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Market chain analysis for potato: A case study in Masha District, Southwestern Ethiopia

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Abstract. This study was initiated to analyze market chain of potato in Masha district. Primary and secondary data were used in this study. Primary data were collected via structured questionnaire from 193 producers, 20 traders and 5 commission agents to capture the socioeconomic and potato marketing factors in 2016. Descriptive as well as econometric analyses were used to analyze the data. The study identified six marketing channels. Producers directly sold highest quantity of potato to traders next to commission agents, whereas, lowest quantities sold to retailers and processors. The estimated output was 4.868 tonnes per hectare. The estimated market concentration ratio for potato traders (72.12%) shows that potato transaction is operating under tight oligopoly market structure. Producers obtained highest share of final consumer price in marketing channel-I, -II and -V. While middle actors resulted for high marketing margin in channel-IV (48.66%), -III (47.98%), -VI (45.69%) and -V (37.29%). In marketing channel-III and -IV intermediaries (traders, wholesalers and retailers) shared about 50% of total benefits. The result revealed that market efficiency was decline with increase in number of intermediaries. Lack of farming inputs were the major constraint in potato production and marketing after damage due to insect and pest. Potato marketing channels in the study area were few and short and only very few actors sell potato after processing. Therefore, (1) attention should be given to potato market expansion and productivity improvement and (2) intervention should be made to enhance processed potato marketing, (3) potato damage due to diseases need urgent study and controlling measures.

Keywords: Marketing channels, market margin, Masha, potato, market supply, determinant, market efficiency.

INTRODUCTION

Agriculture plays crucial role in developing countries and it is base of economy in Ethiopia. Potato is one of the agricultural crops and more than 320 million tonnes are being cultivated annually on 20 million hectares of land worldwide (FAO, 2010) and there is progress in potato cultivation and marketing (Hirpa et al., 2010; Gildemacher, 2012). Potato has a short growth cycle and can be easily integrated into existing agricultural systems and provides high productivity per area as well as it is used for household consumption or sold as a cash crop. As the population grows rapidly, increased productivity of potatoes is used to meet the growing demand

(Gildemacher, 2012). Potato is best option for many households to generate income in Ethiopia. Despite good agricultural product in the past years in the country, there were various constraints in agricultural product marketing systems such as limited market information and lack of transportation facilities. Nowadays changes are happening in agricultural and food markets because of globalization, economic liberalization and urbanization in developing countries (Hoeffler, 2005).

In Ethiopia, potato is produced on 66,746 hectares with an average national yield of 118 quintals or 11.8 tons per hectares in the main cropping season (CSA, 2014). Nevertheless, the country has suitable edaphic and climatic conditions for the production of high guality ware and seed potatoes (Endale et al., 2008; Tsegaw 2010). Besides its productivity, market participation of producers were hindered by different factors. The link between the producers and the consumers is market. Marketing therefore plays central role in development process. However, the marketing system of agricultural products in Ethiopia is failed to address price fluctuations due to improper functioning market system and information asymmetry. Makhura (2001) investigated the transaction costs barriers in market participation of smallholder farmers in the Northern Province. Makhura (2001) found that marketing by smallholder farmers was constrained by poor infrastructure, distance from the market, lack of assets (for example lack of own vehicles) and inadequate market information. Lack of bargaining power along with various credit bound relationships with the buyers has led to farmers being exploited during the transaction where most of the farmers become price takers. The majority of the farmers are smallholders and hence, unable to obtain a fair price for their produce. This results to farmers not being able to sustain their livelihood. The structure of the traditional vegetable supply chains is such that there are a large number of intermediaries (e.g. vegetable collectors, transporting agents, commission agents etc.) between the producer and the consumer. Addition of the marketing margins of all these intermediaries coupled with almost 30 to 40 percent of the vegetables being wasted as post-harvest losses have eventually resulted in producers receiving a very low price for their produce while at the other end the consumers are compelled to pay a highly inflated price for their purchases (Hettige and Senanayake, 1992; Kodithuwakku, 2000).

Jaleta (2007) showed that inadequate market channels and poor information regarding price were among factors affecting commercialization of agriculture. Furthermore, Emana and Gebremedhin (2007) in their study on market chain analysis argued that the marketing of horticultural crops is affected by inadequate local markets, poor pricing system, lack of local markets to absorb supply, low produce prices, excess of intermediaries, and poor marketing institutions and coordination of farmers. Emana and Gebremedhin (2007) further argued that poor handling and packaging of products, poor pricing systems, and information asymmetry affect marketing of vegetables.

Despite of potato production potential of the study area, different socio-demographic aspects were limited amount of quantity supplied to the market. Yet, no study was conducted to identify these factors. This was a reason for why this study sought to identify market supply determinants. In order to improve the marketing system linked with the markets in the study area, the role of market-actors and market channels need to be analyzed. Therefore, this study was initiated to investigate the different marketing channels, analyze the marketing margins and identify determinants of market supply in the study area.

MATERIALS AND METHODS

Description of the study area

Study was conducted in Masha district, of South Nation and Nationalities Region (SNNPR) which located at 700 km to southwest of Addis Ababa. The district receives mean annual rain fall about 2000 m and its mean monthly temperature ranges between 18 to 21°C. Total area of the district is 217,527.15 hectare with the total population of 40,810 of which 49.3% are male and the remaining are female population (CSA, 2007). The area is known for its potato production potential. From 19 rural kebeles of the district the study was conducted in 3 kebeles viz., Gatimo, Atesso and Shebo (Figure 1).

Data collection methods

For this study potential district for potato production and marketing was selected, from which three study kebeles were selected purposively. Finally, 193 potato producers (household heads) were selected randomly for the interview from study Kebeles. Key informant interview, focus group discussion and market assessment were used to supplement survey data. Sample size of was determined by (Israel, 1992):

$$n = \frac{N}{[1 + N(e^2)]}$$

Where n is sample size, N is total household of the district and e is precision level (5%). Besides to producers; 7 local traders, 8 retailers, 5 wholesalers and 5 commission agents were selected for interview using snowball method.

Data analysis

The collected data were analyzed by descriptive statistics as well as inferential statistics and econometric methods.

Market structure, conduct and performance (S-C-P)

S-C-P model is used to study the structure of the market and the behavior of sellers of different commodities and services (Kizoto, 2008).

Market structure

This expresses organization of market system (Gebremeskel et al., 1998). In this study market structure



Figure 1. Map of study area.

characterized by marketing channel, degree of transparency and market concentration.

Market concentration: It is the ratio of the combined market shares of a given number of potato sellers to the whole market size.

$$MS_i = \frac{Vi}{\Sigma Vi}$$

Where, MSi=market share of seller i, Vi=amount of potato of seller i and $\sum V_i$ =total amount of potato of seller

 $CR = \sum_{i=1}^{r} Si i=1, 2, 3, 4....r$

Where, CR = concentration ratio, Si = the percentage market share of the ith seller and r = the number of relatively larger sellers for which the ratio is going to be calculated.

Concentration ratio of four firms (CR₄) is best regarded as a "rule of thumb. If the sum of market shares of CR₄ is greater than 50%, the market structure is tight oligopoly. Whereas, if, CR₄ is between 25% and 50% market structure is characterized as oligopoly market structure and if CR₄ less than 25% market is as competitive market (Kohls and Uhl, 2002).

Market conduct

This refers to a pattern of behavior which market actors

follow in adopting or adjusting to the market in which they sell and buy (Meijer, 1994). In this study market conduct was analyzed price setting and terms of payment.

Market performance

This refers to the performance potato marketing system. Marketing margin estimation is the best tool to analyze performance of market. Thus, in this study market performance was analyzed by marketing margins and profit levels of actors. Marketing efficiency was also estimated.

Marketing margin (MM): This refers to the difference between potato product prices obtained by market actors at different market levels in different market channels and also measures the share of the final selling price that is captured by market actors. The producers share in marketing margin can be calculated as:

$$PS = \frac{P_p}{C_p} = 1 - \frac{MM}{C_p}$$

Where: PS = producer's share, Pp = producer's price, Cp = consumer's price

The total gross marketing margin (TGMM) is the difference between what the end user pays and what the producers receives for a given product.

TGMM = *End user price* – *producer price*

Variables	Minimum	Maximum	Mean	Std. Deviation
Age	20	63	37.6632	10.06259
Education level	0	12	5.399	3.17402
Distance from market	1	12	5.5026	2.72742
Experience	1	27	7.0415	4.34554
Total family size	1	12	6.8622	2.05808
Family size in working age	1	7.00	3.4218	1.48497

$$%TGMM = \left(\frac{Final \ consumer \ price - producer \ price}{Final \ consumer \ price}\right) * 100\%$$

Then, gross marketing margin at a given stage 'i' (GMM_i) was computed as:

$$\% GMM_i = \left(\frac{Spi - Ppi}{TGMM}\right) * 100\%$$

Where Spi is selling price at ith stage and Ppi is purchase price at ith stage.

Marketing efficiency (ME)

Loss in marketing due to spoilage is one of the efficiency parameters. Thus, marketing loss was incorporated in the formula given by Acharya and Agrawal (2001) to estimate ME. $ME \ge 1$ shows efficiency of the marketing channel. The extent by which *ME* exceeds one reveals greatness in efficiency and if < 1 the marketing channel is inefficient (Phiri et al., 2013).

Econometric analysis

Econometric analysis will be used to determine the relationship/association between dependent and independent variables (Greene, 2003). It determines the magnitude and direction of effect of changes in independent variable on the dependent variable. In this study multiple linear regression model (OLS) was used to examine the relationship between volume of potato supplied for sale. STATA₁₃ were used for the regression analysis.

RESULTS AND DISCUSSION

Socioeconomic characteristics of producers

As indicated in Table 1, the average age of respondents was approximately 37.7 years. This implies potato

production and marketing is performed by active working age group. The average family size of respondents was 6 and the average schooling year of respondents was 5.4. Skill and education increases working efficiency and productivity making the household able to use and adopt new agricultural technologies resulting into more income (Gloy et al., 2000). Farmers with good experience have more knowledge in marketing and incur lower transaction costs. Experience of a farmer is one of the factors that explain the level of technical efficiency (Basnayanke and Gurnarate, 2002). The mean distance from the nearest market was 5.5 km. Households located closer to the market center were experience lower transaction cost since they can get information more easily and participation to the market increases.

About 98.4% were male- and remaining were femaleheaded households. Regarding cooperative membership, 76.2% producers have not been member to any cooperatives (Table 2). Only half of producers had access to market information; this implies market information asymmetry. Ethiopian agricultural markets are characterized by inadequate market information system (Mulat, 2000). It is indicated that Lack of market information limit producers' participation in marketing (Giuliano et al., 200; Gibbon et al., 2008). Concerning extension services, 60% of producers had access to extension, but only few (5%) respondents had access to credit sources.

Socioeconomic characteristics of traders

In this study trader refers to local traders, retailers and wholesalers. As indicated in Table 3, the average age of local traders; retailers and wholesalers were 31.43, 29.13 and 35 years, respectively. Local traders, retailers and wholesalers averagely have four family members. Averagely, wholesalers were more experienced (4.2 years) as compared to local traders (2.71 years) and retailers (2 years). Similarly, wholesalers had higher education level, while retailers have lower. The initial working capital of local traders, retailers and wholesalers were 6500.14 Birr¹, 359.38 Birr and 21928 Birr, respectively, but the respective current working capital

¹ The basic unit of money in Ethiopia; equal to 100 cents.

Variables	Description	Frequency	Percent
Mambarahin to any aparativa	Yes	46	24
membership to any cooperative	No	147	76
	Yes	116	60
Access to extension service	No	77	40
	Yes	96	50
Access to market information	No	97	50
	Mala	100	08
Gender	Female	3	2
Access to credit	Yes	5	3
	No	188	97

Table 2. Socio-demographic characteristics of producers (categorical variables).

Table 3. Socio-demographic characteristics of traders (continuous variables)

Variable	Local trad	ers (N = 7)	Retaile	rs (N = 8)	Wholesalers (N = 5)	
Variable	Mean	Std. Dev	Mean	Std. Dev.	Mean	Std. Dev.
Age	31.43	2.82	35	6	29.13	3.682
Family size	4.14	1.773	4	1.96	4.5	1.773
Experience	2.71	1.704	4.2	1.67	2	1.165
Education	8	1.915	8.4	1.48	2.63	1.408
Initial working capital [Birr]	6500.14	2491.86	21928	4657.781	359.38	166.636
Current working capital [Birr]	59000	62804	65034	14761.95	3410.3	3279.721

Table 4. Socio-demographic characteristics of traders (categorical variables).

Variables	Local traders (N=7)			Retailers (N=8)			Wholesalers(N=5)		
variables	Description	Frequency	%	Description	Frequency	%	Description	Frequency	%
Access to market	Yes	7	100	Yes	8	100	Yes	5	100
information	No	0	0	No	0	0	No	0	0
Conder	Male	7	100	Male	5	63	Male	5	100
Gender	Female	0	0	Female	3	38	Female	0	0
Access to prodit	Yes	0	0	Yes	0	0	Yes	0	0
Access to credit	No	7	100	No	8	100	No	5	100

% indicates percent

were 59000 Birr, 3410.34 Birr and 65034 Birr. Table 4 shows all traders and wholesalers were male, while 63% of retailers were female and the rest were males. All traders, retailers and wholesalers had market information; however, none of traders had access to credit sources.

Level of potato production and marketing

Potato is produced for sale and household consumption

Sub-Sahara Africa including Ethiopia and its market is growing (Gildemacher, 2012). From the average farm land size (3.15 hectare) about 27.94% (0.88 hectare) were allocated for potato production. This exceeds farmland area allotted for potato production (0.74 ha/household) at Sinan district in Amhara regional state and Solagrow Plc (0.56ha/household) around Bishoftu area in Oromia regional state in 2012/2013 (Kassa, 2015; Kassa, 2014). Another study also indicated that per household allotted area for potato production in study area was greater than the area estimated by Bizabih and Mengistu (2011) for Tigray Region (0.28 ha/household) and Sidama zone in SNNPR (0.45 ha/household) as farmers need to produce and supply market a considerable volume.

Average annual production is 42.84 quintals per household per average allocated area (0.88 hectare). Of which 61.2% (26.2 quintals) were sold per household. The estimated potato productivity in study area was 48.68 quintals per hectare. This is less than national average out per hectare which is 80 to 100 quintals per hectare (Gildemacher et al., 2009; Abay and Tesfaye, 2011). Other study shows that potato production output in Masha district was less than the quantity obtained in Shashemene area and Hula districts in Southeastern Ethiopia during 2009/10 production (Bezabih and Mengistu, 2011). This is low productivity was partially contributed by use of poor quality seed potatoes of inferior varieties by most potato producers.

Structure, conduct and performance of potato marketing system

In this study three distinct approaches: market structure, conduct and performance were followed to analyze potato marketing system.

Potato market structure

Marketing actors: Different actors were involved in potato marketing activity. These include producers, commission agents, local traders, wholesalers, retailers and consumers. Addition to this there were supportive factors such as District office of agriculture, cooperatives, private traders, custom and revenue office of the district and NGOs. Private trader here refers to those actors commercially delivering farming inputs.

Potato marketing channels: Six marketing channels were identified (indicated below) for potato marketing in the study area.

channels to sell potato; however, the most widely used were channel-II and -III. Higher quantity was purchased by commission agents and local traders. The overall marketing channels are simple and linked producers with other actors. In Masha district about 83% of potato was sold to local traders. According to Gildemacher (2012) in Kenya and Uganda about 87 and 66.67% of potatoes were sold to traders direct from the field, respectively, however, in some parts Ethiopia (in West and North shewa and Awi zones) most potato farmers took their produce piecemeal to village markets, often on horseback or hand carried, where it was sold to wholesalers. In Figure 2 the orange line indicates institutions controlling potato marketing system; this is District Office of Custom and Revenue that monitors and regulates potato marketing in Masha by collecting taxes from traders and wholesalers (2 Birr/quintal). Black line shows flow raw farming materials supplied for producers, whereas, the light blue line represents the flow of potato produced by farmers. All producers and traders sell unprocessed potato; this limited number of marketing channels to be few. Processed potato entering into potato could increase marketing channels.

Degree of transparency/market information dissemination: Only half of producers and all traders had access to potato market information, which implies potato market is characterized by information asymmetry. Traders had good information accessibility than producers and they sell potato at appropriate price. Advances in communication technologies and declining transportation costs facilitate coordination between chain actors (Gibbon et al., 2008).

Market concentration: The result of this research indicated in Table 5 below shows that the concentration ratio (CR₄) of the four largest traders was 72.12%. This figure according (Kohls, &Uhl, 2002) implies the structure of potato tight oligopoly.

Potato market conduct

Marketing I: Producers \rightarrow ConsumersMarket conduct of potato traders and producers in
marketing II: Producers \rightarrow Retailers \rightarrow ConsumersMarket conduct of potato traders and producers in
marketing the conditions of was analyzed focusing on
Marketing III: Producers \rightarrow Commission agents \rightarrow Local traders \rightarrow replied that market price was determined by local
Marketing IV: Producers \rightarrow Local traders \rightarrow Wholesalers \rightarrow Retailers \rightarrow ConsumersMarket replied that market price was determined by local
traders \rightarrow Wholesalers \rightarrow Retailers \rightarrow ConsumersMarketing traders \rightarrow Marketing traders \rightarrow Local traders \rightarrow Wholesalers \rightarrow Retailers \rightarrow ConsumersMarketing traders \rightarrow Marketing traders \rightarrow Marketing traders \rightarrow Local traders \rightarrow Wholesalers \rightarrow Retailers \rightarrow ConsumersMarketing traders \rightarrow Marketing traders \rightarrow Marke

The estimated 5057.5 quintals of potato were marketed by sampled producers in 2015/16. Farmers use all

2010). Absence of competitive pricing system diverts market system from the competitive market structure. From sampled traders 71.43 and 28.57% of respondents



Figure 2. Potato marketing chain.

Table 5. Market concentration of potato.

No. of traders	Cumulative frequency	% of traders	Quantity purchased	Total quantity purchased	% share of purchase	% cumulative % of quantity purchased
1.00	1.00	14.29	935.00	935.00	23.48	23.48
1.00	2.00	14.29	722.50	722.50	18.14	41.62
1.00	3.00	14.29	635.00	635.00	15.94	57.56
1.00	4.00	14.29	580.00	580.00	14.56	72.12
2.00	6.00	28.57	415.00	830.00	20.84	92.96
1.00	7.00	14.29	280.28	280.28	7.04	100.00
		100.00		3982.78	100.00	

described that selling price was set by the market and bargaining with the buyers, respectively. Concerning the payment mode sampled traders sold their product on cash.

Potato market performance

Marketing margins and costs and profits across marketing channels: As revealed in Table 6, highest

percentage producers' share of final consumer price was observed in marketing channel-I and -II which were 100% and 68.31% in, respectively. These two channels have lowest TGMM compared to others. Whereas, lowest producers share is indicated in channels-IV, -III, -VI, -V and they accounted for about 51.34%, 52.03%, 54.31% and 62.71%, respectively. Highest %TGMM was observed in channel-IV (37.29%), -III (45.69%), -VI (47.97%) and -V (48.66%). Estimated marketing margin for the potato under different market chain system Table 6. Performance of potato marketing.

Actors	Dertiquiero	Marketing channels								
Actors	Particulars	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI			
	Production cost	84.65	84.65	84.65	84.65	84.65	84.65			
	Selling price	380.822	396.872	405.953	385	405	405			
	Share [%]	100	68.314	52.023	51.342	62.706	54.307			
	TGMMpr [%]		31.686	47.977	48.658	37.294	45.693			
Producers	Marketing cost	96.123	86.123	99.655	104.655	104.655	104.655			
	Spoilage losses	86.123	86.123	86.123	86.123	86.123	86.123			
	Total cost	180.773	170.773	184.305	189.305	189.305	189.305			
	Profit	200.049	226.099	221.648	195.695	215.695	215.695			
	Profit share [%]	100	65.912	50.877	49.215	60.662	53.874			
	Selling price			415 987						
	Margin			10 034						
	Margin [%]			1.286						
Commission	TGMMca [%]			2.68						
agents	Marketing cost			0						
5	Total cost			405.953						
	Profit			10.034						
	Profit share [%]			2.303						
	Colling price			EE2 227	E0E 227	EE2 227	E06 926			
	Sening price			127.24	120 227	149 227	101 926			
	Margin			137.34	120.327	140.327	191.030			
				17.0	10.040	22.900	20.723			
Traders	I Giviiviiti [%] Markating apot			30.000	32.970	61.576	20.290			
	Tatal aget			34.331	34.331	62.329	12.002			
	Profit			400.010	419.331	407.329	477.002			
	PIUIII Drofit choro [9/1			103.009	00.990	00.990	119.774			
				23.045	21.027	24.100	29.910			
	Selling price			678.523	665.814	645.876				
	Margin			125.196	160.487	92.549				
	Margin [%]			16.044	21.402	14.329				
W/bolocolore	TGMMws [%]			33.441	43.984	38.422				
WIDESalers	Marketing cost			95.895	98.471	38.672				
	Total cost			649.222	603.798	591.999				
	Profit			29.301	62.016	53.877				
	Profit share [%]			6.726	15.596	15.152				
	Selling price		580.953	780.327	749.875		745.762			
	Margin		184.081	101.804	84.061		148.926			
	Margin [%]		31.686	13.046	11.21		19.97			
Retailers	TGMMrt [%]		100	27.193	23.038		43.704			
	Total marketing cost		67.146	30.139	30.139		84.027			
	Total cost		464.018	708.662	695.953		680.863			
	Profit		116.935	71.665	53.922		64.899			
	Profit share [%]		34.088	16.45	13.561		16.21			
	Final consumer price	380.822	580.953	780.327	749.875	645.876	745.762			
Consumers	ТСММ	-	184.081	374.374	364.875	240.876	340.762			
2011010	Total profit	200.049	343.034	435.657	397.629	355.57	400.368			

%TGMMpr, %TGMMca, %TGMMtr, %TGMMws and %TGMMrt indicates percentage share gross marketing margin from TCMM for producers, commission agents, traders, wholesalers and retailers, respectively.

Particulars (in Birr)	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI
Producer's net price	296.172	312.222	321.303	300.35	320.35	320.35
Total market margin	0	81.059	160.3	146.26	55.292	104.563
Total marketing cost	10	67.146	173.897	181.473	119.533	174.621
Total marketing loss	86.123	121.999	139.832	141.797	170.706	166.233
Marketing efficiency index	3.08	1.16	0.68	0.64	0.93	0.72

Table 7. Marketing efficiency estimation.

Producer net price = Selling price - Production cost

indicated that the marketing margins at wholesalers and retailers level was higher. Because marketing cost was relatively high at these levels. This implies that intermediaries play a crucial role in realizing better margins for them compared to that of potato growers.

Intermediaries had no other costs beyond marketing cost; however, that of the producers is the sum of production cost and marketing cost. In marketing channel-I and –II there were few actors, hence lowest marketing cost which were 96.123and 153.296 Birr/Quintal. However, marketing channels with many actors had higher marketing cost. For instance marketing channels-IV, III and-VI had marketing cost of 280.596, 273.02 and 260.744 Birr/quintal.

The size of profit obtained by market actors in marketing channels depends on selling price and total cost incurred by actors. In marketing channel-II and -V, intermediaries had obtained less profit share. In the remaining channels as compared to producers, intermediaries (traders, wholesalers and retailers) by simply buying from the farmers and selling to consumers shared about 50% of total benefits in channel-III and -VI. While farmers, doing all the work of producing potato and bearing the associated risks, took less than 50% of the profit total. Potato producing farmers in North Shewa were making good profits from potato production due to high higher yields, low production cost and relatively good price. Whereas, in West Shewa both yields and prices were lower, while in Awi zone prices were good, but yields very low; this limited the farmers' profits in these areas (Gildemacher, 2012).

Marketing efficiency

Marketing cost is not sole indicator of inefficiency of marketing system. As potato is perishable by its nature market loss is included in marketing efficiency index estimation. Higher the loss, lower will be the efficiency. Marketing efficiency was found higher in the marketing channels I and II, because of lower marketing costs (Table 7). The index was found higher in marketing channel-I and II; however, it was low in remaining channels due higher total costs. Disease usually damages potato at pre and postharvest stages, which results in poor marketing efficiency.

Determinants of potato market supply

Among sixteen variables included to the model only seven of them were found to be significantly associated with marketable supply of potato (Figure 3). These variables were age of household head, distance from known nearest market center, sex of the household head, adult equivalent, and portion area allocated for potato production, quantity of potato produced, access to market information and access to extension services; whereas, the remaining variables were found to have no association with marketable supply of potato.

Quantity produced (QPRO): As hypothesized the total annual quantity of potato harvested in a year had positively and significantly affect quantity of potato supplied to the market at 1% level of significance. It indicates that households who produce more quantity of potato had also supplied more to the market. The reason behind is that farmers can sell more from extra production/harvests: which can meet and satisfy demand of households. Unlike the other cereal crops, farmers cannot store potato for longer time; since it is relatively perishable. Inline to this, the study by Geoffery et al. (2014) found that pineapple yield significantly and positively influenced participation. This implies that as the pineapple yield increases, market participation increases. It is also confirmed by the findings of Abay (2007) and Adugna (2009) who found that an increased amount of tomato and papaya yield augment the market supply of these commodities significantly. On the other hand, Avelech (2011) also found that avocado and mango quantities had a significant and positive effect on marketable supply. In addition, Habtamu (2015) confirmed that the total annual quantity of potato harvested in a year had positively and significantly affect quantity of potato supplied to the market at significantly. The result shows that a one guintal increase in the potato production causes a 0.803 quintal increase in the volume of marketable supply of potato.

Access to market information (ACMI): Access to market information is a variable that positively associated with quantity supply of potato at 5% significance level. Similarly, Mekonin (2015) indicated that Access to market information is positively and significantly associated with

Linear regress	sion				Number of obs F(12, 180) Prob > F R-squared Root MSE	$= 193 \\ = 531.69 \\ = 0.0000 \\ = 0.9346 \\ = 4.8622$
QSUP	Coef.	Robust Std. Err.	t	P> t	[95% Conf.	Interval]
AGE	1202506	.0421921	-2.85	0.005	2035054	0369958
SEX	2.013448	.8199327	2.46	0.015	.3955316	3.631365
EDUCLEV	.2555463	.1333485	1.92	0.057	0075811	.5186737
DISFM	-1.038982	.3587985	-2.90	0.004	-1.746974	3309893
EXPER	.0266511	.0776978	0.34	0.732	1266645	.1799668
COPMEM	.8650846	.8870945	0.98	0.331	8853576	2.615527
FMS	2.151111	.8047372	2.67	0.008	.5631793	3.739044
TPRO	.2443303	.045674	5.35	0.000	.154205	.3344555
AOLP	2.236883	.4533355	4.93	0.000	1.342348	3.131419
PRICE	.0780535	.0201241	3.88	0.000	.0383439	.117763
EXTENSER	1.469457	.7235369	2.03	0.044	.0417518	2.897163
ACCMINFO	1.868936	.8401233	2.22	0.027	.2111791	3.526694
_cons	-22.48815	8.988587	-2.50	0.013	-40.2247	-4.751592

Figure 3. OLS estimation results of determinants of potato market supply.

the market outlet choices of Coffee Producing Farmers. The positive and significant associations between variables indicate that as farmers accessed market information, the quantity of potato sold at market also increases. The regression result confirmed that accessing market information to farmers will tend to increase the marketable supply of potato by 0.504 quintals. The implication is that obtaining and verifying information helps to supply more quantity of potato. Jaleta (2007) showed that inadequate market channels and poor information regarding price were among factors affecting commercialization of agriculture.

PRICE: As hypothesized price of potato influenced volume of marketed positively and significantly at 1% level of significance. The positive and significant relationship between the variables indicates that as the price of potato at market rises, the quantity of potato sold at the market also rises, which in turn increases quantity of potato sold per household per year. Similar to this study, Ayelech (2011) confirmed that a positive relation to the quantity of avocado sold or supplied to market. The implication is that the increase in price of potato by one birr reduces marketable supply of potato by 0.0767 quintal.

Area allocated for potato production (AAFPP): This variable refers to the portion total farm land area owned by household heads allocated to potato production in hectare. This variable has positive association with

quantity off potato supplied to market for sale. As the portion of area allocated for potato production increase by 1 hectare, quantity of potato supplied to market increases 1.9343 quintals. The larger land size the household allotted for potato production let them to supply more quintals of potato to market. The result is in line with the study of Bongiwe and Micah (2013) which studied on Factors Affecting the Choice of Marketing Channel by Vegetable Farmers in Swaziland.

Family size (AEQU): This variable is family size of a respondent is a variable measured in adult equivalent. Potato production and marketing is labor intensive activity. This variable is positively and significantly related to quantity of potato supplied to the market as observed from analysis output. This result is in contrast with the study conducted by Embaye (2010) in Atsbi wenberta and Alamata Woredas which confirmed the negative effect of the variable but in agreement with the study of Woldemichael (2008) and Benyam et al. (2016). Accordingly, as adult equivalent increases by unit, quantity of potato supplied to market tends to increase by 1.961 quintals.

Distance to the nearest market (DISFM): As hypothesized the variable had negative impact and statistically significant at 1% significance level. As the distance to the nearest market increases by a unit, it decreases potato market supply. This indicates that farmers living nearer to market or town produce potato

because it is cash crops in the study area. This result is in agreement with the work of Embaye (2010) and Bongiwe and Micah (2013). Similarly, study conducted by Holloway and Ehui (2002), Gizachew (2005) and Benyam et al. (2016) found the negative relationship between distance to market and the probability of participation in market. This is in line with Holloway and Ehui (2002) and Wolday (1994). In contradiction, Habtamu (2015) market distance had been positively and significantly associated with the potato producers' market participation. The results by Holden and Binswanger (1998) found that geographical location and travel time to the nearest market affected small holder's likelihood to participate in the market. Contrary to this, the results by Christopher et al. (2014) found that distance to the nearest town had a positive and significant effect on potato farmers' market participation.

AGE: The result shows that the age of the household head influenced the quantity of potato supply to the market negatively and statistically significant at 5% significance level. The negative sign indicates that the indirect association between the age of the household head and the amount of potato supplied to the market. Younger farmers were expected to be more adventurous and less risk averse than older farmers (Knowler and Bradshaw, 2006). The result is in line with the study of Bongiwe and Micah (2013). Similarly, the study on vegetable market supply Adugna (2009) showed that age of the household head had negative effect on the elasticity of onion supply to the market. Contrary to this study, Christopher et al. (2014) and Habtamu (2015) found that farmer's age had a positive and significant impact on the decision to participate in the potato market. According to Berhanu et al. (2011) age of household is negatively related with the level of market participation. As the age of the household head increases by one year, the amount of potato supplied to the market decreases by 0.1211 guintals. In contradict to this finding, results by Randela et al. (2008) found that age of respondent having positive and significant relationship with household head commercialization. Further results by Matungul et al. (2001) indicated that older and more experienced household heads tend to have more personal contacts, allowing discovery of trading opportunities at lowest cost. This could be from the fact that as the age of the house hold heads get elder and elder, they could not perform potato production activities. In opposite with the result of finding, Abay (2007) who illustrated as farmer's experience increased the volume of tomato supplied to the market has increased in Fogera, District which is found in South Gonder.

Education level of the Household Head (EDUCLEV): It

was a continuous variable measured by years of schooling. As hypothesized, the variable has positive influence on market supply and significant at 10%

significance level. Educated farmers have more knowledge and experience that allow them to interpret information about the market. It also enhances the skill and ability to better utilize market information, which may reduce marketing costs and make it more profitable to participate in the market as well as improves postharvest handling mechanisms. According to Haji (2003), formal educations of household head in the family were increases the farmer's access to improved farm techniques and effective use of information available on technologies used to improve potato production. The increase in one year education will result in increase in 0.2555463 qt in quantity supplied.

Sex: It is dummy variable which takes 1 if household head is male and 0 if the household head is female. As hypothesized, the variable had positive effect on market supply and significant at less than 5% significant level. Commercial horticultural crops production is a risky venture and ability to take risks may be different across gender. Thus, male headed households, due to their potential crop production efficiency advantages over female headed households, were expected to have positive effect in market supply and negative impact in postharvest loss. The result indicated that when the respondent being a male , potato supplied will increase by 2.013 qt. Male-headed households are expected to be more likely to engage in commercial horticultural production.

Access to Extension Services (EXSER): it is a dummy variable taking a value of one if potato producers have access to extension service and zero otherwise. As it is hypothesized, this variable had positive impact on potato quantity supplied and significant at less than 5% significance level. Agricultural extension services enhance farmers' skill and knowledge, link farmers with modern technology and markets. It is expected that extension service widens the household's knowledge with regard to the use of improved varieties, postharvest handling mechanisms and has positive impact on potato market supply and negative impact on postharvest loss. Farmers that are in contact with extension agents are conceived to be more exposed to information that may not be accessible to other farmers. Furthermore, Rehima (2006) identified that extension visit was positively related to pepper market entry decision and marketed pepper volume. The econometric result indicated that when producers have to extension agents visit the quantity supplied will increase in 1.5 qt.

CONCLUSION AND RECOMMENDATIONS

This study was conducted to analyze the market chain of potato. Potato productivity is less than national level. Producers, trades, commission agents, wholesalers,

retailers, processors and consumers were identified as potato marketing actors in this study. Commission agents create link potato producers involved marketing with potato traders. Six marketing channels were identified in potato marketing. Potato growers sell their produce all these channels. However, majority of potatoes sold directly to traders after commission agents. Potato market structure was characterized as tight oligopoly implying that few local traders dominated the market. Besides, in the majority of the cases price of potato were determined not by supply and demand interaction, rather by the traders, while producers are price takers. Shorter channels provided maximum benefits to actors and found efficient compared to longer channels. It is necessary to expand potato marketing including processed potato and improve productivity through technical and farming inputs provision as well as further researches needs to be conducted on potato diseases identification and controlling measures.

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