and the control groups. The *lps* is a monotonic transformation of the propensity score that provides a straightforward and consistent solution this problem. Formally, the *lps* is defined as:

$$\ell(X_i) = log\left(\frac{e(X_i)}{1-e(X_i)}\right) \qquad \text{(A5)}$$

where $e(X_i)$ is the propensity score, that can be estimated either by a logit or a probit model. In our analysis, we used the latter (cf. Tables A1 and A2) because it provided slightly better fit and overlapping.

Table A1. Probit regression results (within-strata)

Dep var: Migrant	Block 1	Block 2	Block 3	Block 4
Adults 18-45 (male)	0.418*** (0.0547)	0.648*** (0.0440)	0.523*** (0.0387)	0.626*** (0.0573)
Adults 46-65 (male)	0.412*** (0.0887)	0.354*** (0.0675)	0.390*** (0.0654)	0.488*** (0.0949)
Adults 18-45 (female)	-0.111 (0.0715)	-0.116** (0.0546)	0.0223 (0.0490)	-0.0745 (0.0767)
Adults 46-65 (female)	0.067 (0.0938)	0.124* (0.0667)	0.233*** (0.0671)	0.199** (0.100)
Elders (65+)	0.223** (0.0876)	0.310*** (0.0605)	0.165** (0.0689)	0.246** (0.115)
Kids 6-17	0.0844** (0.0346)	0.0194 (0.0267)	0.0454* (0.0250)	0.0679* (0.0401)
Schooling (males)	-0.0554*** (0.0128)	-0.0768*** (0.00965)	-0.0623*** (0.00829)	-0.118*** (0.0124)
Schooling (females)	0.0746*** (0.0149)	0.0587*** (0.0108)	0.0830*** (0.00978)	0.118*** (0.0141)
Muslim	1.020*** (0.176)	0.502*** (0.140)	0.679*** (0.101)	0.426** (0.169)
Entrepreneurship (formal)	-0.073 (0.164)	-0.401** (0.156)	-0.591*** (0.126)	-1.030*** (0.202)
Entrepreneurship (informal)	-0.583*** (0.126)	-0.539*** (0.0895)	-0.536*** (0.0898)	-0.374*** (0.124)
Access to elec. network	0.575*** (0.0937)	0.479*** (0.0600)	0.699*** (0.0756)	0.409*** (0.157)
Sample weights	-0.000566*** (0.000120)	-0.000392*** (0.0000674)	-0.00131*** (0.000226)	-0.0000548*** (0.0000174)
Urban	-1.456*** (0.226)	-1.330*** (0.288)	-3.292*** (0.430)	Omitted
Landless	-0.591* (0.305)	-0.247 (0.191)	-0.281* (0.153)	-0.453*** (0.152)
Constant	-1.642*** (0.383)	-1.435*** (0.269)	1.347** (0.668)	-2.467*** (0.254)
Number of observations	2479	4817	3318	1620
McFadden's pseudo R2	0.211	0.189	0.25	0.229
Log Likelihood	-595.4	-1170.8	-1122.1	-521

Notes: Standard errors in parentheses; * p<0.1,** p<0.05, *** p<0.01; Migrant members characteristics are taken into account to compute the covariates; Entrepreneurship variables dummies take value 1 only if the business was already running before migration.
Source: Author's calculation.

Table A2. Probit regression results (binary comparisons)

	A. Migrants only	B. Remittances only	A∩B. Migrant & Remittances	C. Returnees only
Adults 18-45 (male)	0.520*** (0.0472)	-0.136** (0.0554)	0.645*** (0.0274)	0.161*** (0.0522)
Adults 46-65 (male)	0.468*** (0.0852)	-0.033 (0.0779)	0.452*** (0.0447)	0.0408 (0.0832)
Adults 18-45 (female)	-0.129** (0.0642)	0.0337 (0.0616)	-0.111*** (0.0346)	0.0266 (0.0673)
Adults 46-65 (female)	0.149* (0.0872)	0.0175 (0.0799)	0.196*** (0.0452)	-0.0313 (0.0895)
Elders (65+)	0.191** (0.0850)	0.143** (0.0713)	0.251*** (0.0444)	0.125 (0.0825)
Kids 6-17	0.0209 (0.0328)	0.0127 (0.0295)	0.0684*** (0.0173)	0.00621 (0.0329)
Schooling (males)	-0.0857*** (0.0123)	-0.0158* (0.00943)	-0.0929*** (0.00626)	0.00294 (0.0109)
Schooling (females)	0.0881*** (0.0134)	0.0447*** (0.0111)	0.0814*** (0.00694)	0.0412*** (0.0130)
Muslim	0.477*** (0.147)	0.381*** (0.128)	0.672*** (0.0820)	0.311** (0.134)
Entrepreneurship (formal)	-0.489*** (0.183)	0.0018 (0.132)	-0.584*** (0.0955)	-0.191 (0.151)
Entrepreneurship (informal)	-0.619*** (0.134)	0.0214 (0.0849)	-0.758*** (0.0690)	0.0602 (0.0910)
Access to elec. network	0.513*** (0.0932)	0.277*** (0.0791)	0.512*** (0.0471)	0.358*** (0.0968)
Sample weights	-0.0000838** (0.0000388)	-0.000166*** (0.0000504)	-0.0000453** (0.0000179)	0.0000315 (0.0000255)
Urban	-0.420*** (0.104)	-0.416*** (0.119)	-0.297*** (0.0506)	-0.152* (0.0853)
Regional dummies	Yes	Yes	Yes	Yes
Landless	-0.0605 (0.173)	-0.360* (0.185)	-0.370*** (0.104)	-0.500** (0.209)
P.c. expenditure				0.000289 (0.000397)
Constant	-3.200*** (0.230)	-2.199*** (0.230)	-2.827*** (0.120)	-3.194*** (0.203)
Number of observations	10942	10943	11741	10912
McFadden's pseudo R2	0.252	0.0646	0.271	0.103
Log Likelihood	-602	-757.2	-2409.2	-604.3

Notes: Standard errors in parentheses; * p<0.1,** p<0.05, *** p<0.01; Migrant members characteristics are taken into account to compute the covariates; Entrepreneurship dummies take value 1 only if the business was already running before migration.
Source: Authors' calculation.

Figure A1. Distribution of *lps* (block-wise)

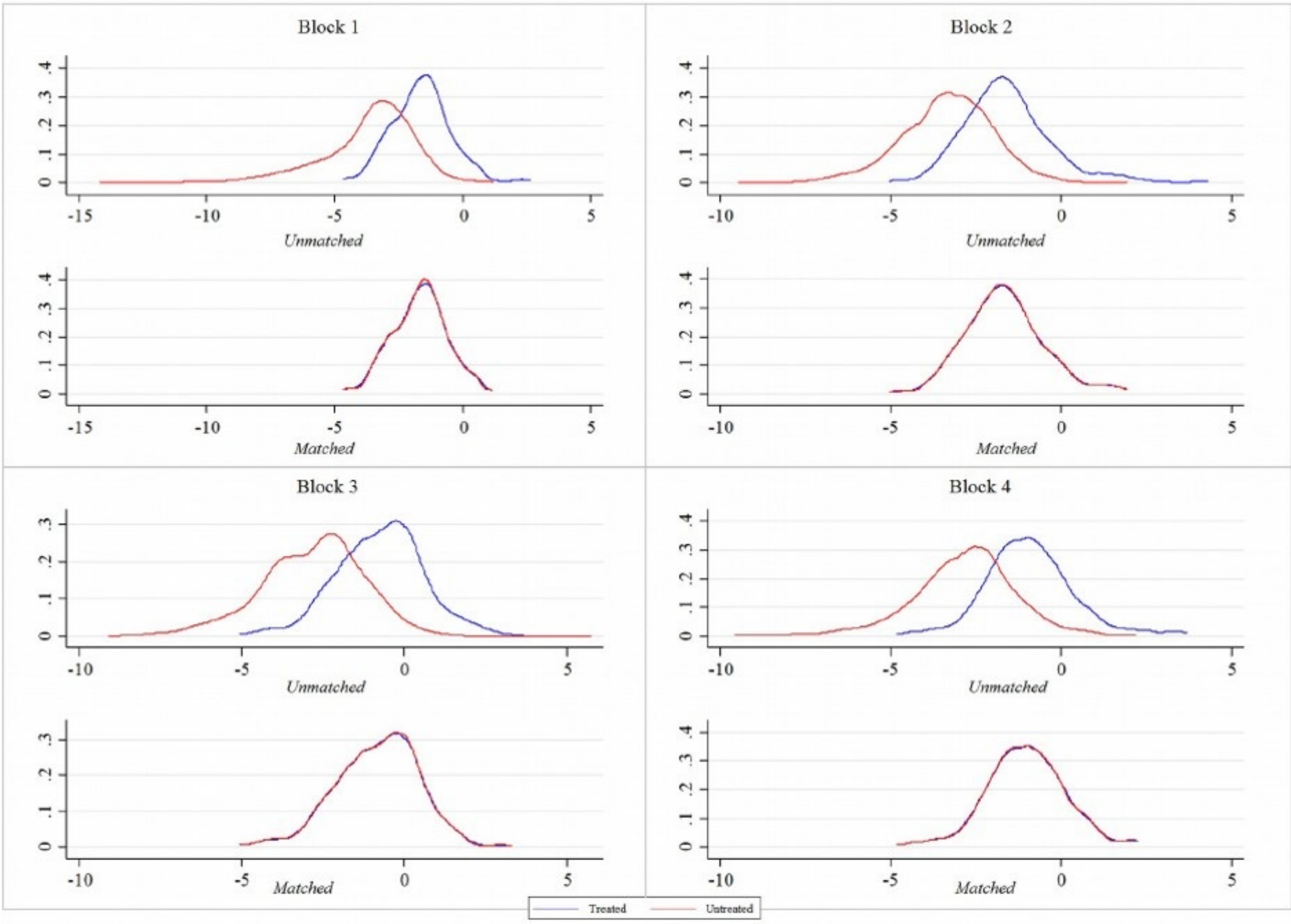
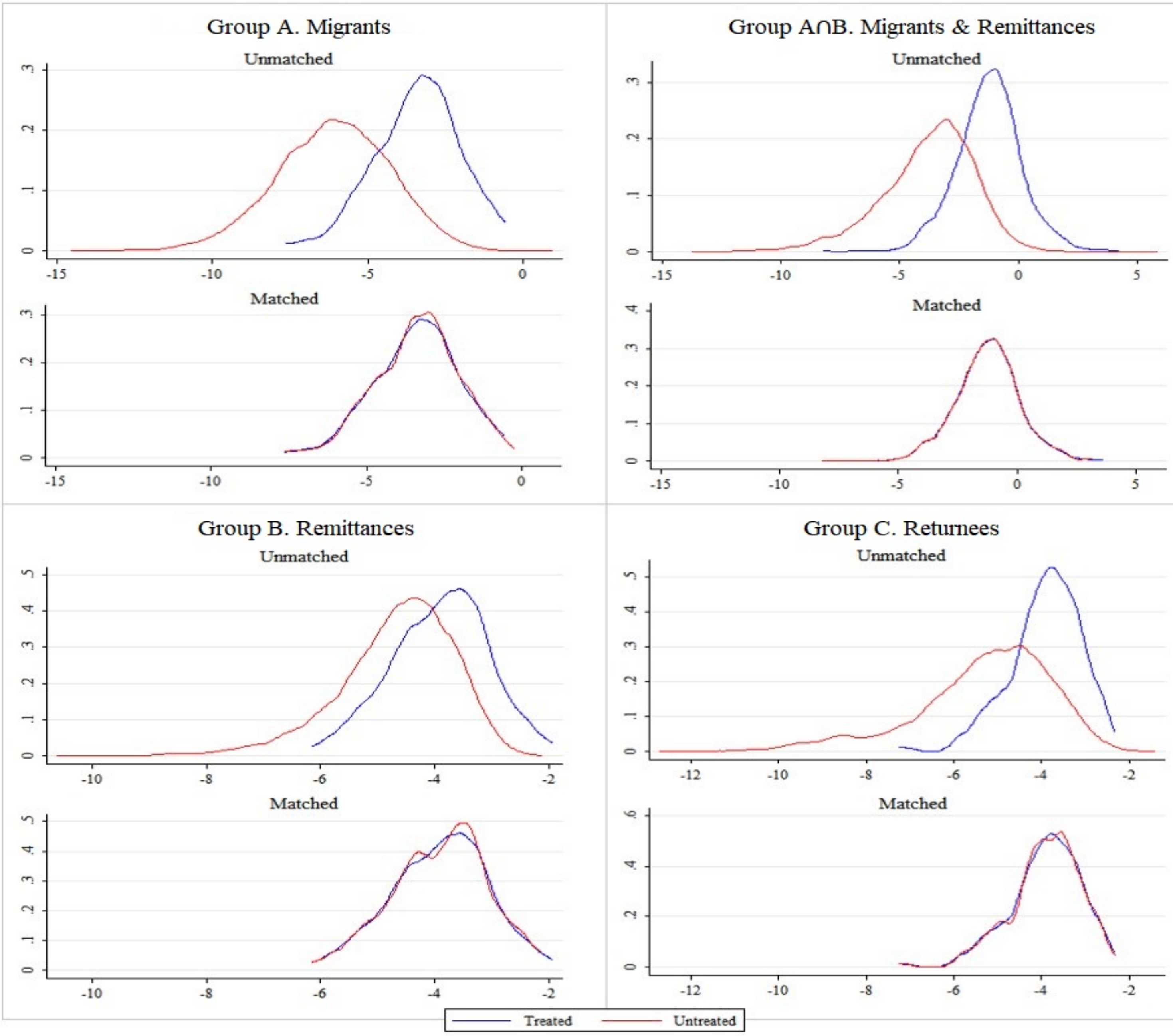


Figure A2. Distribution of *lps* (group-wise)



Additional references (Appendix)

Lechner, M. (2001). Identification and Estimation of Causal Effects of Multiple Treatments Under the Conditional Independence Assumption. In Lechner, M., and Pfeiffer, F. (eds.). *Econometric Evaluation of Labour Market Policies*. Berlin: Springer. pp. 43-58.

Rosenbaum, P.R., and Rubin, D.B. (1983). The Central Role of The Propensity Score in Observational Studies for Causal Effects. *Biometrika* 70(1): 41-55.

Rubin, D.B. (1986). Which Ifs Have Causal Answer. Comment to: Holland (1986). Statistics and Causal Inference. *Journal of the American Statistical Association* 81(396): 945-960.