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Evaluating the welfare effects of nonfarm enterprises on rural households in Papua New Guinea

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Papua New Guinea (PNG) is the country with the largest rural population share in the East Asia and Pacific region. In addition, PNG is affected by El Niño Southern Oscillation (ENSO) climatic events that in severe years cause significant food insecurity due to failed agricultural production. Shrinking land holdings for agricultural production due to the growing population together with climate risk motivates many rural households to explore off-farm income generating opportunities. The analysis reported on here evaluates the importance of nonfarm employment in rural areas in PNG in diversifying risk to household welfare, in smoothing seasonal income fluctuations, and in absorbing excess labor in households with limited agricultural resources.

We use data collected from rural households in PNG between May and July 2018 by the International Food Policy Research Institute (IFPRI). The survey was administered to 1,026 households in 70 communities across specific districts in East Sepik, Madang, and West Sepik provinces and in the Autonomous Region of Bougainville. Respondent households were asked about any nonfarm enterprises (NFE) in which they were involved, including questions on ownership, labor characteristics, and income generation. We explore how engaging in an NFE affects household welfare.

In doing so, we evaluate two questions:

1. What barriers to entry exist for male- versus female-owned NFEs?
2. Do the welfare effects of NFE ownership differ by the sex of the owner?

Our study draws upon a wide-ranging literature focused on the role of NFEs in the livelihood strategies of rural households globally.[1]

Key Policy Messages

- Nonfarm enterprises (NFE) are an important income source for over one-third of households in the sample.
- Households with an NFE have higher protein and calorie consumption, greater total expenditure, and a more diversified diet compared to households without one.
- Households with greater income and more labor have a higher probability of running a male- or jointly-owned enterprise.
- Female-owned NFEs are more common in households that recently experienced a food price fluctuation shock, suggesting that NFEs may be used as a risk reduction or income-smoothing mechanism.

[1] For example, de Janvry and Sadoulet 2001; Lanjouw and Lanjouw 2001; Jayne et al. 2003; Barrett et al. 2005; Haggblade et al. 2007; Lay et al. 2008.

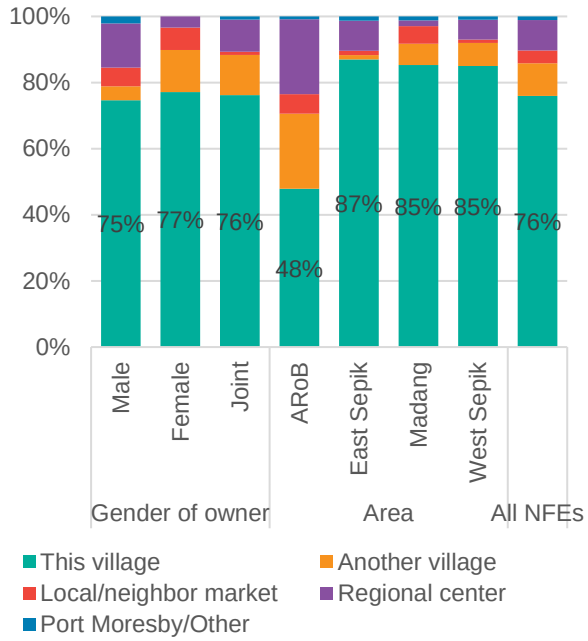
Overall, we find that households with an NFE have significantly higher annual per capita consumption compared to matched households without an NFE, amounting to an average increase in annual household expenditure of 242 kina (PGK) per capita. In addition, households with an NFE consume approximately 10 grams more protein and 211 more calories per person per day and achieve greater diversity in their diets compared to households without an NFE.[2] We find that the positive associations of NFE ownership on welfare outcomes are largely driven by male-owned and jointly-owned (male and female) NFEs. The welfare outcomes attributable to female-owned NFEs are much smaller.

Methodology

To assess the probability of members of a household owning an NFE given a set of household characteristics, we evaluate the decision of survey households to engage in an NFE by using a multinomial logit (MNL) analysis. In doing so, we split our sample into four categories: households that have a male-owned NFE, a female-owned NFE, a jointly-owned (male and female) NFE, and those households that do not have an NFE. As we assume that these factors may differ by the sex of the NFE owner, we disaggregate the sample by male, female and joint ownership. For each of the ownership categories, through the MNL analysis we identify a set of characteristics (or decision factors) that may influence whether a household engages in an NFE.

Second, we estimate the impact of owning an NFE (disaggregated by the owner's sex) on a set of key welfare indicators. Evaluating the impact of NFE ownership on welfare within a cross-sectional study, i.e., using data that are collected only once during survey implementation, may introduce potential bias in the results due to inherent characteristics determining whether a household member owns an NFE also determining the level of welfare of that household. For example, households that have greater start-up capital, a larger household size and, hence, workforce, or are located near a bustling market may have a greater probability both of higher welfare and of having an NFE. To control for such bias, we use a nearest-neighbor matching technique to compare pairs of similar survey households, with the principal difference between them being that members of one household own an NFE, while those in the matched household do not. We calculate the impact on welfare of owning an NFE by comparing average welfare outcomes of NFE-owning households with the matched non-NFE households.

Figure 1: Nonfarm enterprise location, by owner's sex and survey area



Source: 2018 PNG Household Survey on Food Systems
Note: ARoB = Autonomous Region of Bougainville;
NFE = Nonfarm enterprise

Nonfarm Enterprises in Papua New Guinea

More than one-third of survey households reported that at least one NFE was owned by one or more household members. Of the NFE businesses, 30 percent were owned by a male household member, 25 percent were owned by a female, and 44 percent were jointly-owned (both male and female ownership). Over 75 percent of these businesses primarily

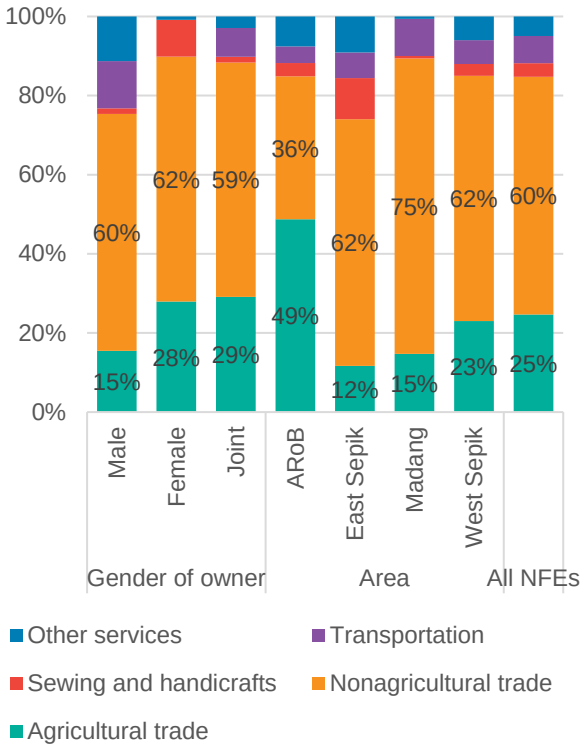
[2] Previous research in PNG generally finds that rural residents have lower than the recommended daily intake of protein. Similarly, rural diets are dominated by starchy staples, such as yam, sago, and sweet potato, limiting the dietary diversity needed for a healthy diet.

operate within the community in which they reside (Figure 1). Only three percent of female-owned NFEs conduct any business outside of their local or neighboring communities or local market center, while 16 percent of male-owned and 11 percent of jointly-owned enterprises do so.

The most common activities of the NFEs of the survey households are agricultural and non-agricultural trade, representing 25 and 60 percent of overall NFE activities, respectively (Figure 2). Within agricultural trade activities, betel nut was the most common agricultural commodity handled, followed by sales of cash crops and garden produce (Table 1). Non-agricultural activities were dominated by sales of fuel, including firewood and batteries; prepared food; and alcohol. These three sorts of enterprises represented 51 percent of the NFEs in the entire survey sample.

Survey respondents reported the total cash income earned from each NFE that they owned. The NFEs of the survey households realize median incomes of approximately PGK 800 per year (Figure 3). NFEs that engage in transportation or other services (mainly construction and carpentry) reported earning the most with median annual incomes of PGK 5,000 and PGK 1,900, respectively.

Figure 2: Nonfarm enterprise type, by owner's sex and survey area



Source: 2018 PNG Household Survey on Food Systems
Note: ARoB = Autonomous Region of Bougainville;
NFE = Nonfarm enterprise

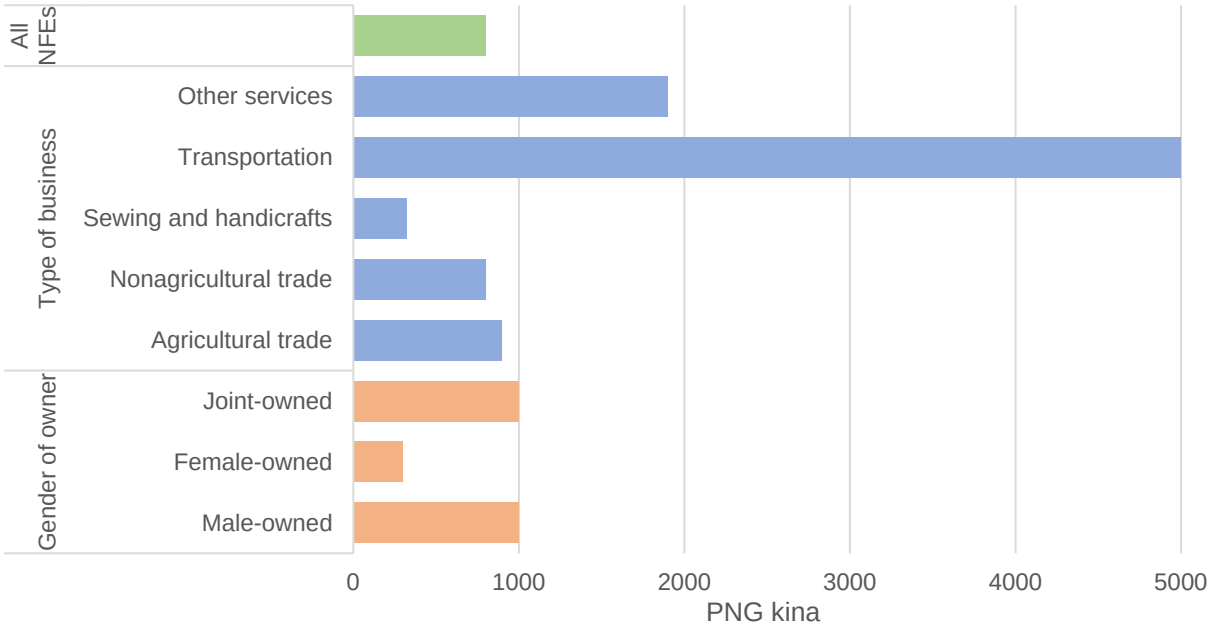
When disaggregating enterprises by male-, female-, and jointly-owned, we find that female-owned enterprises generally earn only about one-third of the income of male- or jointly-owned enterprises.

Table 1: Nonfarm enterprise types by sex of owner, percent of enterprises

	Nonfarm enterprise type	Male-owned NFE	Female-owned NFE	Jointly-owned NFE	All NFEs
Agricultural trade	Betel nut	9	13	6	9
	Cash crops (e.g. vanilla, cocoa)	4	2	10	6
	Other agricultural trade	3	14	13	10
	Total	15	28	29	25
Nonagricultural trade	Fuel/timber/batteries	11	5	10	9
	Prepared food and alcohol	5	36	10	15
	Trade stores / market vendor	44	20	39	36
	Total	60	62	59	60
	Sewing and handicrafts	1	9	1	3
	Transportation	11	0	7	7
	Other services (including construction)	11	1	3	5
	Nonfarm enterprises, number	*142*	*118*	*206*	*466*

Source: 2018 PNG Household Survey on Food Systems.
Note: NFE = Nonfarm enterprise.

Figure 3: Nonfarm enterprise median incomes by owner's sex and business type



Source: 2018 PNG Household Survey on Food Systems.
Note: NFE = Nonfarm enterprise.

Factors Associated with Nonfarm Enterprise Ownership

We use a multinomial logit (MNL) analysis to evaluate the household and individual level characteristics associated with NFE ownership.[3] Results from the analysis suggest that start-up capital (proxied in the analysis by household asset and housing quality indices) and the amount of male household labor available are important determinants of whether members of a household will own an NFE (Table 2). Households in a higher wealth index tercile have a significantly greater probability of engaging in any NFE, but are more likely to engage in a male- or jointly-owned nonfarm enterprise.[4] Households with at least one working aged male are over three times as likely to have a male-owned NFE and 11 times more likely to have a jointly-owned NFE. Female labor availability is not strongly associated with a greater probability of owning any type of NFE among households in the sample.

Price fluctuation risk is significantly associated with whether women act as sole proprietors of NFEs. However the association is not linear – households in communities where almost everyone was affected by a price fluctuation shock (tercile 3) are not more likely to start an enterprise, suggesting that lack of demand for off-farm goods and services may hinder NFE start-up. This result suggests that female-owned NFEs may be created as a labor diversification strategy following shocks to better manage risks to household welfare, rather than as a long-term investment strategy. In addition, households that live within a community with more vibrant NFE activity are considerably more likely to have an NFE owned by female members. Further research should investigate the effects of NFE clusters on female-ownership to understand if positive externalities – for example, improved security among a group of entrepreneurs, lower perceived risk of starting an NFE, or facilitated or otherwise less expensive transaction costs – may be driving this result.

[3] The coefficients are presented as odds-ratios. Thus, a statistically significant odds-ratio that is less than one represents an inverse relationship between the independent and dependent variable, while an odds-ratios greater than one represents a positive relationship.

[4] The wealth index is based on a principal components analysis using the number of durable assets each household owns, plus indicator variables for whether a household has an improved roof or an improved floor (a roof was considered improved if it was made of metal or plastic; and a floor was considered improved if it was wood, tile, or concrete).

Table 2: Factors associated with nonfarm enterprise ownership, odds ratios from multinomial logit regression

Explanatory variables	All NFEs	Male-owned NFEs	Female-owned NFEs	Jointly-owned NFEs
One working age male in HH, 0/1	1.348	3.119**	0.343***	11.661**
Two working age males in HH, 0/1	1.59	3.141**	0.563	12.107**
More than two working age males in HH, 0/1	1.435	3.857**	0.308**	12.110**
One working age female in HH, 0/1	2.227*	0.934	3.757	6.315*
Two working age females in HH, 0/1	1.807	1.119	2.828	3.783
More than two working age females in HH, 0/1	1.906	0.947	4.786	3.278
Dependency ratio of HH, ratio of number of members aged under 15 or over 64 years to those aged 15 to 64 years	1.011	1.089	0.988	0.965
Migrant HH member has been gone for 2 or more years, 0/1	1.309	0.811	2.262	1.096
Wealth index, tercile 2, 0/1	2.426***	2.129***	1.693*	3.562***
Wealth index, tercile 3, 0/1	4.415***	6.143***	1.839**	6.415***
Households in community, excluding own, that grow betel nut, percent	0.958	1.656	0.465	1.127
Within 2 hours walking distance of district town, 0/1	1.212	1.342	1.433	0.938
Share in community, excluding own, that believe in women's empowerment is above the mean, 0/1*	0.998	0.919	0.799	1.318
Women's empowerment gap in community *	1.031	1.286	0.949	0.806
Share in community, excluding own, that were affected by a price fluctuation in last 5 years, tercile 2, 0/1	1.588**	1.824	2.055*	1.203
Share in community, excluding own, that were affected by a price fluctuation in last 5 years, tercile 3, 0/1	0.899	1.121	1.376	0.541
Share in community, excluding own, that own an NFE	2.293	2.076	7.115**	1.057
World Vision programming community, 0/1	0.834	1.258	0.934	0.516***
Household head characteristics	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Sex of the survey enumerator fixed effects	Yes	Yes	Yes	Yes
Observations	996	996	996	996

Source: 2018 PNG Household Survey on Food Systems.
Note: The base category is households that do not own an NFE. Household head characteristics include age and educational attainment categories, but none were found to be statistically significant. NFE = Nonfarm enterprise; HH = Household.
Asterisks denote the level of significance: * p<=0.1; ** p<=0.05; *** p<=0.01
* A gender empowerment index was created by summing responses from five work-related gender empowerment questions asked of the head and senior woman (if head is not female) within a household (with 1 being the least empowered response; 5 being the most). The sum is divided by five, resulting in an index that ranges from 1 to 5. The index is converted to a dummy variable for "empowered" based on values of 3 and above. The community women's empowerment gap is the share of women minus the share of men in each community who believe in women's empowerment (based on the index).

Importance of Nonfarm Enterprises on Dimensions of Household Welfare

Nearest neighbor matching is used in four separate analyses to measure the impact of a household owning: 1) any NFE, regardless of the owner's sex; 2) a male-owned NFE; 3) a female-owned NFE; and 4) a jointly-owned NFE. The results suggest that NFEs play an important role in supplementing and improving the overall diet of household members, particularly in households with jointly-owned NFEs – individuals in households with a jointly-owned NFE eat 13 grams (33%) more protein and consume a 16% more diversified diet (Table 3). This increase in protein and dietary diversity likely reflects the effect of increased incomes for households with male- and jointly-owned NFEs.

Table 3: Household welfare effects of nonfarm enterprise ownership

Welfare outcome	No NFE	All NFEs		Male-owned NFEs		Female-owned NFEs		Jointly-owned NFEs	
	Mean	Unit Effect	Effect (%)	Unit Effect	Effect (%)	Unit Effect	Effect (%)	Unit Effect	Effect (%)
Protein per person per day, grams	39	10***	26%	7	18%	4.1	10%	13***	33%
Kilocalories per person per day	2005	211**	11%	220	11%	58	3%	160	8%
Household dietary diversity score	4.8	0.5**	10%	0.4	8%	-0.2	-4%	0.8***	16%
Total annual expenditure per capita, PGK '000s	1.81	0.242**	13%	0.377**	21%	0.121	7%	0.225	12%

Source: 2018 PNG Household Survey on Food Systems.
Note: The results shown are the average effect of the treatment on the treated (ATT) using nearest-neighbor matching.
The household dietary diversity score (HDDS) is calculated by summing the number out of 16 food groups that the household reported consuming in the last 24 hours, e.g., leafy green vegetables, pulses, dairy, etc. NFE = Nonfarm enterprise; PGK = PNG Kina.
Asterisks denote the level of significance: * p<=0.1; ** p<=0.05; ***p<=0.01.

Female-owned NFEs do not have a statistically significant impact on any of the household welfare outcomes measured compared to households without an NFE. This is partly explained by the dominant activities of female-owned NFEs compared to male- and jointly-owned enterprises. Nearly two-thirds of female-owned NFEs in the survey sample focus on non-agricultural trade or handicrafts, which reap lower revenues compared to other NFE activities. In contrast, a larger share of male- and jointly-owned NFEs are dedicated to transportation or trade in cash crops, both of which are high earning activities. These results are consistent with the MNL analysis that suggests that female-owned NFEs may serve as an income smoothing or risk-reduction mechanism rather than an income expansion strategy.

Conclusions and Policy Implications

More than one-third of households in the sample for the 2018 rural household survey in four rural areas of PNG reported that one or more of their members owned at least one NFE. We find that households with more income to finance the start-up costs or with surplus labor needed to run an NFE are significantly associated with having a male- or jointly-owned NFE. Households that experienced a shock during the last 5 years are more likely to have a female-owned NFE.

Households with male- or jointly- owned NFEs have higher total consumption, consume more protein and calories, and eat more diversified diets than do households with no NFEs. Although female ownership is not associated with improved consumption and expenditure outcomes, women provide a majority of the labor used within small enterprises and the informal sector (Drucza and Hutchens 2008; Stanley 2018). Policies to promote small nonfarm businesses, such as improved access to credit and improved marketing and transportation infrastructure, could increase income, reduce risk of food insecurity, and improve consumption among rural households in PNG. However, it is important to design these interventions in a manner that considers current and customary gender differentiation within the household in how labor and resources are allocated.

References

Barrett, C.B., M. Bezuneh, D.C. Clay, and T. Reardon. 2005. “Heterogeneous constraints, incentives and income diversification strategies in rural Africa.” *Quarterly Journal of International Agriculture* 44: 37-61.

Collier, P. and A. Hoeffler. 2004. “Greed and grievance in civil war.” *Oxford Economic Papers* 56 (4): 562-595.

de Janvry, A., and E. Sadoulet, E. 2001. “Income strategies among rural households in Mexico: The role of off-farm activities.” *World Development*, 29: 467-480.

Drucza, K. and A. Hutchens. 2008. *Women in business in Papua New Guinea*. Canberra: AusAID.

Haggblade, S., P.B.R. Hazell, and T. Reardon, eds. 2007. *Transforming the Rural Nonfarm Economy*. Baltimore: Johns Hopkins University Press.

Jayne, T.S., T. Yamano , M.T. Weber, D. Tschirley, R. Benfica, A. Chapoto, and B. Zulu. 2003. “Smallholder income and land distribution in Africa: Implications for poverty reduction strategies.” *Food Policy* 28: 253-275.

Lanjouw, J.O. and P. Lanjouw. 2001. “The rural nonfarm sector: Issues and evidence from developing countries. *Agricultural Economics*, 26: 1-23.

Lay, J., T.O. Mahmoud, and G.M. M’mukaria. 2008. Few opportunities, much desperation: The dichotomy of nonagricultural activities and inequality in Western Kenya. *World Development*, 36: 2713-2732.

Stanley, J. 2018. *National Audit of the Informal Economy*. Port Moresby: Department for Community Development and Religion.

Winters, P., B. Davis, G. Carletto, K. Covarrubias, E.J. Quiñones, A. Zezza, C. Azzarri, and K. Stamoulis. 2009. “Assets, activities, and rural income generation: Evidence from a multicountry analysis.” *World Development*, 37 (9): 1435-1452.

World Bank. 2014. *East Asia Pacific at work: Employment, enterprise, and well-being*. Washington DC: World Bank.

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