AGRICULTURAL COMMERCIALISATION PATHWAYS, INPUT USE, AND CROP PRODUCTIVITY: EVIDENCE FROM SMALLHOLDER FARMERS IN ZIMBABWE

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ACRONYMS

APRA	Agricultural Policy Research in Africa
FTLRP	Fast Track Land Reform Programme
GDN	Global Development Network
HCI	household commercialisation index
HNP	Health, Nutrition and Population
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
ML	maximum likelihood
PCA	principal components analysis
PLAAS	Institute for Poverty, Land and Agrarian Studies
TLU	tropical livestock unit

ABSTRACT

Agricultural commercialisation is increasingly seen as an effective instrument for transforming smallholder production systems and thus increasing the smallholder farmer's incomes, food security, and other welfare outcomes such as women's empowerment and rural poverty reduction. However, there is a paucity of studies explaining the different pathways of agricultural commercialisation that different types of farmers can pursue, and how the choice of pathway will influence input utilisation and crop productivity. This paper focuses on explaining how two commercialisation pathways, evident among smallholder farmers in Zimbabwe, influences levels of crop input utilisation and general crop productivity.

A household commercialisation index (HCI) was used to explore how levels of commercialisation differed among farmers on the two pathways. A Probit econometric model was also used to identify factors influencing the likelihood of households in pursuing different commercialisation pathways. A sample of 647 households was randomly drawn from smallholder farmers in Mvurwi and Concession areas of Mazowe District. The results from descriptive analyses showed that input-use intensity (inorganic fertiliser, improved seeds, hired labour, and agro-chemicals) was higher among households pursuing tobacco-based commercialisation than those on the food-based commercialisation pathway. Our results also showed that maize yields were significantly higher on the tobacco-based pathway compared to food-based commercialisation, suggesting some potential spillover effects where maize benefits from the tobacco crop.

Results from the Probit regression analysis revealed that household size and overall wealth levels, as well as access to hired labour and inorganic fertilisers increases the likelihood of pursuing tobacco-based commercialisation. We also noted that the availability of firms offering contractual arrangements to farmers could also be crucial in overcoming the barriers to entry into the capital-intensive tobacco value chain and thus encourage smallholder farmers to pursue tobacco-based agricultural commercialisation.

On the other hand, households that are female-headed, and those with access to non-farm income and tractor tillage services, are more likely to pursue a food-based commercialisation pathway. These results imply that understanding the agricultural commercialisation question requires a greater appreciation of the local social dynamics and broad livelihood context shaping both the incentives and general ambivalence towards agricultural commercialisation.

Keywords: smallholder, commercialisation pathways, household commercialisation index, probit model, Zimbabwe.

1 INTRODUCTION

There is growing empirical evidence that achieving productivity growth in African agriculture require a progressive shift of the semi-subsistence production patterns that epitomise smallholder farming systems. Given that most of the population in sub-Saharan Africa still reside in rural areas and engage in primarily agricultural production for their incomes (Barrett 2008; Barrett *et al*. 2017; Beegle *et al*. 2016; Davis, Di Giuseppe and Zezza 2014), agricultural commercialisation would be a potent instrument for achieving smallholder-led growth, poverty reduction, and inclusive transformation of rural communities (IFAD 2016; Jaleta, Gebremedhin and Hoekstra 2009; Kirsten *et al*. 2013; Muriithi and Matz 2015; Pingali and Rosegrant 1995).

There is vast empirical literature documenting the impacts of agricultural commercialisation on various livelihoods and welfare outcomes (Abdullah *et al*. 2019; Carletto, Corral and Guelfi 2017; Govereh and Jayne 2003; Muriithi and Matz 2015; Ogutu and Qaim 2019; Poulton, Kydd and Dorward 2006), as well as its key drivers (Jaleta *et al*. 2009; Pender and Alemu 2007; Pingali and Rosegrant 1995). High-valued cash crops represent one potential strategy for crop intensification and agricultural commercialisation in general. However, the effects of shifting to more commercially-oriented crops on household production behaviour, productivity outcomes, and food security are complex and debate remains as to whether there are trade-offs or synergies between cash crop production and food crop productivity.

Over the years, tobacco production has become central to the patterns of agricultural commercialisation by smallholder farmers in Zimbabwe (Scoones *et al*. 2018). The case for promoting export-oriented cash crops such as tobacco in smallholder farming systems has generally been based on their direct contribution to household incomes. Comparisons of financial costs and returns to production have shown that tobacco is a highly profitable cash crop for both large- and small-scale farmers, compared to the main alternative traditional and non-traditional crops (Keyser 2002). Among smallholder A1[1] farmers in Zimbabwe, the relatively steady incomes from tobacco sales have been seen as key to alleviating liquidity constraints especially when farmers have access to contract farming arrangements (Scoones *et al*. 2018). Tobacco incomes can also be reinvested in other high-value crops, including horticultural exports, particularly when farmers have access to irrigation infrastructure and appropriate marketing arrangements.

However, relatively little research exists on the synergistic effects of cash crops such as tobacco on food production and hence household food security. Policymakers are increasingly interested in the interaction between food and cash crop productivity, as epitomised by the resurgence of the food versus cash debate. This interaction, however, has largely been deemed to be rife with trade-offs, with a general view that cash crops compete with food crops for land and other critical resources such as labour. However, this conventional view tends to neglect the potential role tobacco can play in financing inputs needed for improved management of key smallholder crops such as maize and other food crops (Govereh and Jayne 2003).

However, cash crop production is generally capital-intensive and crops such as tobacco have proven to be expensive to grow, with high upfront costs and high labour requirements (Keyser 2002). The high costs of production present considerable barriers to resource-constrained smallholder farmers and most of them tend to allocate only small portions of their land to tobacco production alongside other food crops, as part of their household food security strategy. There are persistent fears that without efficiently functioning food markets, commercialisation through non-food cash crops may expose smallholder households to food insecurity risks (Strasberg *et al*. 1999). Besides the food security concerns, it can also be argued that a combination of lack of production experience and capital among smallholder farmers, particularly the beneficiaries of the Fast Track Land Reform Programme (FTLRP), explains the tendency to shift production patterns to crops such as maize that are relatively easy to produce, and away from knowledge and technology-intensive enterprises such as tobacco and specialised horticultural crops (Cliffe *et al*. 2011; Mano, Sukume and Rugube 2003; Moyo 2004). Therefore, while there is a financial

incentive for smallholder farmers to grow tobacco, there is also a need to more fully understand whether the necessary conditions exist to support the intensive production of the crop, which will guide appropriate agricultural policy interventions.

Against this background, this study seeks to investigate the implications of tobacco-led agricultural commercialisation on input use and crop productivity among smallholder A1 farmers in the Mvurwi and Concession areas of Mazowe District. Within A1 farming, we hypothesise two potential commercialisation pathways. Firstly, farmers with the requisite farming experience and who have access to capital and other key resources are likely to venture into tobacco production. However, out of food security concerns and as a strategy to lessen their dependence on tobacco, we expect these households to also cultivate food crops and other cash crops. We are calling this first group the tobacco-led commercialisation pathway.

The second group of farmers are those who are mostly into food crop production, but still cultivate some cash crops to support their household income requirements. However, these are not into tobacco production, and are classified as the food-based commercialisation pathway. We then compare the levels of input-use intensity and crop productivity between these two pathways, with a view to explore whether productivity spillovers exist between tobacco-led agricultural commercialisation and food crop production. Given the emergence of tobacco as a key avenue for achieving agricultural commercialisation among A1 farmers, we also investigate factors that are likely to influence participation in tobacco-led commercialisation pathways.

To our knowledge, there is a general paucity of studies adopting this approach to investigating agricultural commercialisation among smallholder farmers. Related studies examined agricultural productivity and input use among A1 farmers against a control group of communal farmers (Chamunorwa 2010; Zikhali 2008). These studies found that A1 farmers were more productive than their communal area counterparts and used significantly more fertiliser, and draught power per hectare (Chamunorwa 2010; Zikhali 2008). However, the biggest critique is that the A1 beneficiaries of the FTLRP have often benefited from preferential access to government input support programmes. Generally, due to the capital-intensive nature of the crop, we expected households embarking on the tobacco-based pathway to utilise more inputs per hectare and generally record higher productivity.

As a result, we further examine factors that are likely to influence households' participation in tobacco-based commercialisation pathways.

The rest of the paper is organised as follows: Section 2 describes the conceptual framework motivating and theoretical underpinnings guiding our study objectives. Section 3 provides details about the household survey data and empirical methods. Section 4 presents the key empirical results and discusses the differences between food-based and tobacco-based commercialisation pathways vis-à-vis crop production and productivity, input use, and overall levels of commercialisation at household level. Lastly, Section 5 concludes with key insights from the study.

2 MEASURING AGRICULTURAL COMMERCIALISATION

The concept of agricultural commercialisation can be complex, as demonstrated by the diversity of definitions and a wide variety of metrics for its measurement. However, there is a general consensus that agricultural commercialisation involves the progressive shifting from semi-subsistence agriculture to production primarily for the market (Poulton and Chinsinga 2018; von Braun 1995), changing land use from low-value commodities to those that receive higher market prices (Pretty, Toulmin and Williams 2011), as well as increasingly relying on the market for the acquisition of production inputs, including labour (Leavy and Poulton 2007). This definition also encompasses the food crops, as commercialising households can market greater proportions of their food crops in response to market signals (Jaleta *et al.* 2009). Through commercialisation, farmers will progressively shift away from subsistence-oriented production that is aimed at meeting subsistence requirements, to market-oriented production decisions that are driven by market signals and comparative advantage (Jaleta *et al.* 2009).

Several indicators have been developed to try and measure the extent of household commercialisation (von Braun 1995). These measures allow researchers to make comparisons across different household typologies and are often used in econometric studies that seek to identify key drivers of agricultural commercialisation at household level. While there is no universal standard for measuring the degree of household commercialisation, the most frequently used measure is the household commercialisation index (HCI), computed as the ratio of the gross value of all crop sales to the gross value of all crop production (Govereh, Jayne and Nyoro 1999; Ochieng *et al.* 2016; Strasberg *et al.* 1999). Following Cameron and Trivedi (2009), the model is specified as follows:

$$HCI = \frac{\text{Gross value of all crop sales}}{\text{Gross value of all crop production}} \times 100$$

The HCI index represents the process of commercialisation as a continuum ranging from total subsistence (HCI = 0) to completely commercialised production systems (HCI = 100) (Carletto *et al.* 2017; Leavy and Poulton 2007). A total of five crops (maize, tobacco, groundnuts, common beans, and soya beans)

were considered in the calculation of the HCI. These were the common crops grown across the households in the two areas. Maize was grown by 98 per cent of the households while tobacco was grown by 68 per cent. Soya bean was cultivated by 32 per cent of the households and groundnuts by 28 per cent. Common beans were the least popular among the five crops and was grown by 16 per cent of the households sampled.

3 METHODS AND DATA

3.1 Data and sample

The data is from a randomly selected sample of 647 households drawn from smallholder farmers in the Mvurwi and Concession areas of Mazowe District in Zimbabwe. These smallholder farmers are A1 resettlement farmers who were beneficiaries of the country's fast track land reform programme. Under the land reform programme, each household was allocated about five hectares of land to pursue agricultural livelihoods. Prior to 2000, the Mvurwi study area was occupied by large-scale, mainly white commercial farmers involved in mixed farming activities. However, after 2000, most of the study area farms were acquired and subdivided into small (about 5ha) to medium scale (30 to 100ha) units. Most farmers initially, particularly prior to 2007, engaged in maize production for sale to traders in the nearby towns of Mvurwi and Concession.

The A1 smallholder resettlement areas have been a focus for agricultural commercialisation over the past 17 years. Since 2007, there has been rapid growth in tobacco production as the dominant commercial crop among the resettled farmers. This has occurred through engagement with various marketing arrangements, including through contract farming and direct sales via auction floors (Scoones *et al*. 2018). While tobacco has remained central to the patterns of commercialisation, farmers also engage in other value chains such as maize, soybeans, and horticultural crops.

Mvurwi has seen increased participation of smallholder farmers in tobacco production engaging in non-food crop commercialisation while in Concession, maize cultivation for food and sale still plays a dominant role in the agricultural system. The area has high levels of participation of private-sector contracting companies, bulk traders, and aggregators (for maize and horticulture products); links to auction markets (for tobacco); and spot markets locally (for horticulture and maize). There is increased competition among traders and contracting companies, and we expect a greater number of households engaging with various markets. The study uses plot-level data from 647 sampled households.

3.2 Empirical model

The second aspect of our empirical approach involves analysing the factors that affect the probability of participation in the tobacco-based commercialisation pathways. Given that our dependent variable is binary, assuming the value of 1 if the household participates in the tobacco-based pathway and 0 otherwise, we used the Probit model to identify determinants of the probability of participation since the predicted probabilities lie between 0 and 1 (Cameron and Trivedi 2009). Following Cameron and Trivedi (2009), the Probit model is estimated using maximum likelihood (ML) and can be computed from the standard normal cumulative distribution function as follows:

$$\Pr(y = 1|x) = \Phi\left(x^{'}\beta\right) = \int_{-\infty}^{x^{'}\beta} \phi(z)dz$$

Pr(y = 1|x) is the probability that an individual household participates in tobacco-based commercialisation pathway given x, which is a K x 1 regressor vector of explanatory variables hypothesised to affect households' decision to participate in the tobacco-based pathway. Y is a binary dependent variable which takes on the value of 1 if the household participates in the tobacco-based pathway and 0 otherwise, and is a vector of unknown parameters. The independent variables that were used in the model are given in Table 3.1 and the choice of variables was guided by the literature and related empirical studies.

Participation in the tobacco-based commercialisation pathway is likely to be influenced by the production characteristics of the tobacco crop. The crop is generally labour-intensive and attracts a significant labour demand. It also requires a considerable degree of managerial expertise during specific operations such as curing, sorting, and grading (Scoones *et al*. 2019). The crop is also capital-intensive, requiring considerable investments in capital inputs and infrastructure, which often represent significant barriers to entry for the relatively inexperienced and resource-constrained smallholder farmers. Smallholder farmers often lacked their stocks of farm equipment and productive infrastructure such as grading shades,

tobacco barns, and irrigation facilities (Moyo 2004). The worsening economic situation, characterised by high interest rates and a shortage of foreign currency, has made it difficult for a new crop of farmers to acquire their own machinery (Mano *et al*. 2003; Moyo 2004). Because of these conditions, we hypothesise that the following variables (Table 3.1) will be important drivers of participation in tobacco-based agricultural commercialisation.

technologies and farming practices. On the other hand, more educated individuals have more career options outside of agriculture and thus may be reluctant to pursue tobacco-based commercialisation.

Our model controls for household-level variables including household size and wealth index, as well as dummy variables representing households' access to non-farm income, extension services, market

Table 3.1 Explanatory variables used in Probit model

Variables	Description	Expected signs
Household head characteristics		
Gender	Gender of the household head (1=Female, 0=Male)	-
Age	Age of the household head (years)	±
Age squared	The square of household head age	±
Education	Household head years of schooling (years)	±
Household characteristics		
Household size	Total number of household members	+
Wealth index[2]	Household wealth index	+
Non-farm income	Whether household had access to non-farm income (1=Yes, 0=No)	±
Extension access	Whether household had access to extension (1=Yes, 0=No)	+
Market information	Whether received information on markets (1=Yes, 0=No)	+
Contract farming	Whether household participated in contract farming (1=Yes, 0=No)	+
Total land size	Total household cultivatable land (hectares)	±
Crop input use and services		
Inorganic fertiliser	Whether household used inorganic fertilisers (1=Yes, 0=No)	+
Hired labour days	Total hired labour used by household (person days)	+
Tractor tillage	Whether household used tractor tillage (1=Yes, 0=No)	+
Location	Geographical location (1=Mvurwi, 0=Concession)	±

Note: +, - and ± indicates a positive, negative, or uncertain relationship with the dependent variable.
Source: Authors' own.

We hypothesise that the probability of participating in the tobacco-based commercialisation pathway depends on the personal characteristics of the household head, family characteristics, and a host of other socioeconomic factors. The key variables capturing the personal characteristics of household head are age, gender, and education. Age can have a negative or positive influence on the participation in the tobacco-based pathway; hence the relationship is hypothesised to be uncertain. Gender was measured as a dummy variable with values of 1 if female and 0 if male. Participation in the tobacco-based pathway is expected to be higher among males compared to females since males tend to have bargaining power in both input and output markets. The level of education, measured continuously as the total years of schooling, is expected to have mixed effects on participation in the tobacco-based pathway. Tobacco production tends to be knowledge-intensive; hence relatively more educated farmers would better appreciate new

information, and contract farming. Most of these household variables, except for non-farm income, were expected to have a positive impact on households' participation in tobacco-based commercialisation. The household wealth index and household size are expected to increase the likelihood of participation in a tobacco-based pathway since the former captures their productive assets while the latter can be used as a proxy for potential family labour available. Participation in a tobacco-based pathway was expected to be high among households with access to credit, market information, and contract farming.

On the other hand, access to non-farm income sources could have mixed effects on a tobacco-based commercialisation pathway. Off-farm income can be a source of capital to invest in tobacco production, while having alternative sources of livelihoods could reduce households' incentive to engage in tobacco production. The model also controls for variables

capturing access to key inputs such as inorganic fertiliser, hired labour, and tractor tillage services, all of which are expected to positively affect the likelihood of pursuing a tobacco-based commercialisation pathway (Cameron and Trivedi 2009).

4 SOCIOECONOMIC IMPLICATIONS OF THE TRADE

4.1 Descriptive results

This section presents the key descriptive aspects of our data analysis, thus identifying dominant strands and emerging commercialisation narratives across pathways. We analyse the key patterns, including land ownership and utilisation, agricultural inputs use, and hiring of labour services, participation in crop activities including the distribution of main crops, livestock ownership, crop productivity, crop and livestock incomes, ownership of key livelihood assets, and participation in agricultural input and output markets.

4.1.1 Socioeconomic characteristics of households

To get a picture of which farmers are embarking on which pathway of agricultural commercialisation, we examine the key household socioeconomic characteristics as well as their general usage of crop inputs and access to key agricultural services. Table 4.1 below summarises the demographic, socioeconomic, and production characteristics of the sampled households, across the two commercialisation pathways.

The survey findings show that the heads of the farm households were predominantly male. About 83.06 per cent of the interviewed household heads were males while 16.94 per cent were females. In the tobacco-based pathway, 87.22 per cent of the households were male-headed while 12.78 per cent were female-headed. On the other hand, about 74.36 per cent of food-based households were male-headed while 25.64 per cent were female-headed. Generally,

Table 4.1 Distribution of respondents' socioeconomic characteristics

Characteristic	Pooled sample (N=602)	Food-based (A) (N=195)	Tobacco-based (B) (N=407)	Difference (A-B)
Household head characteristics				
Gender	0.169	0.256	0.128	0.129***
Age	51.611	54.246	50.349	3.897***
Education	9.066	9.256	8.975	0.281
Household characteristics				
Household size	6.068	5.236	6.467	-1.230***
Dependency ratio	1.070	1.090	1.060	0.030
Extension access	0.857	0.851	0.860	-0.009
Market information access	0.799	0.790	0.803	-0.014
Contract farming	0.389	0.262	0.450	-0.188***
Loan access	0.070	0.092	0.059	0.0334
Wealth index	0.051	-0.388	0.261	-0.649***
Livestock ownership (TLU)	6.022	5.156	6.408	-1.252*
Non-farm income access	0.693	0.779	0.651	0.128**
Total land cultivated	4.626	4.734	4.574	0.159
Crop inputs and commercialisation				
Tractor tillage	0.586	0.656	0.553	0.104**
Inorganic fertiliser	0.965	0.908	0.993	-0.085***
Hired labour	21.498	18.995	22.698	-3.703*
Commercialisation index (HCI)	84.139	74.356	88.826	-14.470***
Crop diversification	2.409	1.933	2.636	-0.703***

Note: *** Statistical significance at the 1 per cent level; ** Statistical significance at the 5 per cent level; * Statistical significance at the 10 per cent level.
Source: Authors' own.

the proportion of female-headed households was generally higher in the food-based commercialisation pathway compared to the tobacco-based pathway, and the difference was statistically significant at the 1 per cent level. With respect to age, household heads in the food-based pathway are 3.9 years older than their counterparts in the tobacco-based pathway and the difference was statistically significant at the 1 per cent level. However, there were no differences in education levels of heads of households in the two pathways.

In terms of household characteristics, we found statistically significant differences in household size, livestock ownership (TLU), and wealth index, as well as access to non-farm income and contract farming between the two pathways. Households on a tobacco-based pathway owned more livestock (6.41 TLUs) than food-based households (5.16 TLUs) and were also generally wealthier (0.26) than their counterparts in the food-based commercialisation pathway (-0.39). Differences in wealth levels were statistically significant at the 1 per cent level while differences in livestock ownership were weakly significant at the 10 per cent level. We also observed bigger household sizes in the tobacco-based pathway compared to households in the food-based pathway, and the difference was statistically significant at the 1 per cent level. Additionally, food-based households had more access to non-farm income than those on the tobacco-based pathway, with the difference significant at the 5 per cent level. Finally, households pursuing a tobacco-based pathway engaged more in contract farming than those on the food-based pathway, indicating that access to contract farming could be an important driver for promoting tobacco-based commercialisation.

With respect to crop input use and general levels of commercialisation, we found statistically significant differences between households on food-based and those on tobacco-based pathways with respect to all five variables considered. The use of inorganic fertilisers and hired labour services was significantly higher among households on the tobacco-based pathway compared to those pursuing the food-based commercialisation pathway, with the differences statistically significant at 10 per cent and 1 per cent, respectively. However, households on the food-based pathway engaged more in tractor tillage services than their counterparts on the tobacco-based pathway, and the difference was statistically significant at 5 per cent.

Households on the tobacco-based pathway had higher levels of crop diversification, measured as the number of main crops cultivated, than those in the food-based commercialisation pathway, and the

difference was statistically significant at the 1 per cent level. Overall, the level of commercialisation was generally high across the sample, averaging 84 per cent. The household commercialisation index was higher among households on the tobacco-based pathway (88.8 per cent) compared to those pursuing food-based commercialisation (74.4 per cent) and the difference was statistically significant at the 1 per cent level. Tobacco is a high-value crop and as such attracts more income which can be used to purchase more capital inputs into the production process.

4.1.2 Crop production, productivity, and sales by commercialisation pathways

The choice of agricultural commodities that farmers produce depends on a wide variety of factors, including size of landholding, agro-ecological potential, market potential, as well as access to capital, skills, and technology. We envisage that agricultural commercialisation will bring about changes in the cropping patterns as well as the choice of marketing arrangements as farmers respond to market signals and economic incentives. The common crops in our study were maize, tobacco, groundnuts, soya beans, and sugar beans. Table 4.2 shows the distribution of the main crop production and sales across the two commercialisation pathways.

The most interesting result is that the maize crop remains the most frequently produced crop in both commercialisation pathways. Overall, 98.3 per cent of the sampled households grew maize, and there was no significant difference in the proportion of households growing maize between the food-based (97.95 per cent) and tobacco-based (98.53 per cent) pathways. The prominence of the maize crops owes to its position as the country's staple crop, and thus even farmers that have pursued a tobacco-based pathway of commercialisation are producing maize. The areas of land devoted to the maize crop are also comparable across the two commercialisation pathways.

Additionally, the proportion of maize sold is roughly the same under the two pathways; hence in both cases there is a significant amount of subsistence production, as smallholder farmers attempt to cushion themselves against the risk of relying on the market for food supplies. Overall, the average area under tobacco (1.49 hectares) is considerably smaller than that under maize (2.17 hectares). Tobacco is generally a high-value crop and therefore farmers can get high returns on the intensive margin, and thus its disrupting effects on household food security are likely to be very minimal. Another interesting result is the observation that a significantly higher proportion of households in

Table 4.2 Main crop production by commercialisation pathways

Crop	Pooled sample	Food-based	Tobacco-based
Proportion of households (%)			
Maize	98.34	97.95	98.53
Tobacco	67.61	-	100
Groundnuts	27.74	23.59	29.73
Beans	15.61	15.90	15.48
Soyabean	31.56	55.90	19.90
Average area cultivated (ha)			
Maize	2.17	2.71	1.88
Tobacco	1.49	-	1.49
Groundnuts	0.70	0.77	0.66
Beans	0.62	0.63	0.62
Soyabean	2.60	2.30	3.02
Average crop yields (kgs/ha)			
Maize	3.542	3.499	3.564
Tobacco	1.306	-	1.306
Groundnuts	1.468	1.339	1.530
Beans	880	1.036	803
Soyabean	1.712	1.760	1.644
Proportion of crop sold (%)			
Maize	62.8	68.6	59.4
Tobacco	100.0	-	100.0
Groundnuts	58.2	61.2	56.8
Beans	68.3	69.5	67.7
Soyabean	85.1	84.6	85.8

Source: Authors' own.

the food-based pathway (55.9 per cent) are growing soya beans compared to households in the tobacco-based pathway (19.9 per cent), which underscores the emerging role of soya beans as an alternative cash crop for households outside the tobacco value chain.

A comparison of maize yields across the two pathways shows that maize productivity is marginally higher along the tobacco-led commercialisation pathway compared to the maize-based pathway. There appears to be some production spillovers and synergies between tobacco-led commercialisation and food crop productivity, as participation in the tobacco value chain could enable households to acquire resources not otherwise available for use in food crop production. Similar results of complementarities between cash and non-cash/food crop production were also observed in the case of cotton production in Zimbabwe (Govereh and Jayne 2003).

Tobacco production can potentially result in increased use of fertiliser and other high-value inputs such as improved seeds, as well as more income to hire additional labour and acquire production equipment

(Govereh *et al*. 1999; Strasberg *et al*. 1999). Another interesting observation is that, considering households in the lowest quintile of wealth, soya bean yields are higher under tobacco-based commercialisation than under food-based commercialisation and the result is reversed when we look at the households in the highest wealth quintile. This could imply that resource-poor households could rely on income from tobacco production to purchase inputs and other necessary investments for soya bean production.

4.1.3 Agricultural input use and input market participation

Agricultural commercialisation is expected to alter input use and labour demand in farming systems (Strasberg *et al*. 1999). Commercialisation is often associated with increases in the degree of participation in input markets, as farmers increasingly rely on the market for the supply of their inputs such as inorganic fertiliser, improved seeds, agro-chemicals, and mechanisation services (Leavy and Poulton 2007). It is therefore important to explore the extent to which agricultural commercialisation affects input use, labour demand, and farmers' general engagement with factor markets.

Table 4.3 Proportion of households (%) using crop inputs over wealth quintiles

	Total wealth quintiles					
	1	2	3	4	5	Total
Tobacco-based						
Agro-chemicals	14.95	11.41	18.00	9.07	14.03	13.47
Organic fertiliser	16.20	9.88	14.86	11.32	13.59	13.16
Chemical fertiliser	100.00	100.00	100.00	100.00	100.00	100.00
Improved seeds (hybrids)	100.00	100.00	100.00	100.00	100.00	100.00
Mechanisation	33.62	54.38	46.36	56.58	83.10	55.64
Food-based						
Agro-chemicals	2.29	7.13	3.97	10.90	10.52	6.90
Organic fertiliser	11.65	20.19	15.92	5.95	13.46	13.26
Chemical fertiliser	98.07	100.00	95.71	100.00	97.74	98.32
Improved seeds (hybrids)	89.65	88.67	94.18	97.49	87.38	91.67
Mechanisation	39.70	44.86	63.14	81.91	84.44	63.05
Overall						
Agro-chemicals	10.46	9.96	13.06	9.73	12.89	11.19
Organic fertiliser	14.59	13.36	15.23	9.38	13.55	13.20
Chemical fertiliser	99.32	100.00	98.49	100.00	99.27	99.42
Improved seeds (hybrids)	96.33	96.17	97.95	99.09	95.91	97.11
Mechanisation	35.41	51.55	51.56	64.56	83.43	57.81

Source: Authors' own.

We examined differences in the levels of utilisation of key agricultural inputs, and how they varied across commercialisation pathways. Table 4.3 shows the utilisation of key crop inputs across the two pathways.

Generally, the use of agro-chemicals, improved seeds, and chemical fertilisers is higher in the tobacco-based commercialisation pathway than in the food-based pathway across the wealth categories. About 89.9 per cent of tobacco-based commercialisation farmers hired labour services, spending an average of US$465.14 on labour payments, while 85.3 per cent of maize-based commercialisation pathway farmers also hired labour but spent on average US$396.23. Generally, the tobacco crop is labour-intensive and involves several critical operations from seedbed management, transplanting, and weeding, to harvesting and curing. However, the use of mechanisation services is higher in the food-based pathway (63.1 per cent) compared to the tobacco-based pathway (55.6 per cent). Access to mechanisation services could be an important factor for households in the food-based pathway as it allows them to intensify their production processes at an extensive margin. It also seems that those households in the food-based pathway are compensating the relatively low utilisation of hired labour services by utilising greater amounts of mechanised services.

4.1.4 Extent of household crop commercialisation

In Section 4.1.3, we demonstrated the varying degrees of market participation across the key crops grown by households. Overall, most of the households in the study area sold some of their crop production, and the levels of sales varied across wealth quintiles. It is necessary to develop an aggregate index to measure the degree of household commercialisation and the general extent to which crop production is market-oriented. We computed the household commercialisation index (HCI), which measures the degree of commercialisation, as the percentage of crop production marketed. Figure 4.1 below shows the overall levels of HCI across the two pathways.

Generally, HCI scores are higher along the tobacco-based commercialisation pathway across the wealth quintiles. Overall, the average degree of household commercialisation was 88.81 per cent for households in the tobacco-based commercialisation pathway and 74.36 per cent for the counterparts in the food-based commercialisation pathway. Earlier, we showed that farmers pursuing food-based commercialisation also engaged relatively more in soybean production as an alternative commercial crop. The result here could imply that the high HCI on the food-based

Figure 4.1 Household commercialisation levels by pathways

HCI levels by wealth levels
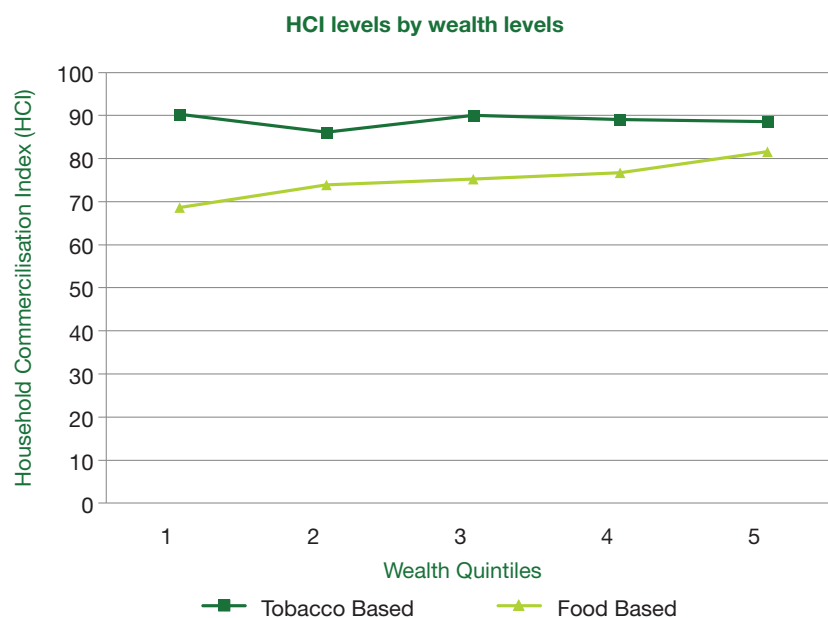
Source: Authors' own.

Table 4.4 Household commercialisation levels (%), by wealth quintiles

	Total wealth quintiles					
	1	2	3	4	5	Total
Tobacco-based						
Mvurwi	90.43	86.71	98.65	88.34	89.07	88.73
Concession	89.98	84.31	91.04	91.42	87.71	89.04
Total	90.28	86.17	90.05	89.11	88.63	88.81
Food-based						
Mvurwi	60.46	71.38	73.31	74.73	87.43	69.39
Concession	76.55	75.52	77.78	77.69	80.59	77.67
Total	68.64	73.87	75.21	76.77	81.63	74.36

Source: Authors' own.

commercialisation pathway is being driven by the soybean crop. Table 4.4 below summarises the HCI over the two commercialisation pathways and across wealth categories.

The results indicate that, under the food-based pathway, commercialisation levels increase with wealth quintiles in both the Mvurwi and Concession production areas. However, for the tobacco-based pathway, the relationship between household commercialisation levels and wealth quintiles is not linear, with households in the lowest wealth category displaying higher levels (90.28 per cent) of commercialisation than those in the highest wealth quintiles (88.63 per cent).

4.2 Econometric results

Having examined the two commercialisation pathways and their implications for crop production and productivity, input resource utilisation, and some selected wealth indicators, a Probit model was

estimated to determine factors influencing the likelihood of participating in a tobacco-based agricultural commercialisation pathway. The food-based pathway was used as the base category. The Probit results are given in Table 4.5 below.

The Probit regression results (Table 4.5) display that household characteristics such as age, gender, and years of schooling of the household head influence the probability of pursuing a tobacco-based commercialisation pathway. The marginal effects show that an additional year of schooling for the household head reduces the household's likelihood of tobacco-based commercialisation by 3.3 per cent. This implies that, as household heads further their education, they are likely to explore more career options and thus widen their livelihood basket, reducing the need to embark on tobacco production.

Moreover, the results indicate that if the household is female-headed, this reduces their likelihood of

Table 4.5 Probit results of factors influencing choice of commercialisation pathway

Variables	Model coefficients	Marginal effects (dy/dx)
Household head gender	-0.397**	-0.142**
	(0.179)	(0.067)
Household head age	-0.109***	-0.037***
	(0.0399)	(0.013)
Square of household age	0.000797**	0.0003***
	(0.000368)	(0.0001)
Household head years of schooling	-0.0984***	-0.033***
	(0.0285)	(0.010)
Household size	0.0974***	0.033***
	(0.0284)	(0.009)
Wealth index	0.0900***	0.030***
	(0.0318)	(0.11)
Contract farming (0/1)	0.703***	0.224***
	(0.151)	(0.045)
Non-farm income (0/1)	-0.320**	-0.103**
	(0.149)	(0.046)
Inorganic fertiliser use (0/1)	1.490***	0.542***
	(0.432)	(0.122)
Tractor tillage (0/1)	-0.341**	-0.111**
	(0.148)	(0.047)
Market information (0/1)	0.0343	0.012
	(0.267)	(0.091)
Extension access (0/1)	-0.000745	-0.0002
	(0.00202)	(0.001)
Location	-0.858***	-0.287***
	(0.140)	(0.046)
Constant	4.212***	
	(1.157)	
Observations	601	

Note: standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' own.

undertaking tobacco-based commercialisation by 14.2 per cent, while an increase in the age of the household head by one year reduces the likelihood of a household pursuing tobacco-based commercialisation by 3.7 per cent. Although weakly significant, the results also show that access to non-farm income reduces the probability of pursuing a tobacco-based pathway by 10.3 per cent. This interesting result indicates that households who have access to other income sources to augment their livelihoods may have fewer incentives to embark on a tobacco-based commercialisation pathway.

The results also demonstrate the importance of household endowments as determinants of choice of commercialisation pathways. The likelihood that a household will embark on the tobacco-based commercialisation pathway because of a one-unit

increase in the wealth index is about 3 per cent. However, this result is treated with caution since it is based on a cross-sectional survey and possibilities of reverse causality might need to be explored through panel studies. Our results further show that an increase in household size by one additional member increases the likelihood of participation in a tobacco-based pathway by 3.3 per cent. Household size represents the availability of potential labour resources at household level and the wealth index captures the availability of production assets, both of which are important resources in the usually labour-intensive tobacco production processes.

Variables representing access to key agricultural services were also important in explaining participation in a tobacco-based commercialisation pathway.

The results show that having access to contract farming increases the likelihood of pursuing the tobacco pathway by 22.4 per cent. Contract farming is not only one of the marketing options for tobacco farmers, but can also provide access to the much needed production finance, extension support, and guaranteed markets (Scoones *et al.* 2018). Therefore, the availability and improved access to agribusinesses offering contractual arrangements to smallholder farmers would be crucial in offsetting entry barriers and thus encouraging farmers to pursue tobacco-based commercialisation.

Similarly, access to inorganic fertilisers increases the likelihood of tobacco-based pathways by 54.2 per cent. However, access to tractor tillage services reduces the likelihood of pursuing a tobacco-based commercialisation pathway by 11.1 per cent. This implies that households with access to tractor tillage services are more likely to pursue food-based commercialisation rather than embarking on a tobacco-based pathway. Tractors allow households to cultivate more land for food crops, which are mostly land-intensive. However, access to market information and extension services were not statistically significant.

5 CONCLUSIONS

The biggest contribution of this paper to the existing literature is to shed more light on the likely effects of shifting to commercially-oriented cropping patterns on input usage and food crop productivity. The results have important policy implications, given that the government has always been interested in the interactions between tobacco production and household food production. Using a Probit econometric model, we further investigated the set of household demographic and socioeconomic variables shaping households' choice of commercialisation pathways. Looking at the two commercialisation pathways, we observed that households pursuing the tobacco-based pathway invested more in inputs such as improved seeds, inorganic fertilisers, agro-chemicals (pesticides and herbicides), as well as hired labour. This was reflected in the relatively higher productivity levels across key crops, which also suggested technological spillovers between tobacco and other food crops.

The key variables significant in explaining the likelihood of participating in a tobacco-based commercialisation pathway include household size and wealth levels, access to inorganic fertiliser, as well as access to contract farming services. On the other hand, households that are female-headed, and those with access to more cultivatable land, non-farm income, and tractor tillage services were more likely to embark on food-based commercialisation. While there were higher gross values of production in the tobacco-based commercialisation pathway, we observed that there are important synergies with the more subsistence-oriented crops. We also observed that, in both pathways, maize remains an integral part of farmers' commercialization efforts. This implies that farmers will still strive to produce their own maize regardless of the commercialisation thrust.

Overall, tobacco is likely to remain an integral part of agricultural commercialisation among smallholder farmers, given that the crop is highly profitable besides its high production costs. However, given the changes in global market conditions, particularly the rising concerns over the health implications of tobacco, it might be prudent for the government to explore viable diversification options and strategies to support other high-value crop substitutes.

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ENDNOTES

1 Model A1 of the Fast Track Land Reform Programme (FTLRP) in Zimbabwe was intended to decongest communal areas and targeted land-constrained farmers in communal areas. The average landholding in these schemes is about 37 hectares.

2 An index of wealth was computed using principal components analysis (PCA) on variables capturing household asset ownership, housing characteristics, as well as access to utilities and infrastructure such as water sources and sanitation facilities, to create an index of household wealth (Vyas and Kumaranayake 2006; Filmer and Pritchett 2001).

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