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Is migration an effective adaptive livelihood diversification strategy  
among households in arid regions of Namibia? An application of  
constructed instruments using heteroscedastic errors

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## Abstract

The nexus between migration as a livelihood diversification and adaptive option and the wellbeing of the rural families in arid and semi-arid regions remains a gap in literature. The focus in this paper is to evaluate the impact of migration on household consumption expenditure and dietary diversity. We use survey data from a representative sample of 653 households across three arid regions of Northern Namibia and employ Lewbel's constructed instruments approach for estimation. Migrant households are poorer and have low long-term consumption spending than those that have no migrants. However, migration intensity has a positive impact on annual spending. Migration has no impact on short-term spending and dietary diversity. Most migrants are unskilled and very few have tertiary education. Equipping migrants with skills can greatly enhance the migration outcome in reducing vulnerability to climate risks and increasing resilience of rural families in arid regions.

Key words: Namibia, semi-arid lands, migration outcome, vulnerability, climate risk.

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## 1. Introduction

### 1.1. Overview

The nexus between migration and the wellbeing of the rural families in arid and semi-arid regions remains a significant gap in literature. The assumption in many of the studies reviewed is a unidirectional flow of remittances from the migrants to their rural families but a study on migration in Namibia by [Frayne \(2004\)](#) indicate a reciprocal interaction through rural-urban linkages. Urban migrants who have limited social contact with their rural families are very vulnerable to food insecurity in the cities. Given that most rural households in arid regions of Southern Africa are classified as poor in national statistical agencies([Spear, Baudoin et al. 2014](#)), the impact of migration on household wellbeing is not obvious across different social groups. Rural-urban migration has been on the increase in Namibia since independence and there is need for a better understanding of its impacts on the wellbeing of the rural households most vulnerable to negative impacts of climate change. The urban poverty is increasing in the city and opportunities to find work are dwindling for most unskilled migrants ([Frayne 2004](#)). In view of the foregoing, the impact of migration on rural households' wellbeing in Namibia is largely unknown. This study bridge this gap by characterizing migration process in Namibia, analysing the characteristics of migrants and evaluating effect of migration on household consumption expenditure, food spending and dietary diversity.

### 1.1. Households' vulnerability to climate shocks in semi-arid regions

Arid and semi-arid lands are home to slightly more than a third of the world's population and comprise of over 40% of the earth's land surface ([Fraser, Dougill et al. 2011](#)). One of the key features of semi-arid climates is rainfall variability and this is bound to increase with climate change. Climate change- induced droughts will most likely push the dryland ecosystems beyond the biophysical thresholds and lead to long-term decline in agricultural productivity, ([Fraser, Dougill et al. 2011](#)). [Batisani and Yarnal \(2010\)](#) find evidence of decreasing number

of rainy days and increased duration of dry spells in Botswana. We can expect climate change to increase vulnerability to risks for societies dependent on resources that are sensitive to changes in climate variability ([Adger, Huq et al. 2003](#), [Conway and Schipper 2011](#)). This will most likely make subsistence agriculture less viable source of livelihood and households will have to diversify their income sources to survive. In Namibia, climate change will have devastating effect on the economy to negatively affect employment opportunities and wages especially for the poor and unskilled workforce ([Reid 2007](#), [Reid, Sahlén et al. 2008](#)). The frequency and intensity of extreme events like droughts will to increase and the projection of temperature rise by 2100 is between 2°C and 6°C ([Reid 2007](#), [Reid, Sahlén et al. 2008](#)). Livestock farmers in Namibia are likely to suffer huge losses due to shrinking pastures and small farm units will not be viable ([Reid, Sahlén et al. 2008](#)).

### 1.2. Past responses to climate-related risks

To address the risks related to climate change, scholars have proposed several interventions at both national and farm level. One such intervention is use of climate insurance as an instrument for ex-ante risk reduction that allow countries most affected by climate change to purchase insurance-like product to cover specific climate risks ([Bals, Warner et al. 2006](#), [Linnerooth-Bayer and Mechler 2006](#)). This idea however has not received much attention due to technical and political ramifications.

At the farm level, index-based crop and livestock insurance are risk transfer instruments designed to overcome the shortcomings of the indemnity-based insurance ([Alderman and Haque 2007](#), [Mahul and Skees 2007](#), [Barnett, Barrett et al. 2008](#), [Meze-Hausken, Patt et al. 2009](#), [Hazell and Hess 2010](#), [Chantararat, Mude et al. 2013](#), [Jensen and Barrett 2017](#)). Some of the shortcomings of the indemnity-based insurance include the high transactions<sup>1</sup> cost of monitoring losses and settling claims. Crop and livestock insurance use some indices that could be either yield, rainfall or even vegetation cover, and farmers receive payments when an index exceeds a certain predetermined loss threshold.

However, while the idea of index-based agricultural insurance is conceptually appealing to researchers and policy makers, the rarity of a success stories where the initiative has sustainably worked for smallholder farmers in developing countries has been the norm rather than exception. The increasing frequency and severity of droughts in Africa is likely to make such initiatives unattractive to investors. Farmers who suffer significant losses but whose levels are below the set threshold are likely to lose trust on such schemes. This option therefore might not be for the vulnerable smallholder poor farmers especially those involved in staple crops production ([Binswanger-Mkhize 2012](#), [Brick and Visser 2015](#), [Smith 2016](#)).

Considering lack of proper climate risk financing for smallholder agriculture in the context of uncertainty due to climate variability, farmers have used other self-insuring mechanisms such as income diversification into nonfarm enterprises, investment in adaptive technologies, their assets and social networks ([Binswanger-Mkhize 2012](#), [Elum, Modise et al. 2017](#)). Migration, the subject of this paper, is another strategy that households have always used to respond to

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<sup>1</sup> Some of the transactions cost in agricultural setting would involve collection of household-level actuarial data for the purpose of risk classification and claim validation.

environmental disasters. Communities in the semi-arid lands of Africa and Asia have for decades used internal and seasonal migration to survive droughts ([Laczko and Aghazarm 2009](#)). However, this option is becoming increasingly unviable due to increased population pressure, climate change and resource conflicts ([McCabe, Smith et al. 2014](#)).

The rest of the paper is organized as follows. Section 2 presents a brief literature review with focus on migration as a livelihood diversification strategy. Section three discussing the conceptual framework outlining the impact pathway of migration on key outcomes. The section also presents empirical strategy and sampling. Section 4 presents summary statistics of the migrants; characterises the migration process and compares the migrant and non-migrant households on observables. Section 5 presents the empirical results and section 6 concludes with synthesis of the results and recommendations.

## 2. Literature review

### 2.1. Overview of migration in Namibia

Studies on migration in Namibia are few and data on migration is hard to find. The international Organization for Migration (IOM), and government of Namibia released the country's first migration profile in 2015 ([Olivier 2016](#)). The 2011 national census show that the urban population has increased tremendously to 43% from 33% in the last decade and the rural population has shrunk by about ten percentage points ([NSA 2011](#)). Many of the studies related to migration focus on urban poverty, housing, unemployment and food insecurity in Windhoek city, the main migration destination ([Frayne 2004](#), [Pendleton, Crush et al. 2014](#), [Karuaihe and Wandschneider 2018](#)). The other important destinations for migrants include Oshakati in central North, Swakopmund and Walvis Bay in the Western coast and Rundu. There is little information on the characteristics of the migrants, motivation and characterization of the migration process.

There were strict limitations on movement of people during the colonial period and apartheid era in Namibia and the majority of the black people were confined to demarcated reserves in the countryside and within certain areas of the big cities like the black township in Katutura ([Niikondo 2010](#)). These restrictions were legislated and implemented through influx control and pass laws. The people that could move from rural areas to towns were mainly men brought to work in factories. These men lived in single-squatter houses and were by law not allowed to bring their families. The influx rule was abolished in 1977 following the end of apartheid legislation triggering rural-urban migration, rapid urbanization and expansion of the informal settlement ([Seckelmann 1997](#)). Over two thirds of migrants to the city of Windhoek live in squatter camps mainly made of corrugated iron sheets and not serviced by municipal council ([Niikondo 2010](#)).

Despite Namibia classification as an upper middle income country, urban poverty is pervasive in Windhoek coupled with high rates of unemployment and most residents reside in informal settlement with poor access to municipal services ([Frayne 2004](#)). Rural-urban linkages are key survival strategy for migrants in urban areas and transfers is both ways. Food transfers from rural areas is the most common and households without rural linkages are more vulnerable ([Frayne 2004](#), [Pendleton, Crush et al. 2014](#), [Karuaihe and Wandschneider 2018](#)). Migrant use these linkages between urban and rural economies to overcome

challenges associate with scarce employment opportunities in the urban formal economy ([Frayne 2007](#)). Life for the urban poor is sometimes more riskier and uncertain than one in the rural areas but the prospect of finding a better job keeps their hope alive and therefore they opt to stay than return ([Niikondo 2010](#)).

## 2.2. Role of migration and livelihood diversification

Migration is one of the livelihood diversification and adaptive strategy rural families could use to manage current socioeconomic and environment shocks while also improving their capacity to cope with future risks ([Tacoli 2009](#), [Grace, Hertrich et al. 2018](#)). Much of the recent scholarly work on migration has focused on the international migration looking at the increasing role of diaspora contribution to social and economic development of the recipient developing countries ([Adams and Page 2005](#), [Giuliano and Ruiz-Arranz 2009](#), [Gupta, Pattillo et al. 2009](#), [Zeza, Carletto et al. 2011](#), [Nyamongo, Misati et al. 2012](#), [Siddique, Shehzadi et al. 2016](#)). In Africa for example, remittances increased four folds between the period 1990 and 2010, surpassing the official development aid since 2007 ([Black, Bennett et al. 2011](#)).

However, related mobility costs might prevent rural poor households to benefit from migration ([Mendola 2008](#)). Whereas international migration has in many studies been shown to have a positive impact on poverty reduction and enhanced livelihoods of the migrant households, the poor has mostly been seen to engage in low-return domestic type of migration due to high entry costs associated with high-return international migration ([Adams, Lopez-Feldman et al. 2008](#), [Mendola 2008](#), [Wouterse 2012](#)). In their study on effect of migration on income diversification in rural Burkina Faso, [Wouterse and Taylor \(2008\)](#) show that the destination of the migrant and the economic activity they engage are also key determinants of migration impacts. Therefore, even with domestic migration, migrant skills, social networks and economic opportunities to apply the acquired skills are important determinants of migration outcome. This in a sense creates a differential impact of migration across different social groups.

The impact of migration through remittances on wellbeing of receiving rural families differ spatially as well as contextually. For instance, studies show a positive impact of migration in reduction of stunting among in children due to improved nutrition in Guatemala, Tajikistan and El Salvador ([Azzari and Zeza 2011](#), [Carletto, Covarrubias et al. 2011](#), [De Brauw 2011](#)). There is also evidence that migration can reduce household vulnerability to shocks related to sharp increase in food prices and smoothen consumption in such periods. [Mergo \(2016\)](#) find that migration also increases consumption expenditure among migrant households in Ethiopia although male migrants have higher impact than their female counterparts do in improving their families' wellbeing. Migration affects household consumption through reduced number of people left in the household, available labour and remittances. The income effect from remittances increase access to food and health by the receiving household ([Zeza, Carletto et al. 2011](#)). It can also influence household's consumption and production practices through information flow ([Karamba, Quiñones et al. 2011](#)).

Some studies have also found migration to have a neutral or negative impact to household wellbeing. For instance, [Wouterse and Taylor \(2008\)](#) find no evidence of any significant impact of migration on crop and livestock production in Burkina Faso. In Ghana, [Karamba,](#)

[Quiñones et al. \(2011\)](#) did not find significant impact of migration on food expenditure but it does seem to shift consumption pattern to less nutritious foods like sugar and beverages among the migrant households. While migration was associated with lifting about 40% of households above vulnerability threshold in Kosovo, it had little significance on the extremely poor ([Möllers and Meyer 2014](#)).

The current study will evaluate the impact of migration on wellbeing outcomes of rural households living in semiarid regions of Northern Namibia. The outcome indicators include household dietary diversity score, months of inadequate household food provisioning and Consumption expenditure. Consumption expenditure outcome comprise of frequent expenditure like food and regular bills and less frequent expenditure like school fees, health and investment in improved technologies among others. Our hypothesis is that migrant households have better wellbeing outcomes than their non-migrant counterparts. However, if push factors are the main drivers of migration such that poor households send more unskilled migrants, then migration is not likely to have significant impact on selected key outcomes.

### 3. Methodology

#### 3.1. Theory of change and impact pathway of migration

We conceptualize migration not just a household's strategy to cope with short-term socioeconomic shocks but also an enabler of long-term investment in other adaptive strategies hence build resilience against climate risks (Figure 1). Rural-urban migration in Namibia is driven not just by the neoclassical theory of wage differential between rural and urban but perceived spatial opportunities in the urban areas. Under the current framework, households facing climate variability challenges send migrants to either pursue education or look for work to diversify family income.

Household's wealth status, social networks, skill set and demographic characteristics of the household leadership determine both migration process and outcome of migration. Richer households are more likely to have skilled human capital and can afford to send migrants to destinations that are more lucrative with high returns.



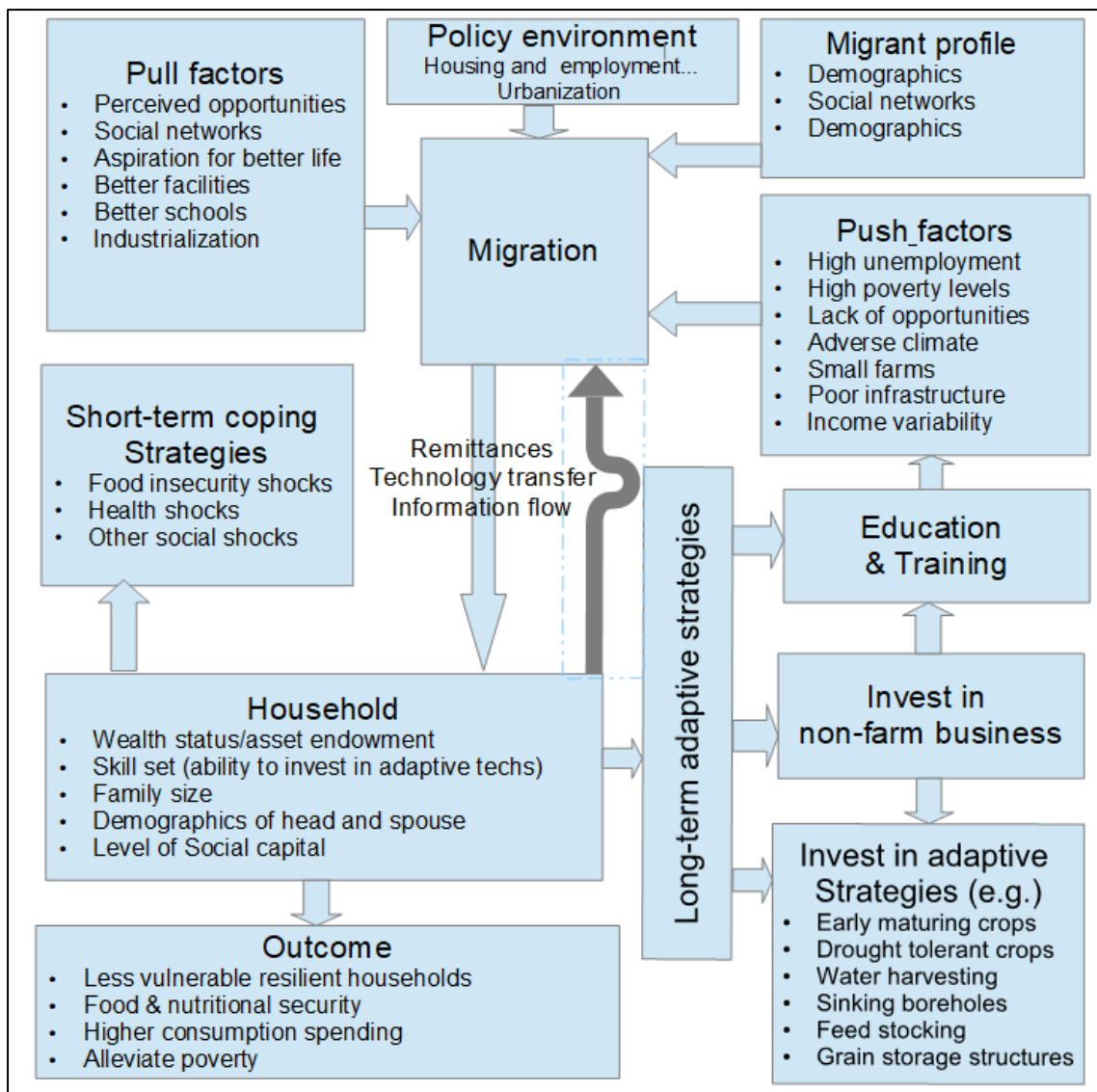


Figure 1. Conceptual model of Impact pathway of migration (source: author)

Poor households on the other hand are likely to send unskilled migrants to less lucrative migration destinations with low probability of finding work. The type of migration is important factor as poor households may fail to overcome entry cost of high-return international migration and hence have a little or no impact on uptake of adaptive technologies and wellbeing outcomes. Wealth status could also indicate household's capacity for self-employment or generate labour demand in the rural setting, which might affect negatively the propensity to migrate among the unskilled potential migrants.

In keeping with neoclassical theory of migration ([Lee 1966](#)), push factors at the rural village like high rural poverty levels, mismatch of opportunities with acquired skills, poor infrastructure, adverse climate, small farms and high-income variability are other determinants of migration. Contrary to [Stark and Bloom \(1985\)](#) new economics of labour migration theory that assumes a joint migration decision at the household level, we posit that the decision to migration in very poor families especially among unmarried youth is more likely to be individual. However, the decision to migrate is highly likely to be coordinated and collective at household level where mobility costs are high and when the motive is to

pursue education. The pull factors at the migration destination include perceived better opportunities than in the place of origin, existing social networks and kinship ties, better amenities and higher wages. There exists evidence that large pool of earlier migrants from the same place of origin facilitate future migration from the same area ([Adams, Lopez-Feldman et al. 2008](#)).

Migrant characteristics are also drivers of both migration and migration outcomes. An educated migrant with high social networks and nonfarm skills is more likely to migrate ([Lanzona 1998](#)), and get employment at the destination compared to unskilled, less educated migrant. Young people with high aspiration for better life are more likely to migrate compared to less ambitious and older people. Likewise, married women are less likely to migrate compared to single women. Young men are generally more likely to migrate than females partly because of the job structures in urban areas and males are less vulnerable to risks related to migration process ([Lall, Selod et al. 2006](#)). These could constitute endogenous push factors of migration process or what [Lee \(1966\)](#) referred to as personal factors.

Policies aimed at improvement of communication and transport infrastructure, rural electrification and market development may open up new opportunities for young people in the rural areas and reduce the likelihood of outmigration. Policies that support manufacturing, affordable housing and security in urban areas will act as pull factors attracting potential migrants. Lack of policy planning may lead to unintended consequences of migration like development of slums and insecurity ([Lall, Selod et al. 2006](#)). For instance, formalized land tenure is a precondition for accessing municipal services in Windhoek yet majority of the city dwellers living in informal settlements do not own land under existing land policy ([Karuaihe and Wandschneider 2018](#)). For historical colonial policy restriction of migration and settlement into major towns in Namibia see [Seckelmann \(1997\)](#).

The impact pathways through which migrants can influence household welfare outcomes and climate change adaptation are remittances, information flow and technology transfer. The amount of remittances received by household is thought to be a function of the migrant-specific characteristics like gender, age, marital status, education, professional training as well as other factors such as destination, industry of work, duration of migration, social networks and type of migration.

The household can then use resources and information received from migrants to cope with short-term socioeconomic shocks like food insecurity, health and community contributions. They can also invest directly in long-term adaptation strategies like stress tolerant crops, water harvesting and management, improving human capital through education and training as well as investing in nonfarm businesses. Households can also use income earned from businesses to enhance further their adaptive capacity.

### 3.2. Analytical framework (Empirical model of impact evaluation)

One of the major challenge in evaluating causal impact of migration using cross sectional survey data is the perverse endogeneity and lack of appropriate exogenous instruments that are correlated with migration decision but uncorrelated with the errors in the outcome equation. Most of the push factors driving an individual's decision to migrate are also likely to affect outcome variables of interest at the household level. The challenge is that an instrument that works for one circumstance might not work in another context. The missing data problem or lack of credible counterfactual can be resolved by employing experimental methods to migration studies ([McKenzie and Yang 2010](#)). However, such experiments are usually very expensive because they might involve tracking the migrants to their destinations and tracing their families back in the rural home villages and countries in the case of international migration. For observational studies, [Lewbel \(2012\)](#) proposes using error heteroscedasticity to construct instruments using available exogenous covariates in identify and estimate endogenous regressor. He later demonstrates that the assumptions required for identification are also applicable when the endogenous covariate is binary ([Lewbel 2018](#)). Here we present these assumptions and application in the context of migration as an endogenous regressor. The model can be presented as

$$Y_i = \mathbf{X}'\beta_1 + M\gamma + \varepsilon_1 \quad (1)$$

$$M_i = \mathbf{X}'\beta_2 + \varepsilon_2 \quad (2)$$

Where  $Y_i$  is the outcome of interest (*consumption expenditure, food security and adaptive capacity in present case*) for household  $i$ ,  $\mathbf{X}$  a vector of exogenous covariates,  $M$  is the endogenous migration variable and  $\beta_1, \beta_2$  and  $\gamma$  are parameters vectors.  $\varepsilon_1 = \alpha_1 U + V_1$  and  $\varepsilon_2 = \alpha_2 U + V_2$ .  $U$  is a common unobserved or omitted variable that directly affects both  $Y_1$  and  $M_i$ . Key assumptions for identification of the reduced form are  $E(\varepsilon_1 X) = 0$  and  $E(\varepsilon_2 X) = 0$ . For structural model identification, one would make strong assumption that at least some of the elements of  $\beta_1$  are equal to zero for the standard instrument variable estimation to be consistent. In absence of identifying restrictions and heteroscedasticity of  $\varepsilon_2$ , [Lewbel \(2012\)](#) suggests restricting  $Cov(X, \varepsilon_2^2) \neq 0$  and  $Cov(Z, \varepsilon_1 \varepsilon_2) = 0$  to identify the structural equation.  $Z \in \mathbf{X}$  represents generated valid instruments for migration that are constructed from the mean-centered exogenous covariates and the vector of residuals,  $\boldsymbol{\varepsilon} = (\varepsilon_1, \varepsilon_2)$ , from the auxiliary first stage regression.

$$Z = (X_j - \bar{X}) * \boldsymbol{\varepsilon} \quad (3)$$

Since  $Z$  is a subset of the  $\mathbf{X}$  vector, no additional information outside of the model is required. The key assumptions are  $\varepsilon_1$  and  $\varepsilon_2$  are independent ( $\varepsilon_1 \perp \varepsilon_2 | Z$ ) and  $E(\varepsilon_1) = 0$ . These two assumptions ensures that the key identifying assumption  $Cov(Z, \varepsilon_1 \varepsilon_2) = 0$  holds.

[Lewbel \(2018\)](#) shows that one can achieve identification even when the orthogonality condition of the errors is violated. We implement the procedure in two steps. In the first step, we estimate  $\hat{\beta}_2$  using either logit or probit model by regressing the endogenous migration dummy on exogenous covariates  $\mathbf{X}$ . The goal is to obtain the residuals  $\hat{\varepsilon}_2$  i.e.



migrant and non-migrant households to check if they are statistically different on observable social, economic and institutional characteristics.

#### 4.1. Gender differentiated migrant characteristics

*Age:* Most migrants are young with an average age of 32 years. Female migrants are slightly younger (30 years) than their male counterparts who have an average age of 33 years (Table 1).

*Education:* The average education level is grade 10 implying that most migrants have completed junior secondary school. More female migrants than their male counterparts completed both Junior and senior secondary school. Consequently, more females than male migrants had access to tertiary education. Over a third of those who completed grade 10 did not proceed to grade 12, an entry requirement for university enrolment. Transition rates to tertiary training is 21%. Transition to university education is very low at 13% for bachelors and 2% for postgraduate degrees. These results almost mirror World Bank’s statistics of 20.69% enrollment at tertiary level. The data shows that more females than males enroll in tertiary education and the gap has been widening since 2008 (Figure 3). (Table 1).

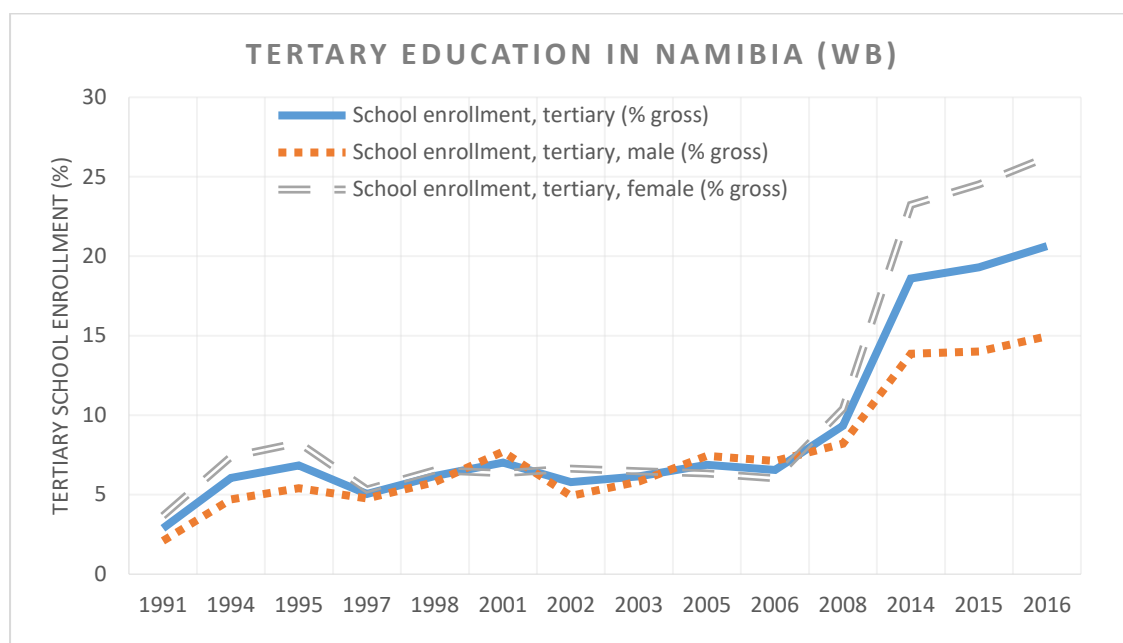


Figure 3: Tertiary education enrolment by gender (source: by author using World Bank open data)<sup>2</sup>

The migrants who drop at primary and those that do not complete secondary can acquire necessary skills through vocational training. However, the data suggests low access to technical and vocational education and training (TVET) colleges. Only about six percent of migrants had attended these colleges. In their paper on income mobility and poverty dynamics, [Woolard and Klasen \(2005\)](#) observe that lack of education keeps families in poverty traps. Formal education and nonfarm experience are likely to be rewarded more in the nonfarm sector ([Junge, Revilla Diez et al. 2015](#)).

<sup>2</sup> Ratio of total enrolment at tertiary level to the population of those that successfully completed secondary education. <https://data.worldbank.org/>. WB Total tertiary enrolment was 21% and our results is 21.16%.

*Professional Training:* Over two thirds of the migrants had no post school training. Most of these migrants without any post school training were female (72%). The proportion of males without training 64%.

*Marital status:* Most migrants are single with less than a fifth being in marriage. Monogamous marriage was the most common type of marriage for both male and female migrants. Less than two percent were either divorced, separated or windowed.

*Relation to the head:* Most of the migrants are children or grandchildren of the household heads. Household heads comprise only five percent of migrants and most of them are males.

*Occupation:* Slightly more than a third of the migrants got some salaried jobs like domestic work, teaching, police and army, security guards and drivers. More female migrants (36.64%) were in salaried employment than their male counterparts (34.5%). A quarter of the migrants were unemployed and most of them were females. Fifteen percent of migrants were student and most of them were females. While more females than males were self-employed in informal business, many male than females engaged themselves as artisans and wage labor.

**Table 1: Demographic and economics characteristics of migrants**

		Female n=554)	Male (n=609)	All (n=1,163 )
Demographic characteristics	Age (years)	30	33	32
	education (Grade)	10	9	10
	Vocational training (%)	5.05	6.57	5.85
	Tertiary-certificate (%)	3.43	1.97	2.67
	Tertiary-diploma (%)	3.97	2.63	3.27
	Tertiary –Bachelor’s degree (%)	15.88	10.67	13.16
	Tertiary (post graduate)	2.35	1.81	2.06
<i>marital status of the migrant</i>	married (monogamous)	16.06	17.41	16.77
	Single	81.95	81.28	81.6
	Divorced/windowed	1.98	1.31	1.64
Relation to the head	Household head	2.16	7.88	5.16
	Spouse	1.62	0.82	1.2
	Child	58.3	53.04	55.55
	Grandchild	22.92	25.29	24.16
	Sister/brother	5.96	5.75	5.85
	Uncle/Aunt	2.53	1.64	2.06
	Cousin	1.44	1.97	1.72
	Distant relative	3.43	2.13	2.75
	Unrelated friend	0.9	0.82	0.86
	Mother/father	0.72	0.66	0.69
Training	No Professional training	71.7	64.4	67.8
	Police/army	5.2	9.9	7.7
	Teacher	6.1	3.4	4.7
	Mechanic/ Welder	0.9	6.9	4.0
	Carpenter/ plumber/ Mason	1.8	4.9	3.5
	Accountant	4.0	2.0	2.9
	Nurse	4.9	0.5	2.6
	Driver	0.0	4.6	2.4

	Engineer	1.1	2.3	1.7
	Hair dresser/barber	1.6	0.2	0.9
	Tailor	1.6	0.0	0.8
	Doctor	0.9	0.5	0.7
	Lawyer	0.2	0.5	0.3
Occupation	salaried employment	36.64	34.49	36.54
	Not working	26.35	22.99	24.59
	Student	18.05	12.64	15.22
	informal business	10.65	6.24	8.34
	Artisan (carpenter, plumber, welder)	2.17	9.36	5.93
	Wage labour	1.62	8.05	3.71
	Registered formal business	1.62	3.94	2.84
	Agriculture (farmer)	1.99	1.31	1.89
	other specify	0.91	0.98	0.94

#### 4.2. Migration characterization

*Motivation to migrate:* Push factors seem to dominate peoples' motivation to migrate from their rural homes. The main motivation for 44% of the migrants was to seek better life and better opportunities (36%). Slightly more male migrants (46%) than female migrants (42%) moved to seek better life. More females (12%) than males (10%) however moved because of the better schools in the target destination. Kinship can also be a motivation to migrate. Motivation to migrate for six percent of female and four percent of male migrants came from relatives. Although few cited drought as the push factor in migration decision, one can link unfavorable climate to lack of economic opportunities in the rural areas. The harsh climate is a common trigger of internal migration as an adaptation strategy among the youth ([McLeman and Hunter 2010](#)).

*Reason for migration:* Search for employment was the main reason of migration for 36 percent of females and 42% of males. A quarter of females and 17 percent of males moved to acquire education. The proportion of female and male migrants who migrated because they got a job was 28% and 33% respectively. Only 3% of female migrants and two percent of male migrants moved to start a business. More female migrants (2.5%) compared to their male counterparts (1%) moved because they got married.

*Facilitation:* Almost three quarter of migrants moved on their own suggesting that the decision to migrate is not always collective at the household level. Results suggest that kinship rather than social networks is more important determinant of migration. Only about one percent migrated through friends and neighbors.

*Duration in the destination:* The average duration of stay in the destination is between 1 to 5 years for 45% and 40% of female and male migrants respectively. Slightly less than a fifth of the migrants had stayed in the migration destination for between five and ten years. Slightly more than a tenth had staying at their destination for over ten years

Table 2: Gender disaggregated characterization of migration process

		Female (n=554)	Male (n=609)	All (n=1163)
Motivation	Seek better life	42.4	46.0	44.4
	No opportunities in the village	34.8	36.5	35.7
	Better schools	12.3	9.9	11.0
	Invited by relatives/	6.1	3.9	5.0
	Droughts	1.3	2.3	1.8
	Marriage	2.5	1.1	1.7
	Moved permanently	0.5	0.3	0.4
Reason for moving	Look for employment	35.7	42.4	39.2
	Got a job	28.3	33.2	30.9
	Acquire education	25.8	17.4	21.4
	Start own business	2.9	2.3	2.6
	To join parents	2.9	2.1	2.5
	Married	2.5	1.1	1.7
	other reasons	1.8	1.5	1.7
Migrated through	Own (n=854)	69.3	77.2	73.4
	Relative/ family (n=290)	28.9	21.3	24.9
	Friend/Neighbour (n=11)	1.3	0.7	0.9
	Contractor/Agent (n=1)	0.2	0.0	0.6
	Government support (n=7)	0.4	0.8	0.1
Duration	<6 months	9	9	9
	6months-1 year	18	19	18
	1-5 years	45	40	42
	5-10years	16	18	17
	>10 years	12	14	13



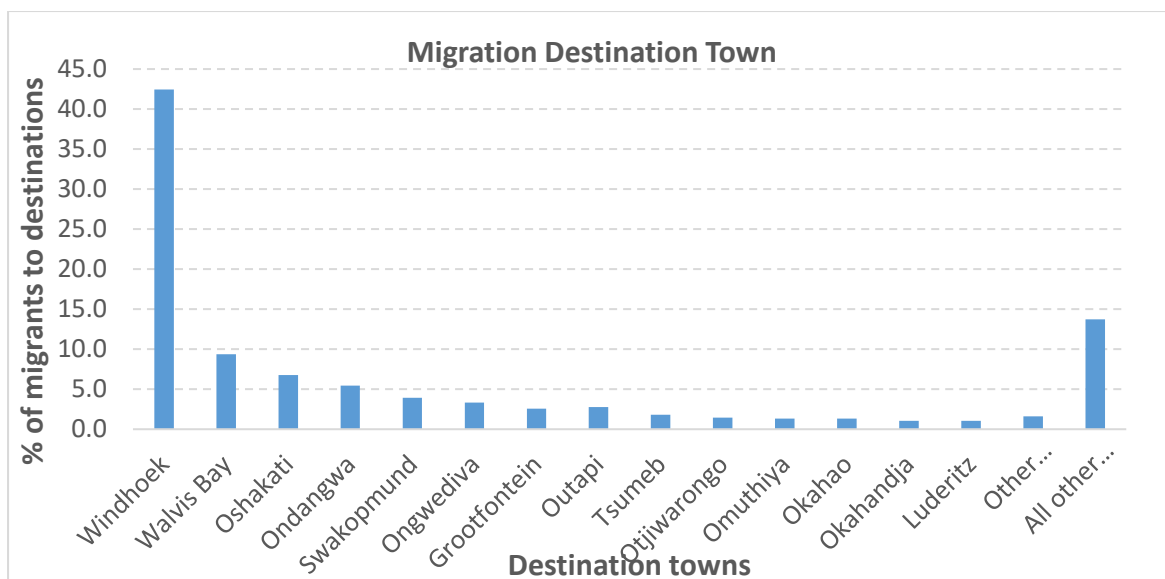


Figure 4: Migrants' destination towns

#### 4.3. Destination and form of migration

Figure 2 shows the most common migration destinations in Namibia. The city of Windhoek was the choice destination for 43% of migrants. Walvis Bay was the second most popular destination city for nine percent of migrants followed by Oshakati (6.8%), Ondangwa (5.5%), Swakopmund (4%) and Ongwediva (3.4%). It is clear from the figure that the main form of migration is internal rural-urban. International destination accounted for only one percent of rural outmigration in our sample. Past study in Southern Africa region covering seven countries including Namibia have shown that compared to internal rural-urban migration, households with international migrants were more likely to receive remittances both in kind and cash ([Crush and Caesar 2017](#)).

#### 4.4. Summary statistics by household's migration status

This section gives a comparative descriptive analysis of key variables between the migrant and non-migrant households. Results show that migrant and non-migrant households are similar in many individual, household and social characteristics (Table 3). The average age of the household head is 61 years and does not differ by migration status of the households. The two groups have about the same level of education of the head (5.6 years) and average household size of about six persons. The average farm size is about 6.5 hectares but migrant households had slightly more farmland (6.6ha) than non-migrant households (6.3ha) did. The average cultivated land was about half of the farm size (3.6 ha) and the difference between the two groups was not statistically significant.

At least three quarters of the households received government drought relief and the difference by households' migration status was not significant. The two groups had about the same level of livestock assets although the migrant households had slightly higher assets endowment than their counterparts. On average, the households had two adult members contributing to household's income.

Farm income from both crop and livestock was about the same between the two groups of households but migrant household's nonfarm income was N\$7400 higher than that of non-migrant households. Pension income did not differ by household's migration status also.

The two groups are similar in terms of access social networks. These include membership to social groups, number of social groups they are members, number of friends and households a family can ask for help in time of need. Looking at the outcome variables, the migrant households seem to be better off compared to non-migrant households. Migrant households had significantly higher annual income by about N\$ 3900, monthly income by approximately N\$200 and food spending by about N\$70. The results also suggest that the migrant households are slightly well off in food security.

However, looking at the distribution of key outcomes, we see that the non-migrant households have significantly higher annual consumption expenditure than migrant households (Figure 5). The monthly expenditure and food spending is not different between the two groups. Results suggests that the migrant households are poorer than non-migrant households at spending levels below N\$ 5000 are. However, at higher levels of expenditure over the N\$5000 mark, the migrant households spend slightly more than non-migrant households do but not so many in the population spend that much. Therefore, we can expect that after controlling for other location-specific, social and economic factors, the average consumption spending by migrant households will on average be much less than for their counterparts.

Table 3: Summary statistics by migration status

	Variable	Control (n=253)		Treatment (n=400)		Whole sample (n=653)		statistical test difference
		Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	
individual	Household head age (years)	60.70	1.05	62.20	0.85	61.62	0.66	-1.504
	Household head education	5.63	0.25	5.66	0.20	5.64	0.16	-0.0265
	Male head	0.48	0.03	0.40	0.02	0.43	0.02	0.083**
Household	Mobile money	0.19	0.02	0.27	0.02	0.24	0.02	-0.082**
	Household size	5.38	0.19	5.76	0.16	5.62	0.12	-0.379
	Farm size (ha)	6.34	0.27	6.66	0.23	6.54	0.18	-0.321
	Area under crop (acre)	3.61	0.15	3.57	0.10	3.58	0.08	0.0358
	Tropical livestock units (tlu)	4.90	0.62	6.16	0.64	5.67	0.46	-1.26
Income	Government drought relief	0.79	0.03	0.76	0.02	0.77	0.02	0.0395
	Adults contributing to household income	1.66	0.08	1.59	0.06	1.62	0.05	0.0676
	Off farm income (N\$) <sup>3</sup>	7694.70	2342.48	15124.03	2360.62	12245.59	1711.94	-7429.30**
	Crop income (N\$)	1282.64	234.68	1267.69	250.37	1273.48	178.17	14.96
	Livestock income (N\$)	241.98	85.70	756.95	238.41	557.43	150.01	-515*
	Pension income (N\$)	8253.76	2080.26	9496.50	1443.80	9015.01	1195.83	-1242.7
social networks	networks	0.22	0.03	0.23	0.03	0.22	0.02	-0.00761
	group	0.16	0.02	0.16	0.02	0.16	0.01	0.00
	Number of friends	3.28	0.41	3.56	0.30	3.45	0.24	-0.28
	households financial help	1.44	0.10	1.63	0.10	1.55	0.07	-0.19
outcome	Yearly expense (N\$)	4773.99	829.98	8725.65	1235.01	7194.61	824.98	-3951.7**
	Monthly expense (N\$)	420.31	41.03	645.56	90.48	558.29	57.79	-225.20**
	Total food expenditure (N\$)	442.91	37.74	511.84	21.66	485.13	19.77	-68.93*
	Food insecurity index (hfias)	7.73	0.44	6.38	0.33	6.90	0.26	1.347**
	Household dietary diversity index (dds)	6.69	0.12	7.08	0.10	6.93	0.08	-0.386**
	Months of inadequate food provisioning	1.43	0.15	1.47	0.12	1.45	0.10	-0.0302

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

<sup>3</sup> The exchange rate was 1 USD = 12.9571 NAD, at the time of the survey. NAD is Namibian dollar

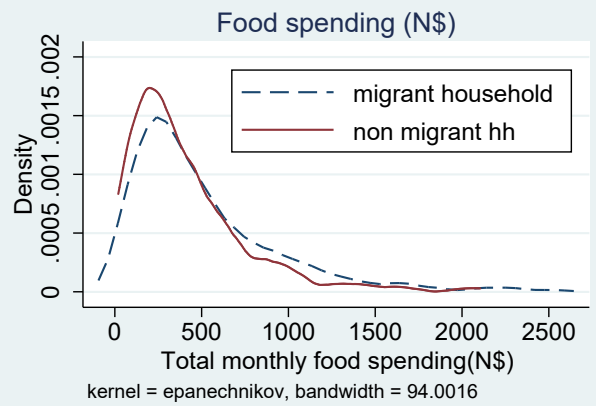
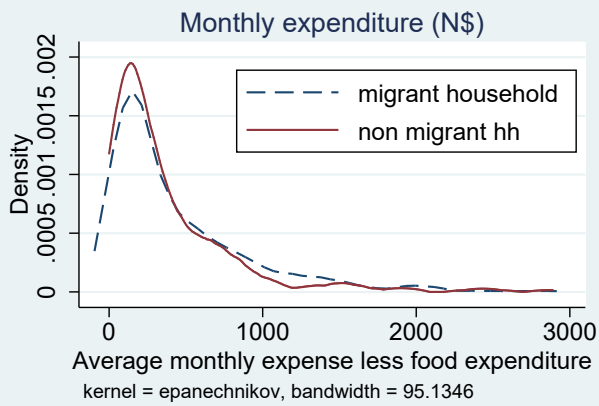
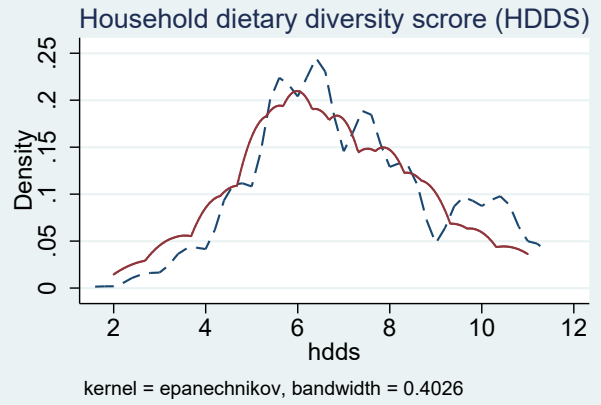
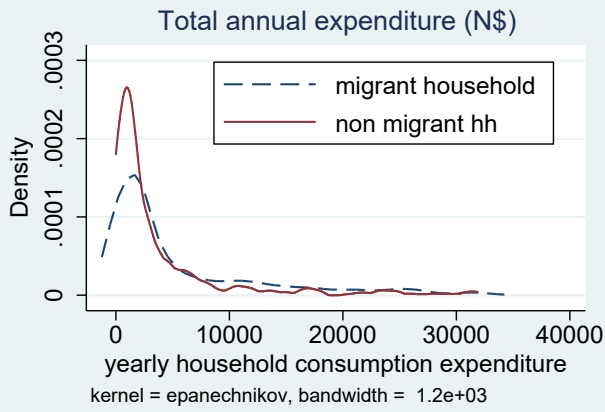


Figure 5: Distribution of key welfare outcomes by household's migration status

## 5. Estimation Results and Discussion

### 5.1. Impact on annual consumption spending

Results of generated instruments are close to that obtained with combination of both the generated and exogenous instruments (Table 4). Migrant households on average spent significantly less annually on health, education clothing and housing than non-migrant households.

Results suggest that migrant households are on average poorer than families that have no migrant member. This paper's descriptive analysis shows migrants move on their own due to lack of opportunities in their rural homes but they also lack critical skills that would help them get better rewarding jobs. Results corroborate with previous research which show most of them go to Windhoek and are poor, food insecure, unemployed and live in informal settlements of the city ([Pendleton, Crush et al. 2014](#)). Conceptually, poverty induce migration and although the concept is well documented in the context of international migration ([Adepoju 2004](#), [De Haas 2005](#)), it could as well apply to internal rural-urban type of migration.

However, among the migrant households, migration intensity has a positive impact on annual spending. Every additional migrant in a household on average leads to N\$5000 increase in annual consumption expenditure. These points to benefits of migration in uplifting family welfare but there is a need to improve the quality of human capital through education and training. Presence of a member with vocational training in the household increase average annual expenditure by at least N\$6230 *ceteris Paribus*.

The annual consumption spending also differed by gender of the household head. Female-headed households had N\$ 3790 less consumption expenditure than households headed by males. There were no significant regional differences in consumption expenditure. Household with a trained household head spent N\$12720 more than those whose heads had no training. Large households were associated with much less consumption expenditure. An additional member to the household was associated with an N\$450 reduction in consumption expenditure. Larger households tend to be poorer than small families (cite). Larger households are associated with low standards of living and results show that on average an additional member to the household led to a reduction in spending by N\$520. Large household size could constitute one of the main sources of poverty trap ([Woolard and Klasen 2005](#)). Households with at least a member having obtained vocational training had higher consumption expenditure than those with none. Households that had registered for mobile money services on average had N\$5400 more spending than households that did not have access.

Wealth endowment as measured by physical assets, livestock assets and land holding was associated with higher consumption spending. A one percent increase in asset index resulted in a N\$1752 increase in annual spending. Similarly, every additional hectare lead to an increase in annual spending by N\$ 332. Increasing livestock ownership by one tropical unit led to an N\$ 347 increase in annual consumption spending. Households receiving government relief had lower consumption spending. This suggests that these households were poorer than those that did not receive drought relief.

Table 4: Impact on annual and monthly consumption expenditure

VARIABLES	Yearly consumption expenditure (NAD)				Monthly consumption expenditure (NAD)			
	GenInst <sup>4</sup>		GenExtInst <sup>5</sup>		GeneInst		GenExtInst	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Migration status	-24,731.36**	9,640.49	-24,215.68***	9,080.90	254.34	685.63	212.17	570.59
Number of migrants	5,180.56***	1,820.27	5,086.14***	1,720.67	-22.09	154.37	-12.89	129.62
Oshana region	277.13	2,154.72	289.95	2,145.22	19.15	102.68	16.31	98.88
Oshikoto region	-131.52	2,085.69	-152.52	2,073.95	198.81	146.04	199.97	148.56
Male head	-3,865.56**	1,700.93	-3,841.27**	1,688.13	-136.09	105.64	-137.58	108.67
Head age	72.44	255.09	74.33	253.87	12.81	12.55	12.87	12.49
Head age2	-0.80	2.03	-0.81	2.02	-0.10	0.09	-0.10	0.09
Head education	-168.54	266.82	-168.26	265.81	-1.17	10.14	-1.11	10.04
Head training	12,996.65***	3,342.14	12,950.73***	3,317.93	883.39*	479.46	885.76*	485.42
Vocational training	6,232.45***	1,950.93	6,235.86***	1,943.50	261.07*	157.62	261.21*	157.48
Tertiary education	1,117.35	2,234.08	1,142.99	2,220.26	-110.78	200.26	-113.02	205.30
Household size	-443.41	275.66	-444.71	274.51	-16.55	10.51	-16.54	10.48
Mobile money	5,782.55***	1,992.80	5,764.97***	1,982.46	324.06**	132.32	326.97**	137.27
Asset index	1,804.65***	601.18	1,806.77***	598.78	118.31***	38.03	117.72***	36.74
Social networks	280.85	1,415.41	281.80	1,410.09	54.13	67.64	54.33	67.50
Households family ask for help	1,683.12***	441.90	1,680.85***	440.02	-0.38	30.11	-0.10	29.59
Farm size (ha)	321.10*	193.34	321.78*	192.57	8.66	14.73	8.51	14.54
Tropical livestock units (tlu)	339.85***	80.70	341.35***	79.88	6.53	4.26	6.41	4.21
Log income	-89.42	81.40	-88.83	81.02	-2.56	5.36	-2.53	5.40
Government drought relief	-3,536.83*	2,031.70	-3,517.06*	2,020.52	-46.96	167.97	-47.83	166.11
Risk taking	-381.56	617.38	-376.82	614.39	69.85	69.83	69.14	67.78
Very little	-64.88	2,092.74	-60.18	2,084.69	124.02	186.16	123.62	185.04
somewhat	5,946.78**	2,360.46	5,904.64**	2,337.67	-90.29	138.21	-87.18	135.73
moderately	3,841.82	2,417.90	3,814.42	2,403.08	-51.52	97.81	-50.01	97.13
Constant	9,915.84	10,091.02	9,661.59	9,934.21	-301.51	508.62	-288.16	485.44
Observations	648		648		648		648	
R-squared	0.13		0.14		0.11		0.11	
Hansen J statistic	0.142		0.136		0.508		0.395	

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

<sup>4</sup> Equation estimated with generated instruments  $Z$  from observed exogenous explanatory variables using linear two stage least squares regression.  $Z = (X_j - \bar{X}) * \epsilon$ <sup>5</sup> This equation is estimated using both generated and the external instruments.

### 5.2. Impact on monthly consumption spending (N\$)

Although statistically the difference in monthly spending between the two groups is not significant, migrant households' average expenditure is less than of families with no migrant (Table 4). The household's quality of human capital and wealth status are evidently the key drivers of monthly consumption spending. A one percent increase in asset index leads to an increase in monthly spending by at least N\$1700.

The role of skills acquired through training are evident in the results (Table 4). Households whose heads had some form of post school training had N\$ 880 higher monthly consumption spending than those whose head had no training. Likewise, having a household head with vocational training increased average consumption spending by N\$ 261. The impact of social networks and trust seem to influence long-term spending like schools and health rather than short-term spending. Access to mobile money services has significant positive impact on monthly consumption spending.

### 5.3. Impact on food expenditure and household food dietary diversity

Though not statistically significant, migrant households had lower food spending and less diversified diets than non-migrant households did (Table 5). This is a further pointer to the fact that migrant households are poorer. However, among the migrant households, every additional migrant however led to an increase in monthly food spending by about N\$10. We do not see significant difference in food spending and dietary diversity across regions and gender. However, food spending increased with age. Elderly people are less likely to farm and more likely to use old age pension and remittances to purchase food. Old people might farm less and rely on government old pension to buy food and other needs.

Education and training positively affect household food spending. Completing an additional grade on average increased food spending by about N\$ 15.50 and a one percent increase in dietary diversity. Households whose head had acquired any form of training on average spent N\$154 more on food compared to those without any form of training. Vocational training of the household head has a positive and significant impact on dietary diversity. Schooling and training increases likelihood of getting employment or engaging in highly productive income generating economic activities thereby increasing expenditure. Larger households have less diversified diets, which could be an indication of food and nutrition insecurity.

Households whose members have registered for mobile money service spent more on food spending than those that had no access to such services. Mobile money could be an indicator of access to financial services and ease of receiving payments and remittances. Mobile money signals access to financial services and those registered for the service are able to transact more or easily receive remittances.

Wealth endowment increases both food spending and dietary diversity. Household food spending also increased with increase in non-farm income. Non-farm income indicate less participation in farming and relying more on nonfarm income to purchase food. Agriculture income: signals surplus production and families will ensure food safety first before selling households whose heads are risk takers spent more on food and had more diversified diets than those that are risk averse. They are likely to engage in off farm business with higher risks but also better returns. Dry spell and high temperatures reduces peoples capacity to grow their own food hence might rely on market and food relief.

Table 5: impact on food spending, household dietary diversity index and uptake of adaptive strategies

VARIABLES	Total food expenditure (N\$)				Dietary diversity index			
	GenInst		GenExtInst		GenInst		GenExtInst	
	coef	se	coef	se	coef	se	coef	se
Migration status	-195.23	229.24	-190.73	228.51	-0.21	0.86	-0.47	0.82
Number of migrants	42.70	45.14	41.88	44.90	0.02	0.16	0.07	0.15
Oshana region	4.40	43.54	4.50	43.48	-0.28	0.19	-0.28	0.19
Oshikoto region	51.56	38.77	51.36	38.74	-0.26	0.19	-0.25	0.19
Male head	0.80	30.42	1.01	30.26	-0.03	0.15	-0.04	0.15
Head age	3.28***	1.11	3.27***	1.11	0.01	0.01	0.01	0.01
Head education	15.51***	4.62	15.51***	4.62	0.08***	0.02	0.08***	0.02
Head training	154.08**	76.23	153.69**	76.24	0.02	0.31	0.04	0.31
Vocational training	48.45	40.24	48.48	40.19	0.30*	0.18	0.30*	0.18
Tertiary education	29.08	52.98	29.23	52.87	0.02	0.26	0.01	0.26
Household size	-1.13	5.52	-1.16	5.51	-0.05**	0.03	-0.05**	0.03
Mobile money	135.63***	42.31	135.49***	42.25	0.11	0.18	0.12	0.18
Asset index	77.66***	13.43	77.68***	13.42	0.36***	0.05	0.36***	0.05
Contribute income	11.77	18.22	11.81	18.20	-0.02	0.08	-0.02	0.08
Social networks	-19.14	23.32	-19.12	23.28	0.15	0.12	0.15	0.12
Farm size (ha)	-0.80	3.81	-0.82	3.81	-0.01	0.02	-0.01	0.02
Area crop (ha)	-7.33	9.47	-7.22	9.43	0.09*	0.05	0.08*	0.05
Tropical livestock units	-1.03	1.10	-1.02	1.10	0.00	0.01	-0.00	0.01
Log crop income	-6.34***	1.68	-6.33***	1.68	-0.01	0.01	-0.01	0.01
Log non-farm income	3.49**	1.57	3.48**	1.57	0.03***	0.01	0.03***	0.01
Log livestock income	1.15	2.45	1.14	2.45	0.02	0.01	0.02	0.01
Log pension income	-0.68	1.72	-0.67	1.72	0.01	0.01	0.01	0.01
Received government drought relief	18.58	38.06	18.74	38.12	0.06	0.18	0.05	0.18
Risk taker	19.07	12.27	19.08	12.26	0.22***	0.05	0.22***	0.06
High temperatures	48.34	36.21	48.19	36.15	0.63***	0.17	0.63***	0.17
Dry spell	45.84	38.43	45.91	38.36	0.34*	0.19	0.34*	0.19
Constant	23.10	144.17	21.49	143.87	5.06***	0.65	5.15***	0.65
Observations	646		646		648		648	
R-squared	0.24		0.24		0.27		0.26	
Hansen J statistic	0.229		0.294		0.496		0.596	

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



## 6. Conclusion

Namibia's rural population remain vulnerable to negative effects of climate change. Most of the existing studies have focused in how changes in climate affects people's mobility looking at migration as response to those changes and as an adaptive strategy. Another emerging body of literature has shift focus to look at migration as a catalyst of adaptation process by relaxing liquidity and credit constrains through remittances, information flow, and technology transfer. This paper contributes to this ongoing discussion by evaluating how migration affects wellbeing outcomes of vulnerable communities living in semi-arid environments and if indeed, it has an impact on their adaptive capacity.

We find that most migrants are young and the main two motivation is to look for work or seek better education. Poverty and lack of opportunities in the rural villages are the main push factor driving migration to towns and cities. The most common form of migration is rural-urban with low entry costs but less lucrative.

Majority of the migrant's lack post school professional training and tertiary education. Past studies have identified these two factors as key for migrant to secure better returns in non-farm sector employment. Only a fifth of migrants accessed tertiary education and majority of them were females. World Bank data indicates that this gap has been widening since 2008. The most popular destination for majority of the migrant is Windhoek city and previous studies show increasing rate of urban poverty especially among the unskilled migrants who live in informal settlements.

Contrary to past studies, we find that migrant households had less consumption expenditure, no significant difference in food spending and dietary diversity. Our results suggest that migrant households are relatively deprived compared to non-migrant households. However, migration intensity had positive impact among the migrant's households. Every additional migrant within a household increase average annual consumption spending by N\$5000. This shows potential impact migration could have as a livelihood diversification and adaptive strategy.

Unlike previous studies elsewhere ([Karanja Ng'ang'a, Bulte et al. 2016](#)), we find no evidence that migration had impact on the adaptive capacity of the community. Relatively deprived households will meet the basic needs first before investing in adaptive strategies. We also think that heavy reliance on government drought relief and cash transfers for the elderly (pension grants) may reduce people's incentive for self-protection. Three quarters of the households received government drought relief.

Based on our finding, we observe that migration has a great potential as an adaptive and risk mitigation strategy against climate variability, but the following two issues must be addressed for meaningful impact. First, invest in higher education and training of the youth to equip them with the necessary skills for the industry and/or self-employment. Secondly, those left in the village must have capacity to invest the remittances for impact. These include empowering them with basic entrepreneurial skills they need to invest in and run off the farm enterprises and information on alternative adaptive options.

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