GROWTH AND TRANSFORMATION OF FOOD SYSTEMS IN AFRICA: EVIDENCE FROM THE POULTRY VALUE CHAIN IN NIGERIA

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Abstract
Increased consumption of poultry products in Nigeria is occurring alongside rapid urbanization and growth in the industry. We use a panel data double-hurdle model to consistently identify key factors affecting engagement in the Nigerian subsector by various actors. Our analysis reveals that there is active engagement in the Nigerian poultry sub sector by a much broader set of actors than traditionally perceived. There is also a huge data gap in appropriate field survey data on the poultry value chain in Nigeria.

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Introduction and Motivation
Nigeria, like other countries in Sub Saharan Africa, is often perceived to have traditional food habits narrowly limited to grains, root staples, and sauces, with rural households relying mainly on home-consumption from own-farming but not market purchases. Yet, there is a clear trend of diversification beyond staples into horticulture, animal proteins, and dairy. Animal proteins alone account for about 15% and 20% of the food budget in rural and urban areas respectively. As incomes rise, it is expected that Nigerians will eat more red meat, chicken, and fish. According to Sahel Capital (2015), based on OECD data, Nigeria's poultry meat consumption per capita in 2014 was about 1.41kg (Our calculations from LSMS survey data put this at about 2kg in 2010). This compares to about 7kg in Ghana, over 30kg in South Africa, and over 40kg in the USA. Additionally, consumption patterns are not homogeneous across regions. Indeed, a look at the LSMS-ISA data reveals that the north consumes more chicken (about a third more) and (one fifth more) per person, but less eggs (one fifth less) and (two third less), compared with the South in 2010 and 2012 respectively.

The increased consumption is occurring alongside rapid urbanization and growth in the industry. The country has two avenues to respond to increased meat consumption: imports and domestic production. Nigeria enacted a ban on the import of poultry products in 2003, although anecdotal and empirical evidences indicate that it still occurs. This implies that there is a huge potential for growth of the domestic poultry sub-sector. Computations from the LSMS-ISA demonstrate that egg output grew 300% (three-fold) from 1980 to 2012, while chicken output grew 220% (2.2 times) from 1980 to 2008.

Using data from multiple sources, this paper presents some key findings from an initial exploration of this dynamic subsector. We combine data from secondary sources including the United Nations' Comtrade data, FAO data and earlier empirical studies in Nigeria to information gathered through a rapid reconnaissance of the poultry subsector in the Ibadan area in 2015 and 2016 for our descriptive analysis (Comtrade; FAOSTAT; LSMS-ISA). This is supported by an empirical analysis using a nationally representative panel dataset on agricultural production and household consumption in Nigeria in 2010 and 2012. We leverage on the panel structure of the LSMS-ISA data and a panel data double-hurdle model to more consistently identify key factors affecting engagement in the Nigerian subsector by various actors.

With the double hurdle model, we are able to consistently identify factors affecting the decision to participate in the subsector or not and those which affect the size of bird holding across various contexts in Nigeria. Most other studies on this topic in Europe and USA are outdated while the majority of studies in developing countries use cross sectional data. This is the first paper we are aware of to conduct such a thorough analysis of participation in the poultry subsector with panel data methods generally, more so in the developing country context, and particularly in Nigeria.
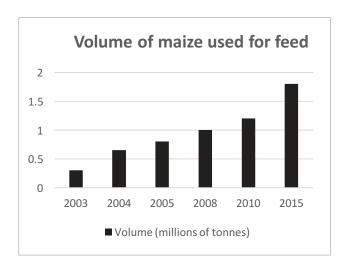
The paper proceeds as follows: Sections 2 presents some key characteristics of the Nigerian poultry subsector. These include trends in production and consumption of poultry products as well as the location and demographic structure of various actors in the subsector across regions of the country. Section 3 presents the conceptual model and empirical analysis used to identify the factors affecting the decision to participate (and extent of participation, conditional on entry) in the subsector. This is followed by a discussion of the results of the empirical analysis in section 4. Section 5 summarizes the article's main findings and consequent policy implications.
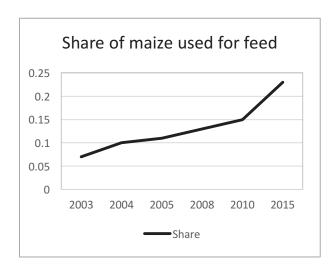
The Nigerian Poultry Sub-sector
The domestic poultry subsector in Nigeria is experiencing a dynamic growth and transformation. In just one decade, the volume of feed used in Nigeria increased by 600% from 300 thousand to 1.8 million tons (see figure 1). It is driven both by massive investments in large feed mills such as Chi Farms and Zartech in southwest Nigeria and in a growing number of small- and medium enterprises dispersed in chicken production areas (CAC, 2016). Most of the maize (a key ingredient in feed) is produced in the north but serves feed mills across the entire nation.

The North Has a Larger Share of Small Farmers' Holdings Compared to the South and Poultry Farming Is a Rural/Peri-Urban Activity: Though population shares of the six geopolitical zones in the country are roughly similar, the study shows that the north has about 60% of the small farmers' chicken holdings versus 40% in the south. This was surprising given the conventional wisdom that the majority of chicken production in Nigeria is in the southwest and the idea that as the north is poorer, it would have far lower holdings of chickens. However, we do find that the majority of the medium- and large-scale farms (which appear to be growing rapidly—see Figure 2) are largely in southwest Nigeria.

In the South, both Consumption and Production Are Relatively Spatially Concentrated in Urban and Peri-Urban Center: The study finds evidence that both consumption and production are relatively spatially concentrated toward the big demand magnets of the urban and peri-urban areas in the south. In particular, the share of chicken holdings plummet as one moves from near the town (at 40%) to about 25% far from the town. In contrast, the direction of this differentiation is reversed in the north-increasing from a share of total holdings of 27% near the town to about 40% far from the town.

Volume of maize used for feed

Share of maize used for feed

Figure 1. Maize use for feed in Nigeria
Source: Authors-generated from United States Department of Agriculture (USDA).

Figure 2: Cumulative number of registered poultry farms in Nigeria over time
Source: Authors' generated from the Nigerian (CAC, 2016) list of registered poultry farms in Nigeria.

Note: Farms still undergoing registration are excluded. Note: The study relies on data available from the Nigerian Corporate Affairs Commission (CAC) to show that medium/large poultry farms had a brief emergence in the 1980s and stagnated for the 1990s and 2000s at about 400 farms. Then, around 2008, there was at first a gradual, and then from 2010, a steep take-off of farms to reach about 1,000 by 2015.

While Adults between 35 and 60 Are the Most Active, the Involvement of Young Adults (24-35) is worthy of Attention: Across Nigeria, adults between ages of 35 and 60 are the most active age group in poultry farming. However, young adults (24-35) are quite active, accounting for between 15% and 20% of bird owners across both years in the north. As an aside note, the second most active age group in the south are those 60 years and over. The share of this age group engaged in poultry production in the south is almost double that of their northern counterparts. This indicates that poultry farming may be an attractive retirement activity in the south.

Female Participation in the Poultry Sector Is Substantial: More than 50% of the households engaged in poultry farming in the south are headed by female; much higher than in the north. However, an important observation is that a significant proportion (50% or more) of smallholder female poultry farmers in Nigeria are not the heads of household and this is more pronounced in the northern part of the country where between about 60% and 90% of the female poultry farmers are not the heads of household.

Conceptual Framework and Empirical Analysis
This section supplements the descriptive analysis above with an empirical analysis of the determinants of engagement in poultry production in Nigeria. Most studies looking at factors affecting farmer engagement in the poultry subsector in the USA are outdated (Cromarty, 1959; Gerra, 1959; Heady and Hayami, 1962; Van de Wetering, 1964). The majority of those in developing countries including Nigeria tend to use cross sectional data or case studies (Abeykoon, Weerahewa and Silva, 2013; Aklilu *et al*., 2008; Alem, Yayneshet and Aklilu, 2014; Ayoyinka, 2012; Bett, Peters and Bokelmann, 2011; Birol *et al.*, 2010; Bukunmi and Yusuf, 2015; Emaikwu, 2011; Mailu *et al*., 2012; Masuku, 2011; Mtileni *et al.*, 2012; Ohajianya *et al*., 2013; Oladeebo and Ojo, 2012; Sodjinou, 2011; Takashi and Kazunobu, 2010; Tijjani *et al*., 2012). Thus, this is the first study we are aware of to make use of current panel data methods to more consistently identify the factors likely to affect a household's engagement in poultry production. It is the first to do this generally but more so in a developing country context, and particularly for Nigeria.

We model farmers' behavior using the traditional agricultural household model of Singh, Squire, and Strauss (1986). Households can be shown to make consumption and production decisions (including crop and livestock choices) as part of the solution to a constrained utility maximization problem given household resource constraints and prevailing prices.

Consequently, we can express the output supply function for the household as:

$$Q_{it} = f(P_{kt}, \boldsymbol{P_{at}}, \boldsymbol{Z_{it}}, \boldsymbol{K_{it}}) \tag{1}$$

Where Q_{it} refers to the quantity of chicken supplied to the market by household i in time t. P_{kt} refers to the price of chicken in Naira per chicken in time t, P_{at} is a vector of input prices in time t (including maize which is a key ingredient in chicken feed), $\boldsymbol{Z_{it}}$ is a vector of controls that are likely to affect the quantity of chicken produced such as household characteristics and production conditions. $\boldsymbol{K_{it}}$ is a vector of household income and asset endowment in time t.

The population model that we estimate follows the unobserved effects model in Wooldridge (2010). For a random draw in the cross section for observation i we estimate the following equation:

$$Y_{it} = \boldsymbol{X_{it}\beta} + v_{it}, \quad t = 1, \dots, T \tag{2}$$
$$v_{it} = c_i + u_{it} \tag{3}$$

where Y_{it} represents the total number of bird holdings in household i in time t. $\boldsymbol{X_{it}}$ represents a vector of observable explanatory variables that affect household's decision to engage in the poultry subsector such as the market price for chickens and other household specific factors. The error term v_{it} is composed of two parts; unobserved heterogeneity (c_i), which reflects time invariant factors such as household preferences and ability that affect individual's production decisions and u_{it}, which are the unobserved time-varying shocks affecting poultry production, while $\boldsymbol{\beta}$ is a vector of parameters to be estimated.

It is highly probable that these time invariant unobserved characteristics (c_i) are correlated with some of the observed variables included as explanatory variables in our model. For example, an unobserved characteristic such as farmer's ability or social network likely affects their access to extension services (an explanatory variable for livestock production) as well as their productivity and extent of engagement in poultry production. As such, we need to allow for "arbitrary correlation between the unobserved effect, c_i and the observed explanatory variables $\boldsymbol{X_{it}}$" (Wooldridge, 2010). If we use ordinary least squares (OLS) estimation method to find the determinants of production in (2), the estimated parameters would be inconsistent. A fixed effects (FE) estimation method, or a Correlated Random Effects (CRE) estimation method can be used to correct for such endogeneity introduced by the time invariant characteristics (Wooldridge, 2010). The FE estimation ensures consistency of the estimated parameters by controlling for unobserved characteristics within a household in a given year.

One disadvantage of the FE estimation is that we cannot recover the coefficient on key time invariant observable characteristics that explain production decisions such as farmer geographic location or cultural preferences. Furthermore FE with non-linear models are known to produce inconsistent estimates as they treat the unobserved effects c_i as N parameters to estimate, leading to the incidental parameters problem (for fixed T). However, CRE models deal effectively with time invariant unobserved heterogeneity in both linear and non-linear panel data method and allow us to recover the coefficient of time invariant characteristics. Furthermore, Wooldridge (2010) argues that the CRE estimation is preferred over the FE estimation in the case of nonlinear models generally. We adopt the CRE method since it allows us to deal effectively with unobserved time invariant factors and estimate coefficients on time invariant observed variables (Wooldridge, 2010).

Another challenge associated with estimating the extent of engagement in poultry production is that a significant number of the households in Nigeria do not have any bird holdings. While a Heckman selection approach might be considered appropriate in this context where many households report owning zero chicken, the Heckman approach is intended for situations where

the zero chicken holdings are unobserved values, such as in the case of wage rate models where the sample includes unemployed persons. In this situation, a corner solution model is more appropriate than a selection model since the opportunity to own chickens is open to all but likely due to market and agronomic conditions, many households choose not to hold any birds. Thus the zeros in the data reflect households' optimal choice rather than a missing value. Therefore this paper uses the Double Hurdle (DH) model proposed by Cragg (1971) to address situations such as ours with a corner solution.

Consequently, we model hurdle 1 to capture the factors that affect a farmer's decision to engage in poultry production or not and if he or she decides to produce chicken, hurdle 2 considers the number of birds held. The maximum likelihood estimator (MLE) in the first hurdle can be obtained using a probit estimator. Then the MLE for hurdle 2 can be estimated from a truncated normal regression. We apply this within the context of panel data to get consistent parameters. Consequently, the first hurdle is estimated using the CRE Probit model. Each regression equation includes a set of explanatory variables as well as the time averages of the explanatory variables. The second stage is estimated using a CRE truncated normal regression where the time variables of all explanatory variables are also included as additional controls in the second stage regressions.

Results and Discussion

The descriptive statistics of the key study variables in **Error! Reference source not found.** reveal clear regional differences. First there is an extremely low share of female headed households (about 5%) in Northern Nigeria compared to the South (about 25%). Not surprisingly, very few households in Nigeria are headed by youth between the ages of 15-24. However, while there are about 20% of household heads in the North between the ages of 25-35 (young adults), less than 10% of household heads in the South are in this age group. Majority of household heads in the South are over 35 (with significant shares between those 35-59 years and those 60 years and older) while majority of household heads in the North are between 35 and 59. Landholdings are largest in the North east and South west (about 1.5 hectares) but extremely low in the South east (less than 0.3 hectares). On the other hand, household physical and human assets (captured by formal education of the household head and the value of household assets) are significantly higher in South west and South south Nigeria. Across the two waves the share of the population that is into poultry production in Northern zones are consistently higher than in the Southern zones while in terms of the average number of birds, the Southern zones control higher number of birds especially in the year 2012.

The empirical results in Table 2 are largely consistent with the results in the descriptive analysis. Given the active participation of household members besides the head in the poultry sub-sector, we supplement an empirical analysis at the household level with an additional analysis of the determinants of the extent of engagement in poultry production in Nigeria at the *individual level*. Households headed by young adults (25-34) and adults between 35 and 60 are more likely to engage in poultry farming compared to those in 15-24 years old range. This indicates that there is active participation among young adults in poultry production in this region. With increasing concerns about youth unemployment and the need to encourage the younger generation to engage in agriculture, these results indicate that the livestock sub-sector might be an avenue for promoting such engagement. An effort to understand the challenges faced by this specific group of actors in the sub-sector is thus, necessary to develop appropriate programs.

While female-headed households might be less likely to engage in poultry production, women as a whole are more likely to be engaged in the poultry sub-sector in Nigeria. Similarly, retired household members 60 years and above (not necessarily household heads) are more likely to be engaged in the sub-sector. The empirical results reveal significant differences between the determinants of engagement and extent of poultry production, in the north versus the south. For example, in northern Nigeria, while females are not significantly less likely to engage in poultry production compared to male-headed households, conditional on engaging in poultry production, they tend to hold significantly fewer birds. This indicates that while there might not be barriers to entry along gender lines, women likely face differential opportunities to grow their bird holdings, worthy of further exploration

Conclusion and Policy Implications

This article used data from multiple sources to show dynamic growth and transformation taking place in the Nigerian poultry subsector. Our key findings are as follows:

- Increased consumption of poultry products in Nigeria is occurring alongside rapid urbanization and growth in the industry. In just one decade, the volume of feed used in Nigeria skyrocketed from 300 thousand to 1.8 million tons – a 600% climb. Most of the maize (a key ingredient in feed) is produced in the North but serves feed mills across the entire nation. The long North to South supply chain for feed is a benefit and opportunity for the North and a boon for the South that warrants further attention. Weather (short term shocks and long term climate change), fuel shortages, transport costs, and socio-political disruptions make a long supply chain from North to South vulnerable without adequate efforts to improve its resilience.

- Though population shares of the six geopolitical zones in the country are roughly similar, we see that the North has about 60% of the small farmers' chicken holdings versus 40% in the South. This implies that programs to help small chicken producers are at least as important in the North as in the South. Appropriate policies within the subsector could play a significant role in improved welfare of households in the North as well as the South which tends to get more attention as far as poultry production is concerned, possibly because medium/large operations cluster there.

- In the South, we find evidence that both consumption and production are relatively spatially concentrated toward the big demand magnets of the urban and peri-urban areas. This implies that the boom in egg demand as incomes rise and urbanization proceeds is best availed where there is significant investment in rural infrastructure, probably especially rural feeder roads.

- While adults between 35 and 60 are the most active age group in poultry farming in Nigeria, young adults (25-35) are quite active, accounting for between 15% and 20% of bird owners across both years in the north. This implies that the subsector is attractive for this age group and particular efforts to understand their challenges within the sector might increase their participation and contribute to addressing issues of youth unemployment.

- The empirical results confirm active engagement in the Nigerian poultry sub sector by a much broader set of actors than traditionally perceived. This calls for a more nuanced approach to supporting the sectors growth. Further analysis to understand the differential factors affecting the success is also relevant to develop appropriate strategies to support the subsector.

- Our analysis also confirms that there is a huge data gap in available field survey data on the poultry value chain in Nigeria. There is huge variation in the apparent organization and likely structure, conduct and performance of the poultry value chain in northern and southern Nigeria. However, there is limited information about the behavior of actors all along the value chain. Reliable policy analysis requires the collection of more data as the current data is very limited with numerous inconsistencies. Consequently, next steps include the design and implementation of "stacked surveys" where data will be systematically collected from representative samples along all the segments of the chicken and eggs value chains in Nigeria. This will enable rigorous policy analysis to be conducted at each node with due attention paid to interactions within and across nodes.

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Table 1: Descriptive statistics of key variables in Nigeria using LSMS-ISA data (by years across geopolitical zones)

Household level variables

	Mean											
	2010						**2012**					
	North central	North east	North west	South east	South south	South west	North central	North east	North west	South east	South south	South west
Female household head (0/1)	0.11	0.04	0.03	0.3	0.23	0.21	0.12	0.04	0.02	0.33	0.22	0.19
Age 15-24 (0/1)	0.02	0.02	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0	0.01	0.01
Age 25-34 (0/1)	0.16	0.21	0.17	0.09	0.15	0.14	0.14	0.14	0.11	0.06	0.09	0.09
Age 35-59 (0/1)	0.63	0.6	0.64	0.51	0.58	0.53	0.57	0.59	0.65	0.45	0.55	0.41
Age 60 plus (0/1)	0.19	0.17	0.17	0.4	0.25	0.3	0.29	0.26	0.23	0.48	0.36	0.49
Household land size (hectares)	1.11	1.44	0.67	0.15	0.65	1.03	1.08	1.49	0.81	0.21	0.77	1.42
Household engagement in Non-farm employment (0/1)	0.69	0.74	0.82	0.61	0.8	0.83	0.71	0.7	0.77	0.66	0.82	0.86
Household Assets (0000 Naira)	9.03	9.34	7.01	7.95	12.1	10.18	10.59	8.97	7.51	9.34	12.64	11.67
Household size (number of individuals)	5.8	6.82	6.5	4.58	5.15	4.17	5.88	7.33	6.96	4.74	5.18	4.12
Household Distance to Nearest Market (00 Km)	0.99	0.68	0.6	0.43	0.63	0.69	0.99	0.69	0.59	0.43	0.62	0.7
Household head has formal education (0/1)	0.56	0.5	0.62	0.62	0.72	0.73	0.54	0.51	0.59	0.58	0.69	0.67
Household head has taken a loan (0/1)	0.37	0.3	0.33	0.26	0.34	0.22	0.34	0.27	0.29	0.35	0.27	0.24
Household head is married (0/1)	0.83	0.9	0.94	0.65	0.72	0.73	0.8	0.84	0.93	0.59	0.66	0.66

	North central	North east	North west	South east	South south	South west	North central	North east	North west	South east	South south	South west
Household received advice through extension services or on animal care	0.07	0.07	0.18	0.06	0.01	0.02	0.07	0.04	0.14	0.01	0.03	0.02
Average number of birds held (unconditional)	22.58	19.03	12.74	16.12	15.13	17.5	17.07	15.93	15.23	12.92	8.07	13.51
Average number of birds held (conditional)	28.57	29.39	23.48	18.85	18.72	22.29	26.29	28.61	25.58	21.28	24.62	30.84
Share of households engaged in poultry production	0.46	0.48	0.41	0.47	0.23	0.13	0.44	0.47	0.49	0.44	0.18	0.15

Individual level variables

	2010						2012					
	North central	North east	North west	South east	South south	South west	North central	North east	North west	South east	South south	South west
Female member (0/1)	0.3	0.19	0.27	0.53	0.48	0.42	0.14	0.04	0.06	0.35	0.18	0.22
Age 15-24 (0/1)	0.06	0.05	0.07	0.02	0.04	0.03	0.01	0.02	0.01	0	0	0.01
Age 25-34 (0/1)	0.17	0.2	0.2	0.09	0.14	0.1	0.11	0.13	0.12	0.04	0.03	0.03
Age 35-59 (0/1)	0.57	0.52	0.59	0.52	0.57	0.63	0.5	0.51	0.6	0.33	0.26	0.33
Age 60 plus (0/1)	0.2	0.24	0.14	0.36	0.25	0.25	0.39	0.34	0.27	0.63	0.7	0.64
Average number of birds held (unconditional)	17.33	13.52	9.404	12.58	12.03	15.4	14.48	11.29	10.1	9.789	6.895	12.6
Average number of birds held (conditional)	23.84	24.85	20.4	16.33	15.58	20.73	24.28	25.22	22.84	19.61	24.39	33.32

Source: Authors' estimations from the LSMS-ISA data.

Table 2: Double hurdle estimation results (household and individual level)

	Double hurdle model (Household level)				Double hurdle model (Individual level)			
	Hurdle 1 (Probability of participation in poultry production)		Hurdle 2 (Supply of Birds, conditional on participation)		Hurdle 1 (Probability of participation in poultry production)		Hurdle 2 (Supply of Birds, conditional on participation)	
	North	South	North	South	North	South	North	South
	APE	APE	APE	APE	APE	APE	APE	APE
Female household head (0/1)	-0.030	-0.326**	-17.636***	5.089	0.300***	0.166	11.275	-6.792
	(0.143)	(0.135)	(5.915)	(15.576)	(0.101)	(0.124)	(9.723)	(10.646)
Age 15-24 (reference group of household head)								
Age 25-34	-0.102	0.483**	-14.236	-12.747	0.032	0.343***	2.685	-11.190
	(0.071)	(0.235)	(13.049)	(33.640)	(0.058)	(0.107)	(2.817)	(7.330)
Age 35-59	-0.112	0.428*	-15.339	-15.976	0.027	0.305***	1.091	-8.212
	(0.072)	(0.238)	(13.570)	(30.337)	(0.062)	(0.113)	(2.979)	(6.667)
Age 60 plus	-0.124	0.354	-15.841	-14.540	0.003	0.269**	-0.865	-5.271
	(0.087)	(0.250)	(14.019)	(27.196)	(0.082)	(0.133)	(4.064)	(6.663)
Household member is household head (0/1)					0.132	-0.179*	15.173**	14.948
					(0.100)	(0.106)	(6.319)	(11.115)
Household head is married (0/1)	-0.065	-0.129	-6.348	6.370	-0.069	-0.100	-10.752***	18.287**
	(0.101)	(0.094)	(4.820)	(6.421)	(0.081)	(0.107)	(3.584)	(7.582)
Household received visit of extension services or advice on animal care	-0.047	0.143	3.095	-1.078	-0.041	0.186**	4.005	-9.930
	(0.044)	(0.088)	(3.526)	(7.809)	(0.048)	(0.093)	(3.039)	(9.305)
Household head has taken a loan (0/1)	0.053*	-0.054	-0.248	-1.832	0.043	-0.040	-0.117	-1.345
	(0.029)	(0.042)	(2.833)	(3.767)	(0.031)	(0.045)	(1.879)	(4.035)
Household land size(hectares)	-0.007	0.024	2.579**	2.323	0.023	0.011	2.632**	3.274
	(0.018)	(0.039)	(1.231)	(2.629)	(0.018)	(0.044)	(1.142)	(3.825)
Household engagement in Non-farm employment (0/1)	0.053	-0.052	-0.883	2.625	0.033	0.031	0.810	-2.795
	(0.035)	(0.052)	(3.576)	(3.151)	(0.037)	(0.048)	(2.305)	(3.289)
Household Assets (0000 Naira)	0.002	0.001	0.227	0.377***	0.003	-0.001	0.236	0.558***
	(0.002)	(0.002)	(0.160)	(0.133)	(0.002)	(0.003)	(0.161)	(0.204)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Household size (number of individuals)	-0.003	0.003	0.364	1.674	-0.028*	0.008	0.276	1.694
	(0.016)	(0.019)	(0.929)	(1.035)	(0.016)	(0.021)	(1.282)	(1.345)
Household Distance to Nearest Market (00 Km)	0.339	0.679	-2.794	-4.042	-0.665	0.439	-2.467	9.788
	(0.323)	(0.451)	(27.014)	(36.703)	(0.580)	(0.415)	(33.282)	(25.404)
Household head has formal education (0/1)	0.046	-0.044	-0.850	2.007	0.032	-0.032	-1.791	7.269*
	(0.035)	(0.062)	(3.089)	(4.270)	(0.035)	(0.059)	(2.062)	(3.751)
Price of chicken (00 Naira)	-0.014	0.003	1.022	1.480*	-0.004	0.005	1.239	1.743*
	(0.010)	(0.012)	(1.017)	(0.760)	(0.012)	(0.013)	(0.769)	(0.960)
Urban (0/1)	-0.035	-0.075**	-6.216**	2.605	-0.032	-0.063*	-5.453**	5.534
	(0.044)	(0.034)	(3.095)	(5.543)	(0.042)	(0.035)	(2.257)	(3.714)
2010	-0.047*	-0.022	1.853	0.207	-0.008	0.062**	2.326	-4.626**
	(0.024)	(0.032)	(2.677)	(1.895)	(0.026)	(0.030)	(1.439)	(2.130)
North east	-0.183***		1.685		-0.166***		2.942	
	(0.027)		(8.120)		(0.029)		(4.880)	
North west	-0.191***		-1.175		-0.221***		1.535	
	(0.029)		(8.772)		(0.031)		(6.661)	
South south		-0.041		-2.677		0.012		-4.293*
		(0.036)		(3.123)		(0.038)		(2.511)
South west		-0.137***		3.153		0.013		1.089
		(0.052)		(7.311)		(0.048)		(2.554)
CRE controls included	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,815	1,408	1,941	1,146	3,153	1,506	1,895	1,118
Overall F stat	3.64		3.64	2.73			4.65	3.24

Source: Authors' estimations from the LSMS-ISA data.   *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: The variables female, receiving formal education, marital status, taking a loan are for the member of the household for the individual level results