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The Role of Agriculture and Agro-Processing for Development in Jordan

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ABSTRACT

This paper aims to support the implementation of the strategic development plans of Jordan by analyzing the role of agriculture and farmers in the Jordanian economy, the role that productivity and structural change can play for fostering agricultural growth, and the role agro-processing may play in Jordan's economic development. We argue that the development of the agro-processing sector often has stronger backward and forward linkages with the agricultural sector than other sectors and, thus, plays an important role for rural transformation. To further promote rural transformation for economic development and job creation, our findings suggest that Jordan's agricultural sector should continue its path of transition towards higher value agricultural production and agro-processing. Our findings suggest that farm households can benefit from participating in agro-processing activities as households moving out of agriculture into this sector are less likely to be poor. There also is still scope for improving agricultural productivity, especially for fruits, and for the expansion of greenhouse production and adoption of high value and high water-use efficiency crops. Most importantly, incentivizing the expansion of agro-processing industries in rural areas to serve domestic and export markets should be pursued.

1. INTRODUCTION

As is the case for most countries in the Middle East and North Africa region, Jordan's economy and people have been heavily affected by the repercussions of conflict and instability in the region. The civil war in Syria has resulted in a sharp increase in the number of refugees fleeing to Jordan, making Jordan the host of one of the largest populations of registered refugees in the world (Economic Policy Council 2017). The national census of 2015 estimates that 1.3 million of the 2.9 million foreign nationals residing in Jordan are refugees (DOS 2015). In addition, instability and conflict has affected tourism, foreign direct investment, and exports. Tourism, the second-largest employer, has suffered a fall in the number of visitors and, consequently, a decline in revenue growth since 2013 (MOTA statistical newsletters). The flow of foreign direct investment slowed down between 2008 and 2012, affected by the double burden of the global economic downturn and regional instability. Exports have also been negatively affected by instability in Syria, which was a major route for agriculture exports, and Iraq, which used to absorb a large share of Jordan's manufacturing exports.

As an additional factor, the regular supply of low-priced natural gas from Egypt, which used to provide around 80 percent of Jordan's electricity needs, was sharply interrupted by the Egyptian revolution in 2011. Jordanian authorities had to fill the gap with more costly purchases of oil on world markets, adding approximately \$6 billion to public spending as of March 2015 (USAID 2015). As a result, Jordan's public debt has increased substantially since 2012. After succeeding in decreasing its debt-to-GDP ratio from an all-time high of 220 percent in 1990 to 65 percent in 2008, this ratio had risen to 95 percent in 2016 (Economic Policy Council 2017).

As a result, economic growth has slowed, youth unemployment has increased, and food security has deteriorated. The economy's annual growth dropped from an average of 6.5 percent between 2000 and 2009 to 2.5 percent between 2010 and 2016. Youth unemployment increased from an already high starting point to reach 34 percent in 2016. Food security declined between 2012 and 2014, particularly in terms of food availability, only starting to recover in 2015 (EIU Food Security Index 2017).

Facing these economic challenges, the government of Jordan has introduced substantial reforms aiming at increasing GDP growth to 5 percent starting from 2018, with a target of 10 percent growth in the agriculture sector alone. Related to these national development goals, the Ministry of Agriculture in 2016 launched the second National Strategy for Agricultural Development (NSAD) for the period 2016 to 2025 in an attempt to align national development efforts under Jordan Vision 2025.¹ The introduction of NSAD 2016-2025 coincided with the inauguration of the National Strategy for Food Security (NSFS) 2016-2025 in recognition of the synergies involved in the implementation of both strategies. The key goals of NSAD include increasing agriculture's share of GDP by at least 17 percent, increasing agriculture's share of exports by 33 percent, and increasing irrigation efficiency by expanding the area of land irrigated by drip irrigation (Ministry of Agriculture 2016). The Economic Growth Plan 2018-2022 also emphasizes agriculture as a major growth engine.

This paper aims to support the implementation of the Economic Growth Plan, the NSAD and the NSFS by analyzing the roles:

¹ The first National Strategy for Agricultural Development (NSAD) 2002 – 2010 was introduced to contextualize sustainable agricultural and rural development in an integrated socio-economic framework. The strategy highlighted some of the main constraints to agriculture development in Jordan, such as declining agricultural resources, weak market linkages, and a lack of comprehensive agricultural development planning.

- a) Of agriculture and farmers in the Jordanian economy,
- b) That productivity and structural change can play in fostering agricultural growth, and
- c) That agro-processing² may play in economic development in Jordan. This last point implies that the focus of the analyses is on the broader concept of rural transformation, rather than agricultural transformation only (FAO 2017; Breisinger and Diao 2008; World Bank 2008).

In this context, we argue that the development of the agro-processing sector often has stronger backward and forward linkages with the agricultural sector than do other sectors and, thus, plays an important role in rural transformation. For example, a food processing plant located in a rural area close to the producers may buy fruits and vegetables from local farmers, thereby adding value and often quality to the local product, which is an important backward linkage. In addition, economic activities around agro-processing, including packaging, retailing, and marketing, also add value and generate jobs, which are important forward linkages.

This paper follows previous analyses for two country case-studies in the MENA region, Egypt and Tunisia, in examining the role of agriculture and agro-processing in Jordan's path towards economic development (Nin Pratt et al. forthcoming). Section 2 describes the geographic distribution of Jordan's population and highlights the role of refugees in the economy. Section 3 depicts the role of agriculture and agro-processing in Jordan's economy and in employment creation and then examines changes in agriculture productivity and in the structure of agriculture production over time. Section 4 provides a household-level analysis of the role of agriculture in employment and welfare. Section 5 discusses the future of agriculture in Jordan. Section 6 concludes with a summary of key findings.

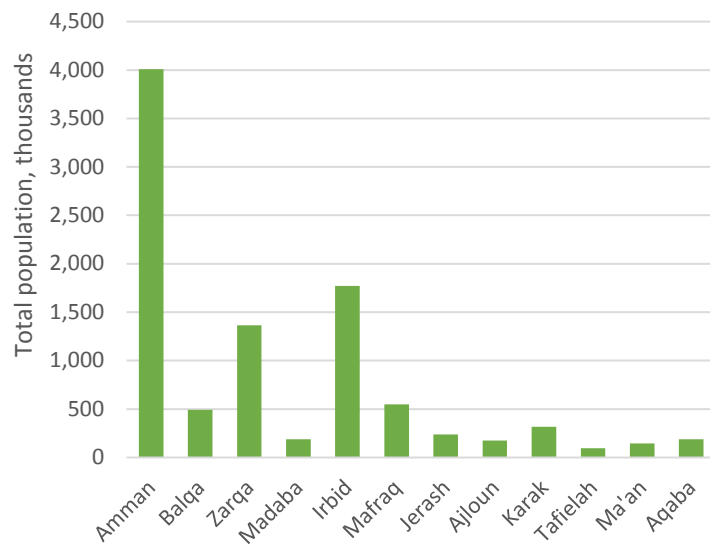
2. POPULATION, GEOGRAPHY, AND THE ROLE OF REFUGEES

In order to understand how agriculture and agro-processing can help foster economic growth and improved welfare, we first present the geographic distribution of the population and highlight the role of refugees.

The majority of the Jordanian population, 84 percent, lives in urban areas. The capital, Amman, alone houses 42 percent of the population, while Irbid and Zarqa house 19 and 14 percent, respectively (Figure 2.1). The percentage of the population living in rural areas has been decreasing over time, dropping from 20 percent in 2000 to 16 percent in 2016, although the rural population continues to grow, if slowly, with an annual growth rate of 1.8 percent in 2016 (Figure 2.2). Geographically, the highest concentration of rural villages is in the fertile northwest corner of Jordan and in the Jordan Valley in the governorates of Balqa, Jerash, and Madaba. However, the governorates of Mafraq, Karak, and Ma'an have the highest share of their populations residing in rural areas at more than 30 percent (Figure 2.4).

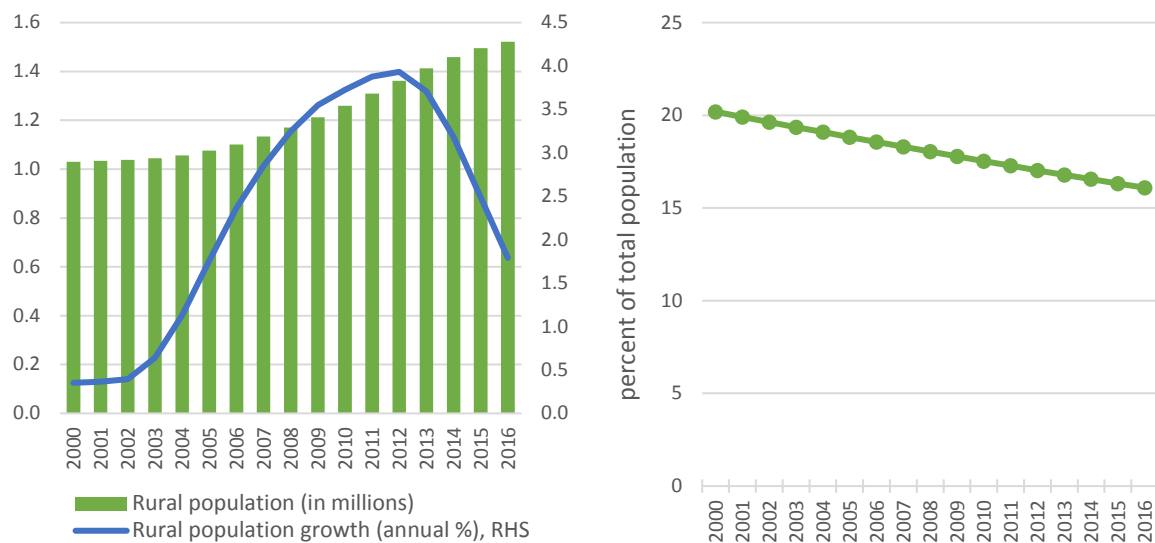
² Agro-processing industry refers to the subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector. Agro-processing industries transform products originating from agriculture, forestry and fisheries. For the purpose of the present analysis, we follow the UN International Standard Industrial Classification of All Economic Activities (ISIC) which classifies agro-industrial production from different manufacturing sectors: 3.1 Manufacture of Food, Beverages and Tobacco; 3.2 Textile, Wearing Apparel and Leather Industries; 3.3 Manufacture of Wood and Wood Products, Including Furniture; 3.4 Manufacture of Paper and Paper products, Printing and Publishing; 3.5.5 Manufacture of rubber products. (Source: FAO: <http://www.fao.org/docrep/w5800e/w5800e12.htm>).

Figure 2.1. Distribution of total population in Jordan, by governorate



Source: Author's calculation based on National Census 2015

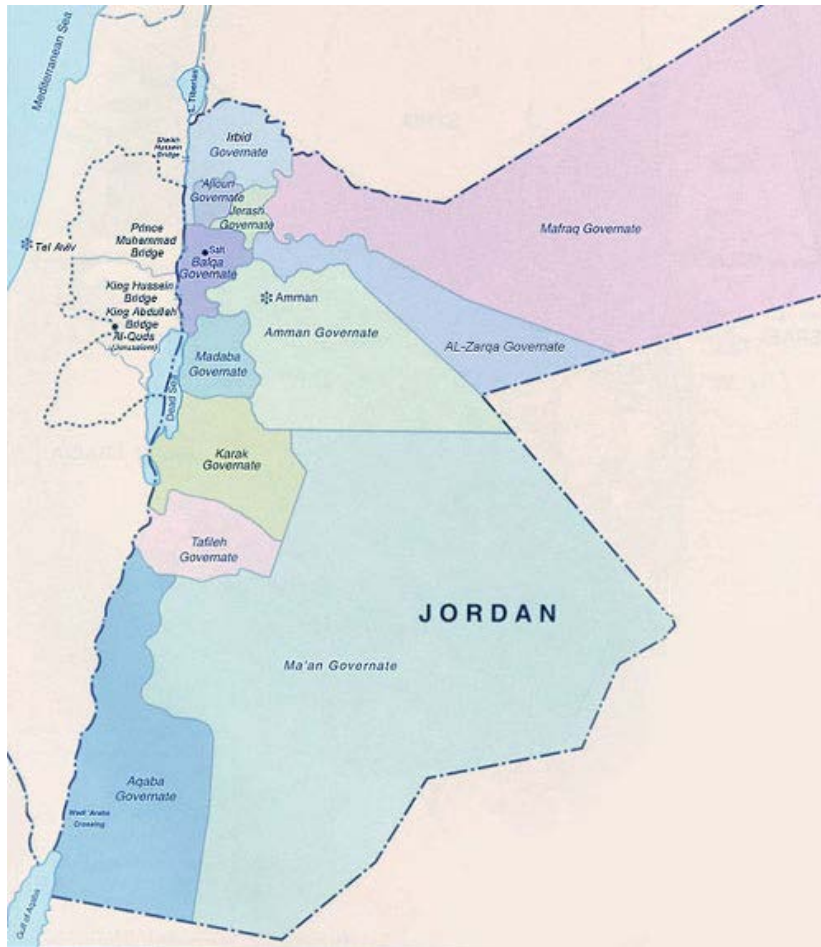
Figure 2.2. Rural population trends in Jordan between 2000 and 2016 – size and growth (left) and as percent of total population (right)



Source: Author's calculations based on World Development Indicators (2017)

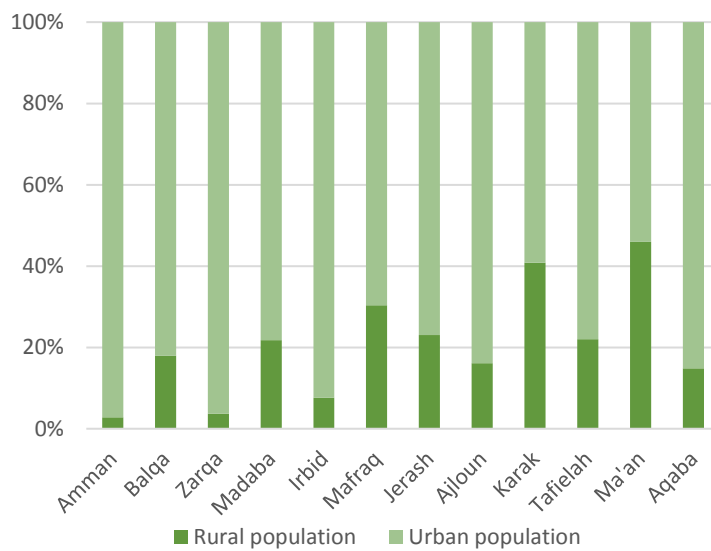
Ecologically, Jordan can be divided into three distinct ecological zones. The first is the Jordan Valley (the lowlands) which represents a narrow strip located below the mean sea level, stretching from the north-west to south-west. The second is the western highlands which hosts most of Jordan's main population centers, and is distinguished by relatively high rainfall. Finally, the third zone is the arid and semi-arid land referred to as Badia, which comprises more than 75 percent of the total land area. Agriculture in Badia takes the form of livestock systems and some cultivation that relies on groundwater irrigation.

Figure 2.3. Jordan governmental map



Source: Jordan Ministry of Planning and International Cooperation website

Figure 2.4. Rural and urban populations by governorate, percentage share

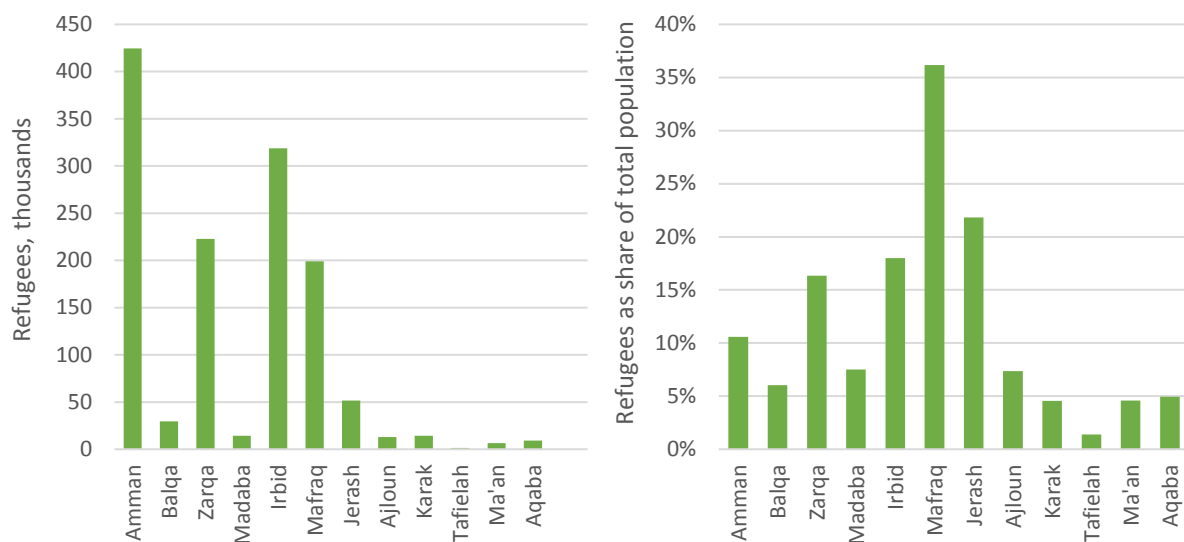


Source: Author's calculations based on National Census 2015

The distribution of refugees among Jordan's governorates, according to the 2015 census, shows an interesting pattern (Figure 2.5). While Amman, Irbid, and Zarqa host the highest number of refugees, the percentage of refugees as a share of the total population is highest in Ma'raq

(36 percent) and Jerash (22 percent), followed by Irbid, Zarqa, and Amman. In particular, rural communities in the border governorate of Mafraq have been a major destination for Syrian refugees. At the same time, it is noted that about one-fifth of Jordan's "poverty pockets" are located in Mafraq governorate; whereas, in general, the incidence of poverty in Jordan is higher in rural areas (19 percent) than in urban areas (10 percent) (FAO 2014). As we will discuss in the employment section of this paper, refugees make up a large share of the agricultural workforce.

Figure 2.5. Refugees in Jordan in 2015 – number (in thousands) (left) and as a percentage share of total population (right), by governorate

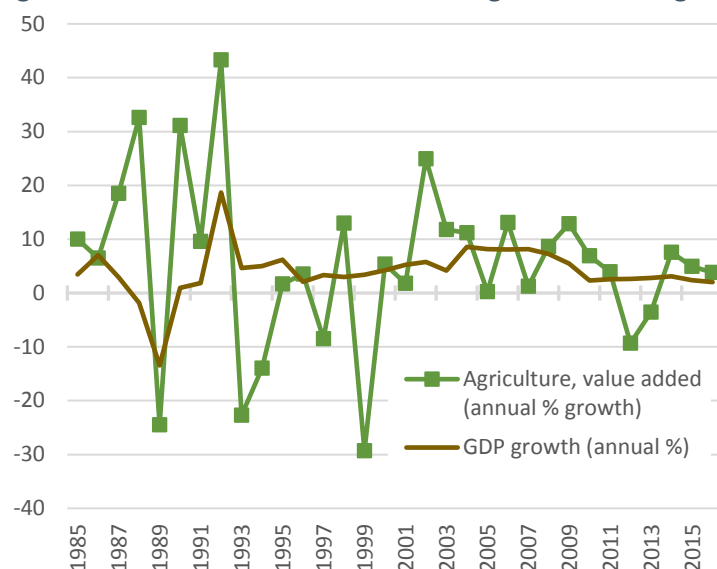


Source: Author's calculations based on National Census 2015

3. AGRICULTURE AND THE AGRO-PROCESSING INDUSTRY IN JORDAN

Since the mid-1990s, agriculture has been part of the structural reforms under the Agricultural Structural Adjustment Program (ASTAP) and the Agriculture Structural Adjustment Loan (ASAL) by the World Bank. These structural reforms aimed at minimizing distortions and ensuring a balance between the use of natural resources for agricultural and non-agricultural uses. However, the implementation of these reforms has yielded mixed results. While some reforms have improved the efficiency of markets through lifting price controls and liberalizing external trade, it has also been argued that at least part of the decline in agriculture growth in the late 1990s (Figure 3.1) was attributed to the structural adjustment program (UN 2007). A major drawback was that improved horticulture export potentials were not fully captured in the reform programs due to inadequate attention to market intelligence and trade promotion (World Bank 2003).

Figure 3.1. Jordan – annual value-added growth in the agricultural sector, 1985 to 2016



Source: World Development Indicators (2017)

Table 3.1. Selected aspects of the structure of the Jordanian economy

	Share in GDP	Share in Ag GDP or agro-processing GDP	Share in total employment	Share in exports	Export intensity*	Share in imports	Import intensity**
Agriculture	4.5	100.0	1.7	8.6	24.8	5.9	17.7
<i>Crops</i>	2.6	57.8	1.1	5.3	27.3	5.5	27.2
Vegetables	1.3	27.8	0.5	2.1	21.7	0.1	0.7
Fruits	0.5	11.7	0.2	0.9	22.1	0.0	1.4
Other crops	0.8	18.3	0.3	2.4	39.6	5.4	58.8
<i>Livestock & Fishery</i>	1.9	42.2	0.6	3.4	21.7	0.4	3.1
Livestock	0.8	17.6	0.3	1.5	21.7	0.3	5.2
Poultry	1.1	24.3	0.4	1.8	21.5	0.1	1.2
Fishery	0.0	0.4	0.0	0.0	33.8	0.0	8.5
Agro-processing	12.5	100.0	13.6	20.3	23.2	18.3	20.7
Agri-food	7.4	59.5	8.0	12.5	26.7	6.7	15.3
Textile	0.1	1.0	0.1	2.1	21.1	2.5	23.4
Carpeting	0.1	1.2	0.2			0.3	62.3
Clothing	3.6	29.1	4.0	3.1	17.1	5.6	26.1
Leather	0.0	0.2	0.0			0.1	92.6
Footwear	0.1	0.8	0.1	0.2	31.8	0.0	8.8
Wood	0.1	1.0	0.1	0.9	49.5	1.8	64.7
Furniture	0.4	3.2	0.4	0.7	36.4	1.3	51.6
Paper	0.5	4.1	0.6	0.8	11.9	0.1	0.9
Other industry	19.0	n/a	20.0	33.0	22.8	39.6	11.9
Services	64.0	n/a	64.7	38.1	9.2	1.8	0.5
<i>Total non-agricultural</i>	95.5	n/a	98.3	91.4	14.1	59.8	14.0
Total	100.0	n/a	100.0	100.0	14.7	100.0	14.2

Source: Social Accounting Matrix (2006)

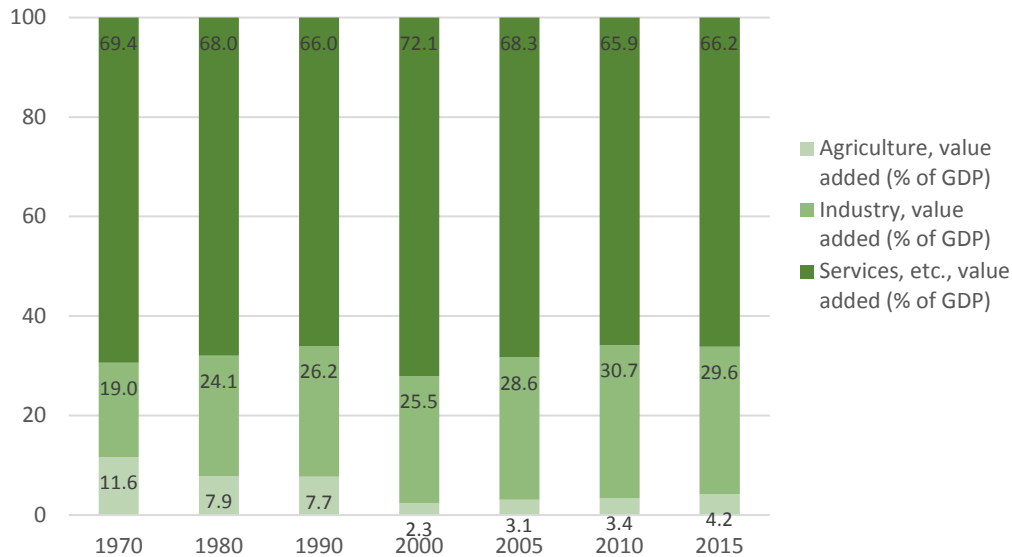
* Export intensity is the share of exported goods and services to total domestic output. Numbers higher than 100 can be explained by re-exports.

** Import intensity is the share of imported goods and services relative to domestic consumption.

The agricultural sector in Jordan accounts for 4.5 percent of the country’s GDP with vegetables representing almost a third of total agriculture value-added (Table 3.1). One quarter of total agricultural exports are vegetables and fruits, which are mainly exported to other countries in the MENA region (Economist Intelligence Unit 2015). In contrast, other crops (excluding vegetables and fruits) constitute the highest share of agricultural imports, making up 91 percent of all agricultural products imported. The share of imports made up by vegetables and fruits is negligible. Looking at the export and import intensities for agriculture reveals that the sector is more export-oriented than import-oriented: 23 percent of all agricultural products are exported, with a higher export intensity for vegetables and fruits at 40 percent. Furthermore, despite its relatively low share of the national economy, agriculture has almost doubled its contribution to GDP between 2000 and 2015 from 2.3 to 4.2 percent (Figure 3.2), driven by increase in domestic demand. The agriculture sector has displayed promising growth rates over the past few years, with a compound annual growth rate of 12 percent between 2010 and 2015.

Despite the recent increase in the contribution of agriculture to Jordan’s economy (Figure 3.2) the share of the economy made up by agriculture in 1970 was almost three times that of 2015 with 11.6 and 4.2 percentage shares, respectively. Thus, the importance of agriculture to Jordan’s economy is significantly less now than it was four decades ago, suggesting that the Jordanian economy has been going through a process of structural transformation (Nin Pratt et al. forthcoming). The loss of value in the agricultural sector has been accompanied by a parallel growth of industry. As shown in Figure 3.2, between 1970 to 2015 the share of the economy made up by the industrial sector grew around 57 percent, while the share made up by the services sector remained practically unchanged.

Figure 3.2. Jordanian economy, value-added by sector, 1970 to 2015



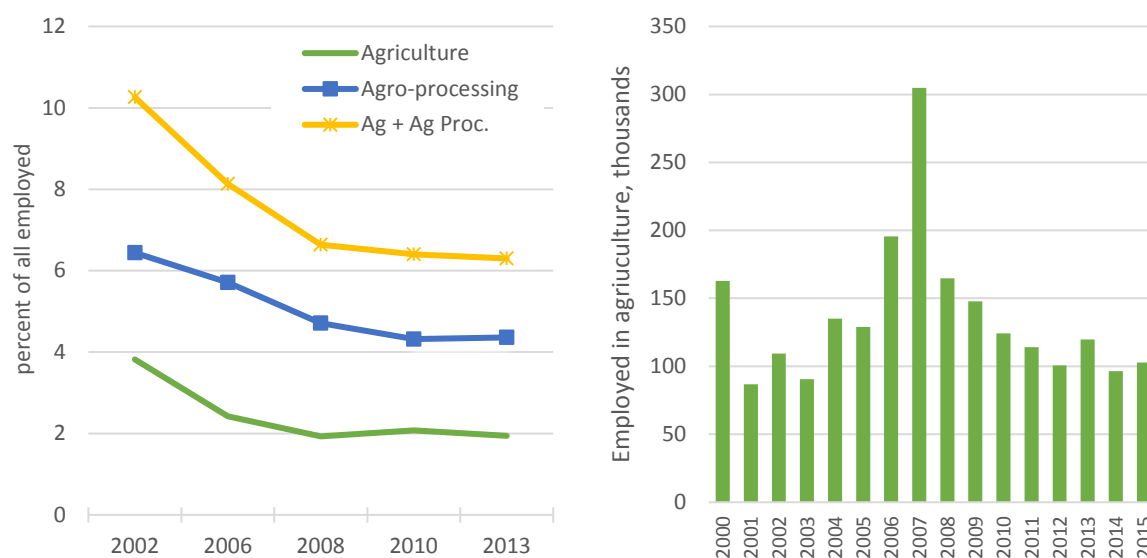
Source: Author’s calculation based on World Development Indicators (2017)

Within the industrial sector and strongly related to agriculture, the agro-processing sector plays a significant role. As shown in Table 3.1, about 12.5 percent of total value-added in the economy is due to activities in the agro-processing sector, with 60 percent of this contribution due to agri-food activities. The agro-processing sector also accounts for 20 percent of total exports, with an intensity of 23.2 percent. The importance of the sector can also be observed by the share of total employment in the economy being in agro-processing, which at 13.6 percent is more than seven times larger than the share of employment in agriculture.

Agriculture and agro-processing for employment creation

The role of the agriculture sector for employment has been decreasing, but remains important for migrant laborers. As shown in Figure 3.3, the share of employment in agriculture has decreased from 3.8 percent in 2002 to 1.9 percent in 2013. This decrease came together with an increase in the relative importance of industry and services – an increase of 4.8 points in industry and a marginal 0.8 points for services. However, while the share of Jordanians working in agriculture has gone down, many refugees are employed in the sector. According to Department of Statistics, non-Jordanians constitute the majority of labor in agriculture – about 85 percent of livestock workers and 92 percent of crop labor in 2015 were non-Jordanians (Figure 3.4). Permanent employment is far more important than seasonal and casual employment. At the same time, employment in crops has been decreasing between 2013 and 2015, years during which Jordan experienced a large influx of refugees.

Figure 3.3. Employment in agriculture and agro-processing in Jordan as percentage share of all employed (left) and total employed in agriculture (in thousands) (right), 2002 to 2013

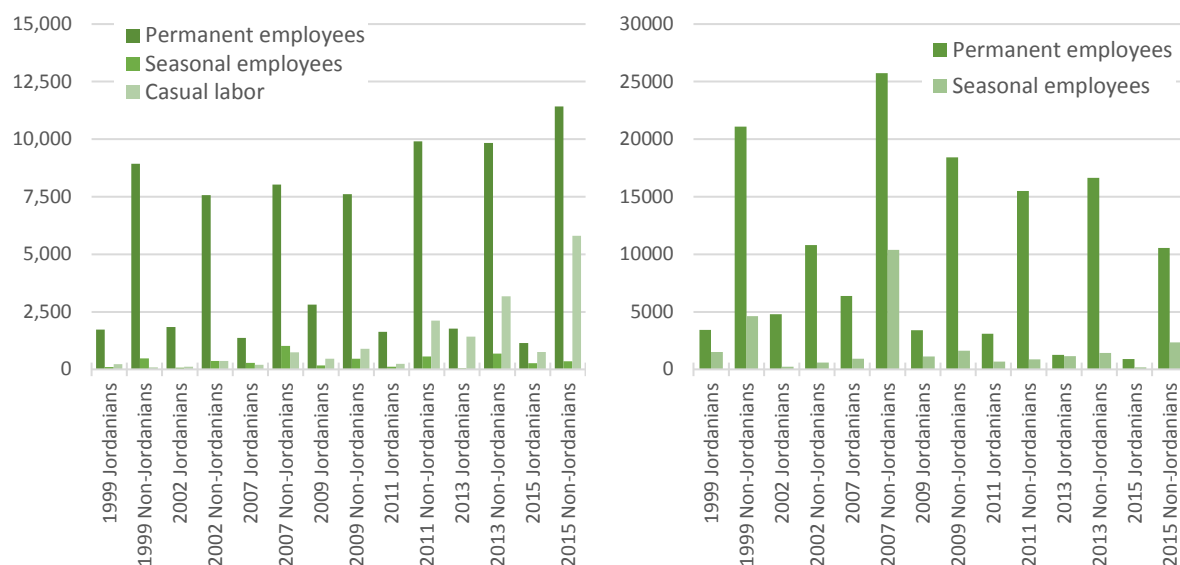


Sources: Authors' calculation based on HEIS (left); Authors' calculation based on Department of Statistics, Jordan (right).

This may partly explain the different patterns that emerge from the data of the Household Expenditure and Income Survey (HEIS) and those from the Department of Statistics. The slowdown in the contribution of the agriculture sector to employment can also be observed in absolute terms (Figure 3.3 right) – after a peak in 2007 of 300,000 workers, employment in the sector declined sharply so that by 2015 the sector employed only 100,000 workers.

Employment in agro-processing has also declined over the past ten years according to the HEIS (Figure 3.3 left). It is important to note, however, that HEIS mainly surveys Jordanian households and may omit refugees that work in the agro-processing industry.

Figure 3.4. Total working age individuals employed in livestock husbandry (left) and in crop production (right) in Jordan by citizenship, 1999 to 2015

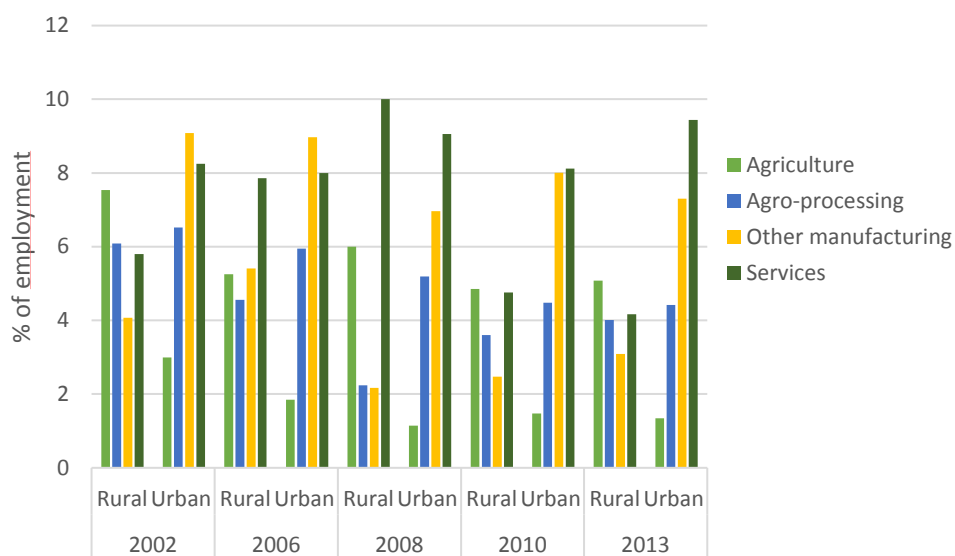


Source: Author's calculation based on Department of Statistics Jordan

As in most countries, the role of agriculture in employment in Jordan is more important in rural than in urban areas. In 2015 the share of agriculture in total employment was 5.0 percent in rural areas and 1.3 percent in urban areas. Moreover, both areas experienced a decline in the share of those employed working in agriculture from 7.5 to 5.0 percent in rural areas and from 3.0 to 1.3 percent in urban areas between 2002 to 2015 (Figure 3.5). Over the same period there was also a significant drop in the share of those employed working in agriculture across all governorates in the country (Figure 3.6). On average, Jordanian governorates experienced a 55 percent drop in share of employment in agriculture, with this loss being higher for Tafilah and Zarqa at 80 and 70 percent, respectively, and lower for Mafraq and Aqaba at 38 and 40 percent, respectively. However, between 2010 and 2013, five of the 12 governorates experienced a reversal of this trend, especially in Aqaba where the share of those employed working in agriculture grew by a factor of four in comparison with 2010. Moreover, except for Balqa, the governorates that did not experience an increase in agricultural employment are those that host the majority of Syrian refugees. One possible explanation for the agricultural employment trends in these governorates is that refugees took up employment in agriculture.

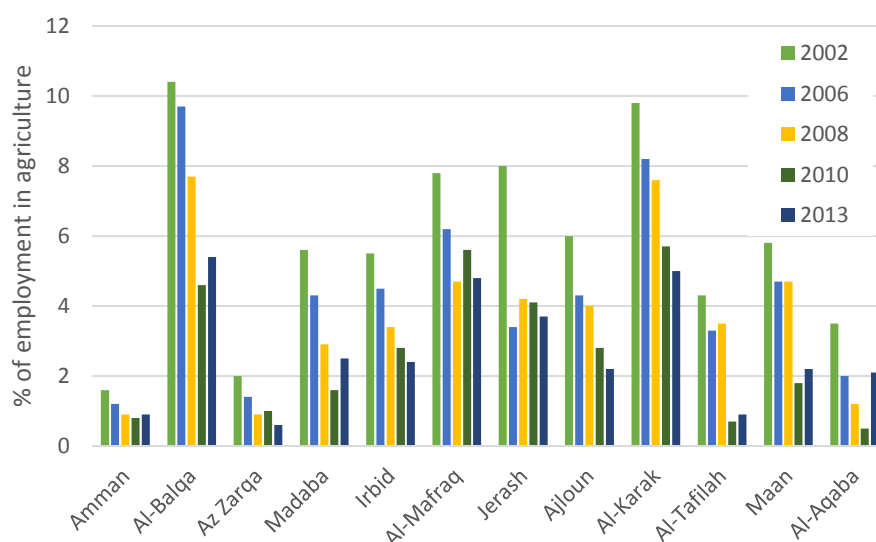
Some interesting patterns are observed when looking at trends in employment in the agro-processing sector over time. Although the role of agro-processing is less relevant over time (2002-2013), in urban areas, employment in agro-processing is higher than in rural areas over the same period (Figure 3.5). This suggests that the agro-processing sector has contributed to structural change by creating jobs in higher-value activities.

Figure 3.5. Employment in Jordan by sector in rural and urban areas, 2002 to 2013



Source: Author's calculation based on Department of Statistics of Jordan

Figure 3.6. Employment in agriculture in Jordan by governorate, 2002 to 2013.



Source: Author's calculation based on Department of Statistics of Jordan

Productivity and structural change in agriculture

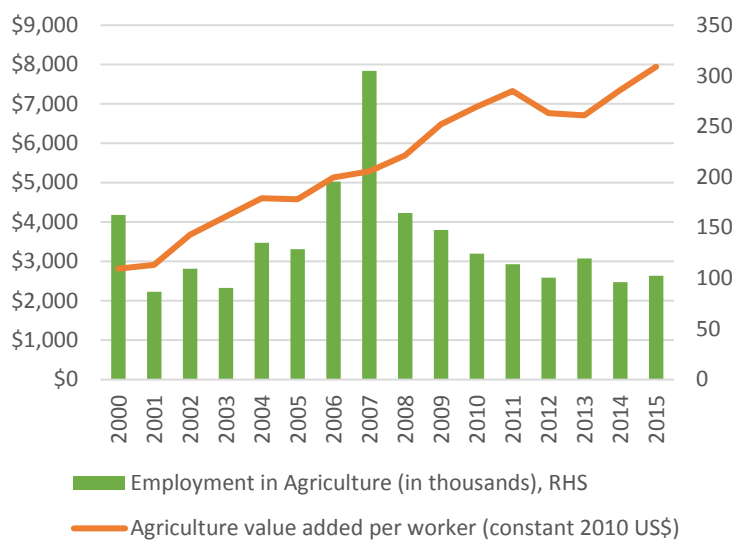
As shown, the share of agriculture in the Jordan economy is low but has been increasing over the past few years. At the same time, employment in agriculture has declined, which means that productivity in the agricultural sector has increased or agricultural growth was driven by structural change within the sector. Here we examine the drivers of agricultural growth by looking at labor productivity, yields, and characteristics of structural change.

Labor productivity

Figure 3.7 shows that labor productivity in the agricultural sector has been steadily increasing since 2000. Agricultural value-added per worker in 2000 was approximately USD 3,000 (at constant 2010 prices), but USD 8,000 15 years later, representing an increase of 166 percent. The performance of the Jordanian agriculture sector is above the average of medium income countries (MIC) and superior to that observed in other MENA countries with a similar level of development, like Egypt. In

2013, the average value-added per worker for MICs was about USD 2,000, while it was USD 5,000 in Egypt, in contrast with almost USD 7,000 in Jordan.

Figure 3.7. Agriculture labor productivity in Jordan, 2000 to 2015

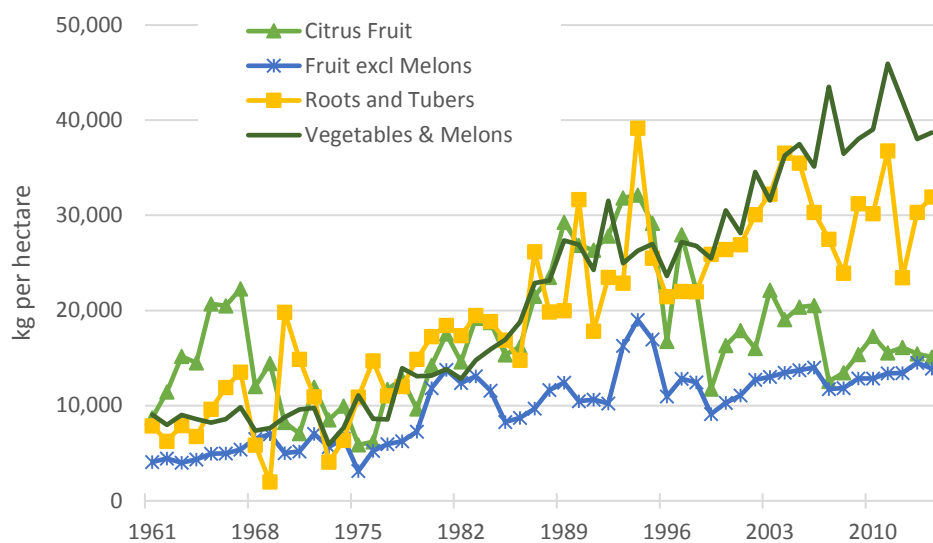


Source: Author’s calculation based on World Development Indicators (2017), and Department of Statistics Jordan

These trends are in line with the analysis by Nin-Pratt et al. (forthcoming) that shows the comparative advantage of agriculture for 23 countries in the MENA region. Together with Egypt and Tunisia, Jordan is one of the few countries in the region with a clear advantage in agriculture, especially regarding agriculture exports. Moreover, Jordan is the top performer – only surpassed by Lebanon – in terms of labor productivity and labor productivity growth in the MENA region.

Yields

Figure 3.8. Yields of selected crops in Jordan, 1961 to 2013

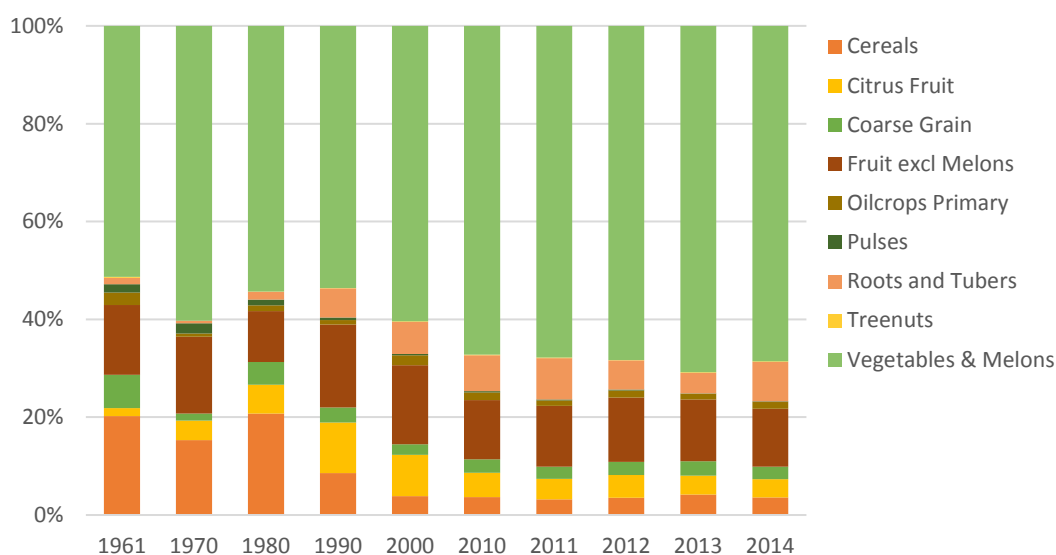


Source: Author’s calculation based on FAO Stat.

Structural change in agriculture

Jordan has experienced significant structural change in the agriculture sector of the economy, generally moving from lower value crops, like cereals, to higher value crops, like fruits and vegetables. Figure 3.9 shows the changes in crop shares of agricultural output for the period 1961 to 2014. The crop mix in Jordan overall since 1961 has significantly changed towards vegetable-oriented production. In 2014, vegetable production accounted for 70 percent of total crop output in the country, followed by 12 percent for fruit production. The largest increase in the share of crop production is observed for roots and tubers, whose production in 1961 represented only one percent of total output, but accounted for about 8 percent of output in 2014. In contrast, and as mentioned above, the relative importance of cereals for the agriculture sector is very low in comparison with 1961 when 20 percent of total output was given by cereals. This pushes Jordan to import practically all the wheat and other cereals consumed in the country (Economic Policy Council 2017).

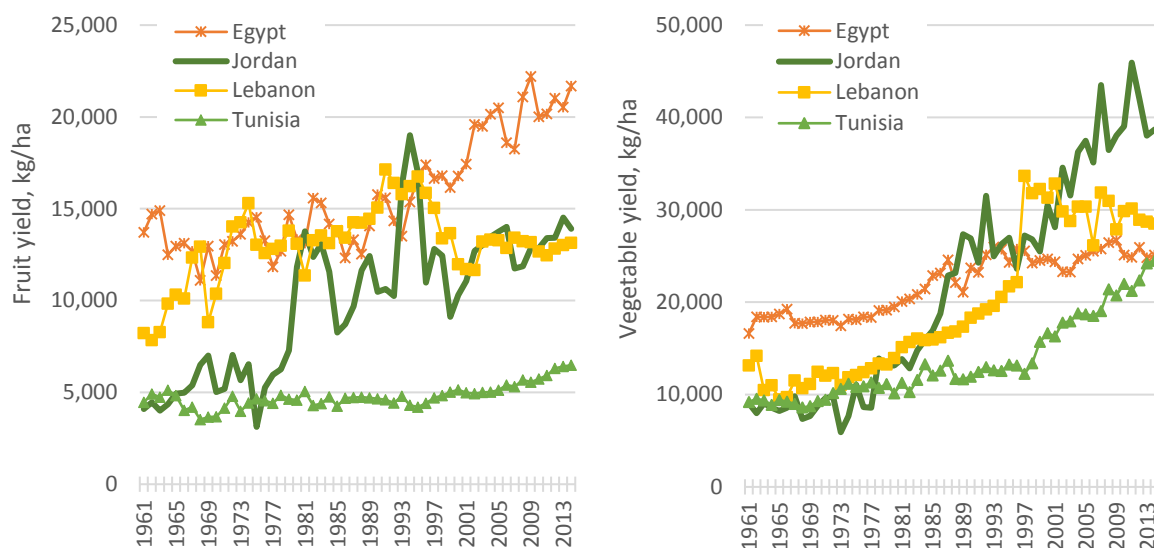
Figure 3.9. Composition of total crop output in Jordan, by category of crop share, 1961 to 2014



Source: Author's calculation based on FAO Stat.

In support of these structural changes, Jordan has successfully increased its yields of major crops, particularly vegetables. A comparison of Jordan's yield of fruits and vegetables from 1961 to 2013 with yields from Egypt, Lebanon and Tunisia, shows mixed results (Figure 3.10). For fruits, Egypt demonstrates a better performance overall, while Jordan shows high yield fluctuations over this period. This shows that, despite of the growth in fruits yields since early 1980s, there is still room for improving crop productivity. For vegetable yields, Jordan has successfully increased its productivity since the early 1990s, surpassing the average yields realized in Egypt, Lebanon, and Tunisia.

Figure 3.10. Fruits (left) and vegetables (right) yield comparisons: Jordan, Egypt, Lebanon, and Tunisia, 1961-2013



Source: Author's calculation based on FAO Stat.

4. THE ROLE OF AGRICULTURE AND AGRO-PROCESSING FOR HOUSEHOLDS EMPLOYMENT AND WELFARE

As suggested by these analyses, the agricultural and agro-processing sectors of Jordan have undergone significant change over past decades. To further explore how these developments have played out at the household level and to shed light on the changing characteristics of Jordanian families participating in agricultural and agro-processing activities, we analyze the social, demographic, and economic characteristics of Jordanian households over time. This analysis at household level is to gain a better understanding of the kind of households that tend to remain in agriculture and what kind may move away to other sectors. Although our analysis does not intend to provide a causal interpretation, the analysis of household characteristics associated with the decision to remain in agriculture can help to understand how the transformation process has been affected by households' involvement in different sectors, and at the same time, which specific household characteristics are associated with this process.

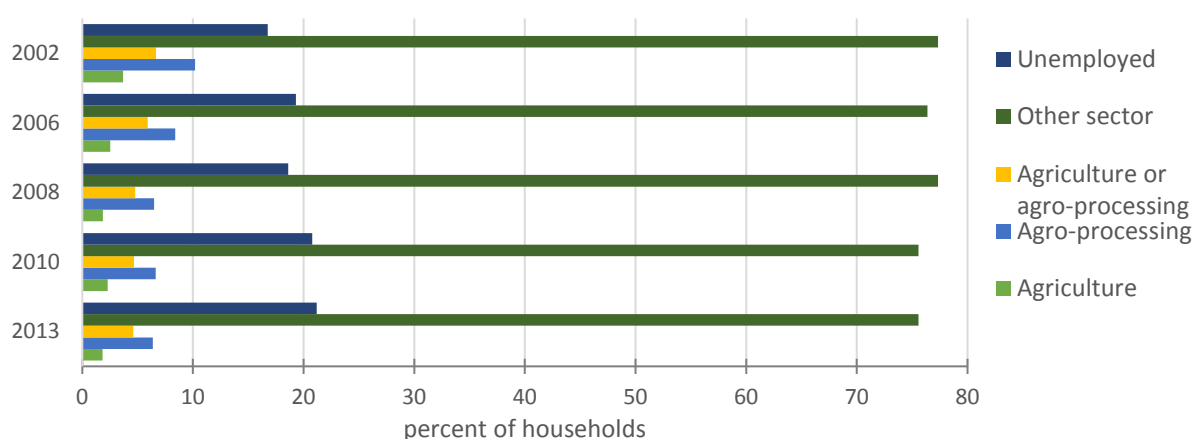
As observed in other countries, the transformation process does not occur simultaneously for all households. Typically households start moving out from agriculture depending on how well "equipped" they are to benefit from opportunities in other sectors. For example, some jobs in the industrial and service sectors require skills that demand higher levels of education. In such cases, it is expected that households with higher levels of education would move away from agriculture more quickly than less educated households. Moreover, the transformation process does not occur at the same time for all family members, precisely for the same reasons that make some households move away to other sectors and others remain in agriculture. To pick up these nuances in our analysis, we categorized households according to the number of members who work in different sectors, with a focus on agriculture and agro-processing. Previous analyses in other countries have analyzed the transformation process using similar categorizations. For example, El-Enbaby et al. (2016) compare households in Egypt where all members work in agriculture with households where some members are in other sectors, and define these as "mixed households". Examples outside the MENA region include Diao et al. (2017) and Owusu, Abdulai, and Abdul-Rahman (2011).

For the analysis of Jordanians households, we used the following definition of households:

1. **Agricultural households** have at least one member aged 15 or above whose main occupation is working in agriculture;
2. **Agro-processing households** have at least one member aged 15 or above whose main occupation is in agro-processing activities; and
3. **Other households** are those in which no members are found in agriculture or agro-processing. This type refers to households working in services, or industry or manufacturing, excluding agro-processing.

To assess changes over time, we analyze data from five rounds of the Jordanian Household Expenditure and Income Survey (HEIS): 2002, 2006, 2008, 2010, and 2013 (OAMDI 2014a; 2014b; 2014c; 2014d; 2017). The HEIS is representative of households at national and governorate levels and contains detailed information on household labor, demographic, and socioeconomic characteristics. We present results for rural and urban areas and for all Jordanian governorates.

Figure 4.1. Jordanian households with members employed in specific sectors of employment, 2002 to 2013



Source: Author's calculation based on HEIS.

Note: Households have at least one member employed in sector in question. A single household may have members employed in more than one sector.

The share of households in agriculture, which was already relatively low in 2002, experienced a modest decline between 2002 and 2013 (Figure 4.1). In 2002 about four percent of households in Jordan had at least one member in agriculture, in contrast with 1.8 percent in 2013. Agro-processing has been more important for employment generation as can be seen from a higher share of agro-processing households in the country. Nonetheless, the importance of the sector has also been decreasing following the trend observed for agricultural households: the share of agro-processing households went from 6.7 percent in 2002 to 4.7 percent by 2013.

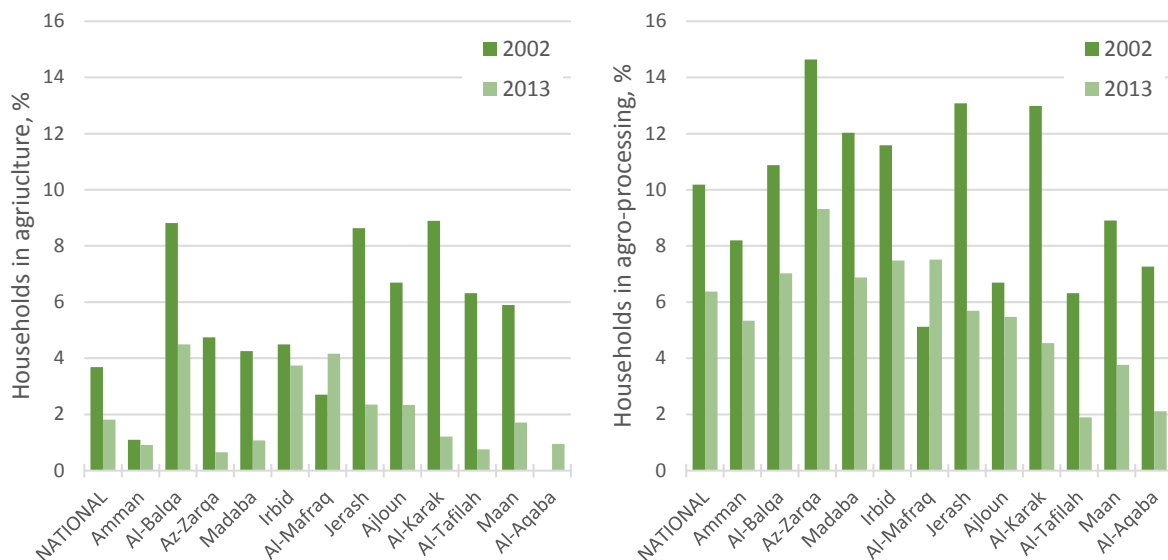
These numbers contrast with the share of unemployed households where no single member reported being employed. Not only the share of unemployed households is large for all years, but also it has increased in the same period from 16.7 to 21.2 percent.

On the other hand, the non-agricultural sectors have not absorbed workers coming from agriculture or agro-processing, as the share of "other-sector" households have remained relatively stable in the same reference period at around three-quarters of all households. This suggests that people moving out of agriculture often do not find formal employment in other sectors. Further, it seems that the observed growth of the agro-processing sector described earlier, either relies on

increases in labor productivity, e.g., through the use of more machines, or on the employment of non-Jordanians workers who are not reflected in national official surveys like the HEIS. This might explain the low share of agricultural households in national household surveys too.

At the governorate level, the HEIS results show that the share of households with at least one member in agriculture and agro-processing in most governorates has declined, but this decline is not uniform across governorates (Figure 4.2). Only two governorates experienced gains in the share of households in agriculture between 2002 and 2013. In this period, the share of households with members working in agriculture in Mafraq went from 2.7 to 4.2 percent, a 54 percent increase. The other governorate registering an increase in the share of households working in agriculture is Al-Aqaba, but the results should be taken with caution due to missing information in 2002. The remaining ten governorates saw varying declines in agricultural households ranging from 88 percent in Tafilah to 17 percent in Amman. The share of households in agro-processing activities also decreased for most governorates. Again, only in Mafraq is a positive increase observed from 5.2 to 7.5 percent of households. The largest loss in agro-processing households took place in Aqaba and the smallest in Ajloun, with 71.0 and 1.8 percent, respectively.

Figure 4.2. Share of Jordanian households that depend on agriculture (left) and agro-processing (right) by governorate, 2002 and 2013



Source: Author's calculation based on HEIS

Which factors are associated with the move of households out of agriculture and agro-processing in Jordan? Table 4.1 presents demographic and economic indicators for the household types. Households in agriculture and agro-processing tend to be older and less educated. In both rural and urban areas, heads of agricultural and agro-processing households are on average older than heads of households employed in other sectors than agriculture or agroprocessing ("Other" households). Further, household heads working in industry, services or manufacturing show higher educational levels. This might be the result of these households having younger members, since, as in other countries in the region, educational attainment has been increasing in Jordan, resulting in higher education levels for younger generations. For example, less than one percent of rural households in agriculture or agro-processing have a head with higher education in contrast with almost 15 percent of "Other" households. In urban areas, a similar pattern is observed, although the educational gap between agro-processing households and households in other sectors is less pronounced. There is also a higher level of education among urban households than rural ones.

Table 4.1. Demographic characteristics of households in Jordan, 2013

	Rural				Urban			
	Agri-cultural	Ag-pro-cessing	Other	Unem-ployed	Agri-cultural	Ag-pro-cessing	Other	Unem-ployed
Age of head, years (mean)	49.2	53.1	46.4	55.9	45.3	50.3	47.0	57.1
Age of spouse, years (mean)	42.0	45.4	39.8	45.8	40.4	43.9	40.2	48.3
Household size (mean)	6.0	6.3	5.6	4.5	6.1	5.5	5.4	4.0
Household members per room (mean)	1.6	1.6	1.5	1.3	2.0	1.5	1.5	1.1
Income earners (mean)	2.2	2.9	2.4	1.8	2.7	3.0	2.6	1.7
Disposable annual income, JOD (mean)	8,188	8,408	9,132	5,414	9,442	8,502	10,088	6,361
Poor households (%)	39.5	26.3	17.0	23.9	33.3	15.4	14.9	15.3
Male-headed household (%)	93.0	78.4	90.5	69.8	91.4	91.3	92.0	68.2
Head is literate (%)	78.1	69.5	88.6	66.1	94.5	92.8	95.4	82.3
Spouse is literate (%)	75.7	78.2	87.2	72.3	89.1	94.1	94.3	87.8
Head is Jordanian (%)	92.7	97.3	97.9	96.9	93.0	90.8	93.9	89.3
Education of head (%)								
None	36.5	31.8	18.8	44.9	22.5	13.4	11.1	29.4
Primary	45.8	48.0	51.7	42.5	58.6	59.0	44.2	36.1
Secondary	16.8	19.0	15.0	6.7	13.5	7.1	14.3	9.4
Post-secondary	0.9	1.1	14.4	5.9	5.4	20.4	30.4	25.1
Education of spouse (%)								
None	31.3	32.1	18.9	40.6	28.8	12.2	9.3	20.1
Primary	46.9	40.7	43.4	44.8	45.3	47.3	39.2	44.0
Secondary	11.3	11.9	11.7	6.1	15.9	13.0	16.8	20.0
Post-secondary	10.6	15.3	26.0	8.5	9.9	27.4	34.7	15.9
Maximum education level in household (%)								
None	2.9	0.0	0.7	14.5	0.0	0.0	0.8	14.1
Primary	44.4	43.3	30.4	46.4	47.7	33.2	26.1	35.2
Secondary	32.4	29.8	21.8	19.7	27.5	20.7	19.5	15.6
Post-secondary	20.2	26.8	47.1	19.4	24.8	46.0	53.5	35.2

Source: Author's calculation based on HEIS

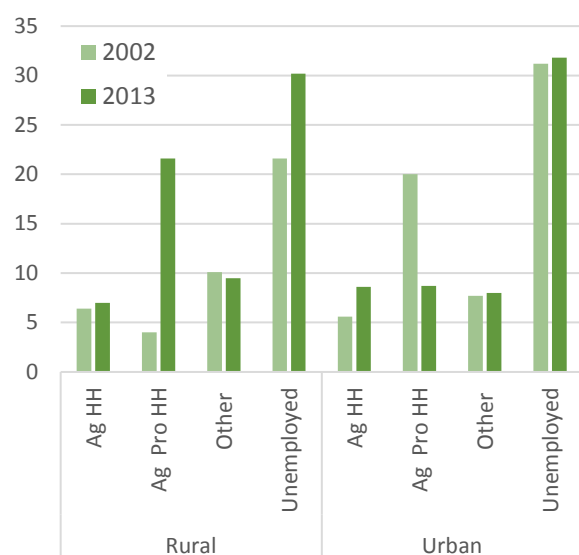
Note the higher level of education among spouses vis-à-vis household heads. Within household types, the education of the spouse is higher than the level of education of the head. This is probably due to the fact that spouses are on average younger than household heads. On the other hand, the education of other members of the household is associated with participation in agricultural activities. Looking at the maximum level of education of any member for all household types reveals that higher levels of education are found among non-agricultural households.

Agricultural labor is associated with a higher incidence of poverty levels as measured by income, being higher among rural households. The share of poor households, i.e., those in the lowest two deciles of household annual expenditures, is always higher among agricultural households and seems to decrease as households rely less or not at all on agriculture. For example, in rural areas, 40 percent of household in agriculture are poor, in comparison with 26 and 17 percent of households involved in agro-processing and in other activities, respectively. Although households in urban areas are generally less poor, the same pattern is observed – the group of households relying less on agriculture shows a lower incidence of poverty: about 33 percent of agricultural households are poor while the share among non-agricultural households is 15 percent. Although not shown in Table 4.1, the disadvantage of agricultural households in terms of poverty is observed even when comparing these households with unemployed households.

Although the analysis does not permit disentangling the causes of the observed higher poverty shares among agricultural households, it is possible to observe that some characteristics, which are typically associated with poverty, are more prevalent among these households. For example, in rural areas the percentage of households headed by non-Jordanians is highest among agricultural households at about 7 percent. As poverty is more prevalent in rural areas and the agricultural sector relies mostly on non-Jordanians, it is likely that the agricultural sector is absorbing a large percentage of the low-skilled non-Jordanian labor force.

On the other hand, the role of women in the transformation process can be seen in the higher share of households engaged in agro-processing that are led by women. In 2013, one in every five rural households engaged in agro-processing were headed by women. The percentage of households headed by women has been increasing over time (Figure 4.3). In rural areas, agro-processing households led by women went up from 4.0 to 21.6 percent between 2002 and 2013. However, the opposite trend is seen in urban areas – the share of households led by women in agro-processing decreased by 56 percent from 20.0 to 8.7 percent.

Figure 4.3. Female-headed households in 2002 and 2013, by rural/urban



Source: Author's calculation based on HEIS

This descriptive analysis provides an initial overview of how the employment of households is distributed according to different characteristics. However, to explore to which extent these characteristics are correlated with the decision of households to participate in agricultural or other economic activities, we carried out a multivariate regression analysis taking household employment type as the dependent variable. We run four models using the following dependent variables: 1) Household in agriculture; 2) Household in agro-processing; 3) Household in agriculture or agro-processing; and 3) Household employed in other sectors. The results are presented in Table 4.2.

The multivariate analysis confirms some of the observations found with the descriptive analysis. For example, being poor is negatively associated with households not engaged in agriculture and positively associated with agricultural activities (0.656 vs -0.372, respectively). Interestingly, the association is negative for households in agro-processing (-0.282) suggesting the potential of the sector for income generation and employment, especially in rural areas, where it is more likely to find households in agro-processing and agriculture in comparison with urban areas.

Table 4.2. Logistic regression for predicting sector of economic participation of household, 2013

	Agriculture	Agro-processing	Agriculture & agro-processing	Other sectors
Poor ¹	0.656*** (0.0160)	-0.282*** (0.0126)	-0.00788 (0.0101)	-0.372*** (0.0123)
Urban ²	-1.290*** (0.0161)	-0.132*** (0.0137)	-0.579*** (0.0104)	0.449*** (0.0126)
Number of income earners in household	0.655*** (0.00828)	0.637*** (0.00509)	0.683*** (0.00468)	6.339*** (0.0200)
One female income earner in household ³	0.400*** (0.0197)	0.467*** (0.0113)	0.459*** (0.0101)	-0.127*** (0.0185)
Two or more female income earners in household ³	0.378*** (0.0465)	0.146*** (0.0278)	0.214*** (0.0248)	-6.374*** (0.0622)
Head is between 35 and 49 years ⁴	-0.252*** (0.0237)	-0.0113 (0.0181)	-0.112*** (0.0145)	0.204*** (0.0159)
Head is older than 50 years ⁴	-0.365*** (0.0300)	-0.0953*** (0.0201)	-0.172*** (0.0167)	-0.139*** (0.0207)
Spouse is between 35 and 49 years ⁴	0.410*** (0.0220)	1.029*** (0.0160)	0.851*** (0.0130)	-0.652*** (0.0146)
Spouse is older than 50 years ⁴	0.621*** (0.0289)	0.524*** (0.0191)	0.465*** (0.0161)	-0.280*** (0.0202)
Head is male	0.560*** (0.0309)	-0.253*** (0.0174)	-0.0138 (0.0156)	-0.0420*** (0.0183)
Head has primary education ⁵	-0.870*** (0.0196)	-0.129*** (0.0141)	-0.439*** (0.0117)	-0.136*** (0.0158)
Head has secondary education ⁵	-0.902*** (0.0274)	-0.796*** (0.0204)	-0.894*** (0.0167)	0.426*** (0.0219)
Head has more than a secondary education ⁵	-2.518*** (0.0437)	-0.714*** (0.0187)	-1.073*** (0.0167)	0.491*** (0.0218)
Maximum education level in household is primary ⁵	1.180*** (0.0623)	0.406*** (0.0131)	2.058*** (0.0600)	-0.416*** (0.0331)
Max. ed. level in household is secondary ⁵	1.203*** (0.0633)	0.292*** (0.0136)	1.990*** (0.0604)	-0.284*** (0.0342)
Max. ed. level in household is more than secondary. ⁵	0.250*** (0.0647)		1.457*** (0.0606)	0.0849** (0.0341)
Main source of household income is remittances ⁶	1.038*** (0.0255)	-1.010*** (0.0305)	-0.0618*** (0.0187)	-0.816*** (0.0163)
Main source of income is business & other activities ⁶	0.846*** (0.0315)	-0.485*** (0.0256)	-0.0789*** (0.0200)	-0.445*** (0.0169)
Head not employed	-1.375*** (0.0235)	-0.216*** (0.0132)	-0.523*** (0.0118)	-0.251*** (0.0167)
Head is Jordanian	-0.177*** (0.0287)	-0.491*** (0.0172)	-0.421*** (0.0150)	0.595*** (0.0176)
Constant	-4.893*** (0.0756)	-3.512*** (0.0354)	-4.409*** (0.0642)	-3.865*** (0.0441)
Observations	4,850	4,659	4,850	4,850

Source: Authors' calculation based on HEIS.

Notes: Dummy variables for each governorate included in the analysis but coefficients not shown. Values in parentheses are robust standard errors.

¹ Poor defined as the 2 first deciles of per capita average expenditures; ² Reference category is rural; ³ Reference category is no female earners in the household; ⁴ Reference category is 15-34 years old; ⁵ Reference category is no education; and

⁶ Reference category is source of income from salaries and pensions.

Households are more likely to participate in agro-processing and agriculture when they have more women contributing to income generation, highlighting the role of women for these households. In contrast with households in other sectors, like services and industry, it is more likely to find female earners among households in agriculture and agro-processing as suggested by the positive association between the number of female earners and the households' participation in these sectors. The importance of women for the agro-processing sector is also evident, as seen in the negative correlation of a household having a male head and agro-processing type (-0.253).

Households in agriculture are also less likely to rely on formal activities for income generation. Compared to households whose main income source are salaries or pensions, agricultural households are more likely to depend on remittances and income from business (1.038 and 0.846, respectively). Also, non-Jordanian households are more likely to be involved in agricultural activities than Jordanian ones, as can be seen from the negative association between having a Jordanian household head and agricultural type households (-0.177). The same relationship is also seen for households in agro-processing (-0.491).

5. THE FUTURE OF AGRICULTURAL AND AGRO-PROCESSING DEVELOPMENT IN JORDAN

These analyses highlight several opportunities and challenges that are important for the future development of agriculture and agro-processing in Jordan.

Jordan has gone through several reforms that have contributed to make the agricultural sector more productive and competitive. Agricultural marketing policies in Jordan comply with World Trade Organization (WTO) regulations since the country's accession to the WTO in 2000. Other agreements that had an impact on agricultural trade include the Great Free Trade Zone between Arab countries which has gradually removed all custom duties among members between 1998 and 2005. Jordan also signed the Jordan-EU Association Agreement in 2000, which provides for the establishment of a free trade area with exemption in custom duties on Jordanian exports of agricultural products. Jordan has also signed several bilateral trade agreements with a number of countries, such as USA and Singapore, since 2001. In particular, the Free Trade Agreement (FTA) with USA has opened the door for a wide range of Jordanian agricultural products to enter the US market with exemption or reduction of custom duties. However, the majority of Jordan's agricultural exports, particularly horticultural products, are directed towards Arab countries, which – in contrast to more sophisticated markets in the EU and USA – tend to have less strict quality and packaging requirements (Sidahmed et al. 2012).

In addition to considering higher quality and higher value export markets, there is still scope for improving productivity. Comparing Jordan's yields with those of Egypt, Lebanon, and Tunisia shows that Jordan has the highest yields for vegetables, but relatively lower yields for fruits and citrus fruits. Consolidation of fragmented lands, for instance, could lead to more diversification, use of modern technologies, and the expansion of greenhouse production of vegetables for export. High-value products, such as medicinal herbs and aromatic plants, also have good potential for expansion, particularly in locations suitable for production (Sidahmed et al. 2012). Importantly, these commodities possess high water use efficiency and have relatively high economic returns per unit area in comparison with conventional crops.

The most important opportunity may be growth in agro-processing industries. The combination of rapid urbanization and population growth leads to increased demand for processed foods, which presents an opportunity for expanding agro-industry to meet this demand with local

production (Bereuter, Glickman, and Reardon 2016). The agribusiness sector also represents an opportunity for attracting capital from both the domestic private sector and foreign direct investment.

The major challenge facing agricultural growth in Jordan is limited water and land resources. According to the Ministry of Agriculture, of a total land area of 89,000 km², 10 percent of the Kingdom's land is arable and only 2.7 percent is now being cultivated (approximately 2,000 km²). Moreover, Jordan is ranked among the world's most water scarce countries, with a water deficit of 312 mcm (million m³) in 2013 (MWI 2013). There is some evidence that Jordan has made progress in improving water efficiency due to the adoption of drip irrigation and related farming technologies, especially in the Jordan Valley, where these improvements have led to higher productivity (Van den Berg et al 2016). However, further efficiency gains are needed, as a large share of scarce water resources is diverted to agriculture through the public irrigation system in the Jordan Valley as well as the private underground scheme in the highlands (Molle, Venot, and Hassan 2008). In fact, the share of agriculture land under irrigation has increased about 7 percent in 2001 to around 10 percent in 2014, whereas irrigation constituted about 53 percent of total water use in Jordan.

Rainfed agriculture is especially vulnerable to climate change, which could lead to changes in farming systems (Al-Bakri et al. 2011). Climate change is expected to put pressure on rural communities to build up their adaptive capacities. For example, the adoption of soil water conservation is considered an important adaptation measure in order to increase available water to crops. In addition, there is scope for improved marketing, as the agriculture sector also suffers from weak linkages between production and marketing with an underdeveloped marketing information system (UN 2007; GOPA 2014).

6. SUMMARY AND CONCLUSION

Jordan has been affected by ongoing conflicts in neighboring countries over the past years, which resulted in slower economic growth and an increase in youth unemployment and food insecurity. In response to these challenges, the Government of Jordan has set itself ambitious targets in the country's Economic Growth Plan, the National Strategy for Agricultural Development, and the National Strategy for Food Security. In support of the implementation of these, the present paper has analyzed the role of agriculture and farmers in the Jordanian economy, the role that productivity and structural change can play for fostering agricultural growth, and the role agro-processing may play for development in Jordan.

The role of agriculture has been increasing over the past years, albeit from very low levels. Agricultural growth rates have started to pick up over the past years, which contributed to an increase of agriculture's share in GDP from 2.3 percent in 2000 to 4.2 percent in 2015. This growth was mainly driven by increasing labor productivity and rising yields for some crops, particularly vegetables. Structural changes within the sector have also contributed to growth by moving agricultural production towards high value crops, such as fruits and vegetables. Yet, there is still a potential for increasing agricultural growth, as foreseen in the agricultural development strategy, by further structural change, further increasing productivity, and, perhaps most importantly, by improving linkages between production and marketing. In addition to improving local markets, Jordan can also capitalize on its free trade agreements with major partners, such as USA and the EU, by targeting high quality production with stricter packaging requirements.

As one of the results of growing labor productivity, the share of households depending on agriculture has been decreasing over time. Our household analysis shows that the young and the

educated households tend to move out of agriculture, whereas older and less well-educated households tend to stay in agriculture. One way to promote innovation in agriculture and make farm households better off would be to make the sector more attractive for educated youth. Our analysis suggests that moving out of agriculture and into agro-processing can make people better off, as households in agro-processing are less likely to be poor in comparison with other types of households. In parallel, the role of migrant labor in agriculture appears to have been increasing, particularly with the recent influx of Syrian refugees in Jordan. While more research is needed on the role of migrant labor in agriculture, it is likely that these migrant laborers have filled a gap left by Jordanians that migrated out of agriculture and to urban areas. This incoming non-Jordanian labor at least sustained and potentially also supported growth in the agricultural sector.

While there is still potential for agricultural growth, the role of the agro-processing sector in Jordan is more important and has higher potential for growth going forward. According to latest available estimates, agro-processing activities make up 12.5 percent of GDP and make up an estimated 13.6 percent of employment. Our analysis also suggests that women play an increasingly important role for agro-processing, especially in rural areas, where about one in every five households in agro-processing was headed by women. Therefore, in addition to the agro-processing sector's role for the rural economy, the sector can also play an important role for increasing household incomes, women's incomes, and potentially youth employment. Anecdotal evidence suggests that agro-processing can be a more attractive employer for the country's youth than agriculture.

In sum, to further promote rural transformation for economic development and job creation, Jordan should continue its path of transition towards higher value agricultural and agro-processing production. There still also is scope for improving agricultural productivity, especially for fruits, and for the expansion of greenhouse production and adoption of high value and high water use efficiency crops, such as medicinal herbs and aromatic plants. Perhaps most importantly, incentivizing the expansion of agro-processing industries in rural areas to serve domestic and export markets should be considered.

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