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Comparative Advantages of Syrian Barley

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Executive Summary

The scarcity of natural resources and the ongoing opening of Syrian economy to the world markets call for an urgent need to reallocate domestic resources and tradable inputs within the agricultural sector towards the objective of increased specialization based on comparative advantages.

'Comparative Advantage' refers to the most cost-effective compromise between economic efficiency and social benefit. Policy makers are then able to consider to what extent the production of certain agricultural products is possible using domestic resources efficiently, or if it is worthwhile to substitute local production with imports and to use those domestic resources for other agricultural commodities that have potential comparative advantages.

The barley is the most important crop in syria. Its price and demand have increased dramatically. Thus, the Syrian policy makers are more concerned to study this vital crop.

Hence, the Policy Analysis Matrix (PAM) is used to evaluate the effects of both governmental interventions and market distortions. The PAM is calculated by the means of data on revenues and costs, at both market and social prices, to calculate profits and transfers and to derive the economic indicators of the PAM.

Regarding the current technology, the trend of the world prices, the samplings in 2006 and the available data the following conclusions were reached in the study:

- The major costs of barley production concentrate at farm level especially seed, fertilizer and harvesting costs. While the most costs of trader concentrate in the fixed and capital costs.
- Syria has a strong comparative advantage in producing the rain-fed barley in zone 2 (DRC[1]=0.58).
- Syria has reasonable comparative advantage in producing the rain-fed barley in zone 3 (DRC=0.85).
- Syria hasn't any comparative advantage in producing the rain-fed barley in zone 4 (DRC=1.9).

There are many ways to improve the comparative advantage of Syrian barley, in the mid and long term:

- Barley should be given more attention in the regions that have comparative advantage (zone 2 and 3). High yielding varieties adapted to environment might be invented, introduced and distributed. Furthermore, in order to maximize utilizing of the barley comparative advantage in the mentioned regions, barley should be expanded in these regions to substitute the crops that haven't any comparative advantages. This will contribute to reduce the government budget deficit and the amount of money spent on barley import. In addition, this will cover the shortage in livestock's fodder. Giving that, the international barley demand has been increasing due to using barley for generating the bio fuel.
- Legume crops should be entered in the agricultural rotation to enhance the soil fertility and to increase the yield.
- It's very important to cooperate between the General Commission for Agricultural Scientific Research (GCASR) and international organizations to create new varieties,

[1] Domestic resource cost ratio.

which are drought resisting and high yielding, especially in zone 4 to both increase production and improve the income.

1. Introduction

The Syrian economy has been gradually going through extensive transformations during the last decade with increased exposure to international competition by joining the Great Arabic Free Trade Area and signing the Free Trade Area Agreement with Turkey. Other sources of challenges are foreseeable with Syria's forthcoming Association Agreement with the EU and the prospect of accession to the World Trade Organization (WTO). In this respect, trade agreements involving reciprocal trade concessions will force Syria to liberalize its markets and to move further ahead towards a more market oriented economic system. This scenario may lead to appropriate reactions concerning improving economic efficiency and so enhancing international competitiveness, particularly in the agricultural sector. Therefore, policy makers need to make a comprehensive assessment of the potential impact of possible policy changes on the economic viability of Syrian produced commodities to increase their contribution to the economy.

The scarcity of natural resources and the ongoing opening of Syrian economy to the world markets call for an urgent need to reallocate domestic resources and tradable inputs within the agricultural sector, directed towards the objective of the increased specialization based on comparative advantages.

The concept of comparative advantages dictates that if a country has lower production cost of a good than that of the rest of the world, it should produce this good with its own domestic recourses (labor, capital, land and water) to supply its population and possibly to export. If this is not the case then it is more economically efficient to import this good and to reallocate domestic recourses to other goods that have comparative advantages. The aim of applying the concept of comparative advantages is to diversify domestic resources efficiently under free market conditions.

The Barley is considered the major fodder crop in Syria. Its price and demand have increased dramatically in recent years; one contributing factor to this evidence is its use to produce bio fuel. Thus, the Syrian policy makers are more concerned to study this vital crop.

1.1. Policy issues

Barley is an important strategic and fodder crop in Syria. The Syrian Government is involved in its production and marketing at various levels through the following activities:

- To protect domestic production, an additional tax on imports was levied until 1999, when it was reduced to 1% to enhance imports and to compensate for the fall of domestic production caused by the drought.
- The General Commission for Agricultural Scientific Research (GCASR) continues to create improved barley varieties which are adapted to the climatic conditions in the various regions. The objective of this policy is to both increase the average yield of the crop and to reduce its variability over the years (see below).
- The General Establishment for Seed Multiplication (GESM) distributes the improved seeds to the farmers through short in-kind loans. For barley, however, its activities are

very limited; in 2006, it distributed 1,000 tons of barley seeds, accounting for 1% of total barley need (125,984 tons).

- The Ministry of Agriculture and Agrarian Reform (MAAR) determines the price of improved barley seeds, through the GESM, depending on production cost (without any marginal profit). In 2006, the price was 12.1 Sp/kg
- The government sets up the barley price that is delivered to The General Establishment for Fodder (GEF). This price was fixed at 7.5 Sp/kg during the recent years. While it became 9.5 SP/Kg, in 2006. The official price is less than the cost determined by MAAE, in some year, (Table 1.1).

Table 1.1. Barley price and cost in Syria, 1997-2006 (SP/Kg)

year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
cost SP/kg	7.6	8.6	10.8	10.8	10.8	9.3	10.2	8.8	8.5	7.9
Official price SP/kg	7.5	7.5	7.5	7.5	7.5	12	7.5	7.5	7.5	9.5

Source: Elaborated from the MAAR Database.

- The General Establishment for Fodder (GEF) is the responsible governmental authority for the purchase of barley from farmers. It uses it for producing the fodders and imports the needed barley from abroad. The private sector has been allowed to import the barley since 1987.
- The production of barley follows a licensing system according to the indicative Annual Agricultural Production Plan (AAPP) of the Ministry of Agriculture and Agrarian Reform (MAAR).

1.2. The importance of barley

Barley is considered the first fodder crop in Syria. Therefore, the Government gives due attention to this crop to both improve the livestock sector and attain an adequate integration between crop and animal production. Barley is mainly used to feed ruminant animals, such as sheep and cattle. It is used also at very limited quantities in the feed ration for poultry layers. Sheep are the major consumers of barley in Syria.

Barley is mainly planted rain-fed in Syria. In 2006, its area attained 1.3 million ha accounting for 51% of the Syrian winter crops area. Barley concentrates in north and north east regions including AL-Hassakeh, AL-Rakka and Aleppo governments. Most of the barley area is located in climatic zones 2, 3 and 4. The production of barley mostly comes from zone 2 and 3. This is because the yield is very low in zone 4.

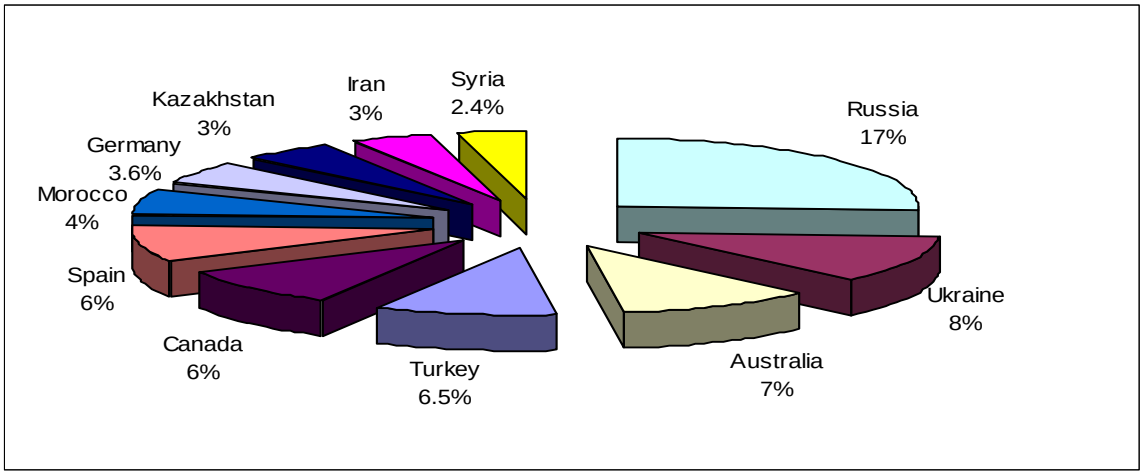
Hence, climatic changes and drought waves have a negative impact on barley production in Syria. In 2006, Syrian barley production attained 920 thousand tons.

1.3. Global and Syrian barley outline

Area

According to FAO Statistics, Syria barley area (1.3 million ha) accounted for 2.4% of barley world area (55.5 million ha). Russia has the largest area (9.6 million ha) accounting for 17% of the global area devoted to barley, followed by Ukraine 8%, Australia 7% and Turkey 6.5% (Figure 1.1).

Figure 1.1 Global barley area, 2006 (%)

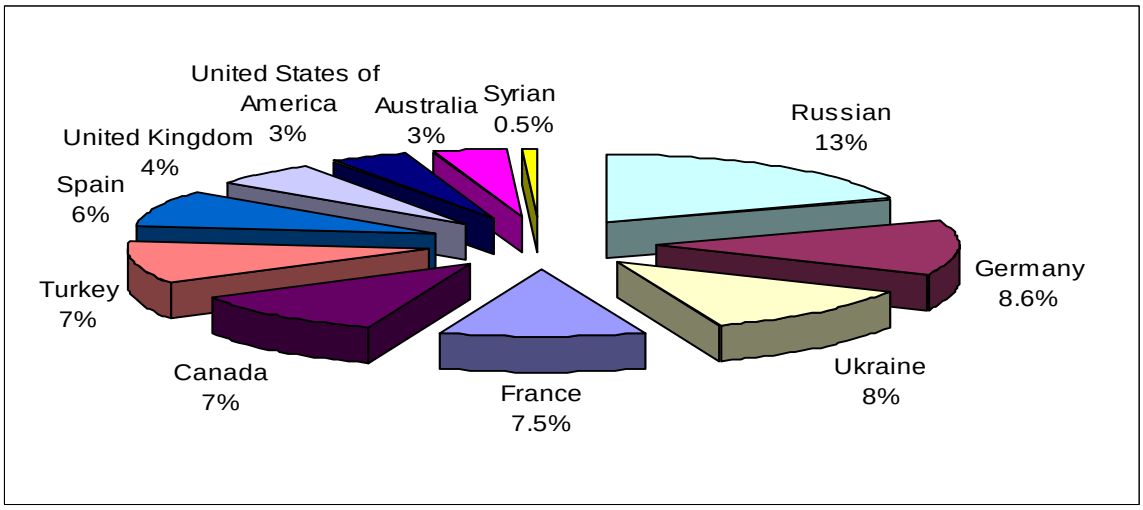


Source: Elaborated from FAO Statistical Database

Production

In 2006, Syrian barley production attained 700 thousand tons accounting for 0.5% of barley global production (139 million tons), According to FAO Statistics for the same year. Russia had the largest production 18 million tons, which accounts for 13% of global total. Russia has been followed by Germany (8.6%), Ukraine (8%) and France (7.5%), see Figure 1.2.

Figure 1.2 Barley production in the world, 2006 (%)



Source: Elaborated from FAO Statistical Database

This small production results from the low productivity compared with other counties. Keeping in mind, in some countries, barley is planted in irrigated or high rain rate areas; while, in syria, it's mostly planted rain-fed and in low rain fall areas. According to FAO Statistics Database, in 2006, Syrian productivity attained 868 kg/ha, accounting for approximately 1/3 of the global productivity (2,497 kg/ha). Belgium had the highest productivity (7,496 kg/ha), see Table 1-2. it's noteworthy that significant area of Syria barley is located in climatic zone 4 which has low productivity (312 kg/ha).

Table 1.2 Global barley productivity, 2006 (kg/ha)

Country	Productivity
Belgium	7,496
Saudi Arabia	6,900
Ireland	6,499
Kenya	6,343
Switzerland	6,191
France	6,152
Netherlands	6,028
United Kingdom	5,947
Germany	5,909
New Zealand	5,833
World	2,497

Source: Elaborated from FAO Statistical Database.

Trade balance of barley

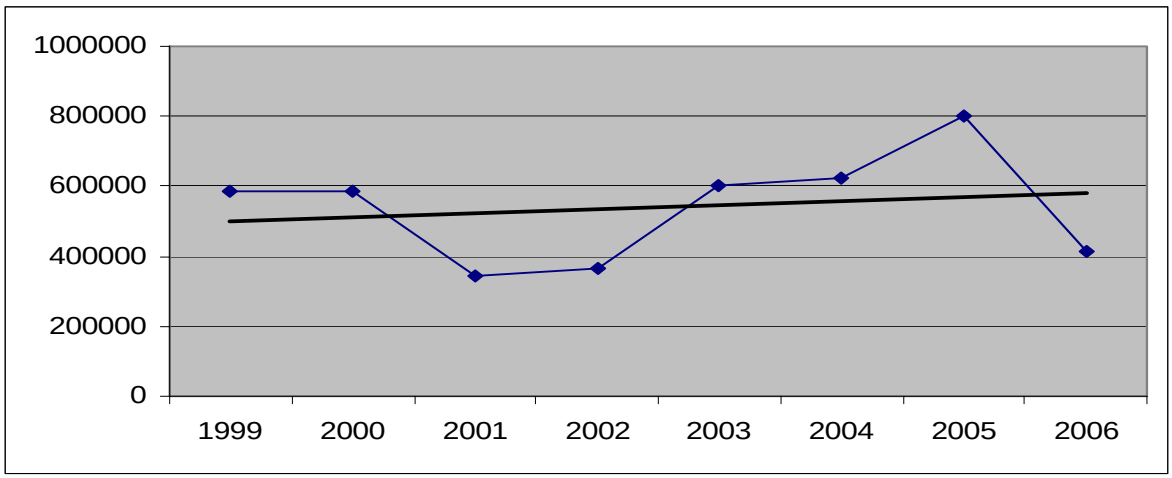
In Syria, most of the barley is used for feeding sheep. The demand for barley fluctuates from year to year depending on the number of livestock, the production of this year and the availability of grassing crops. Demand increases during drought periods and during the winter due to the lack of grass at that time. Syrian demand for barley was estimated by 2.3 million tons, in 2007, for both feed and seeds. Consumption is expected to increase due to the lack of grass in the Syrian steppe. Thus, the imported quantities decrease in the abundance years such as 2001 and increase in the drought years such as 2004 and 2005. The exported quantities are very small and can be zero in some years (Table 1.3, Figure 1.3).

Table 1.3 Barley trade balance, 1997-2006 (000 tons)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Production	983	869	426	212	1,956	920	1,079	527	767	1,202
Imports	0	0	584	588	345	368	601	625	803	462
Exports	297	0	0	0	0	89	546	194	2	0
Balance	686	869	1,010	800	2,301	1,199	1,134	958	1,568	1,664

Source: Elaborated from NAPC Statistical Database

Figure 1.3 Imported quantities of barley and their tendency, 1999-2006 (tons)



Source: Elaborated from NAPC Statistical Database

Table 1.4 shows the most important importing and exporting countries of barley in 2005. Global trade volume of barley attained 25 million tons. Syria imported 953 thousand tons of barley accounting for 3.8% of global total. Saudi Arabia was the major importer of barely (6360 thousand tons accounting for 25.6% of global total import), followed by China (9%) and Spain (7%). France was the main exporter of barley (5,042 thousand tons accounting for 20% of global total export), followed by Ukraine and Australia (3,415 and 3,339 thousand tons accounting for 13.7% and 13.4%, respectively).

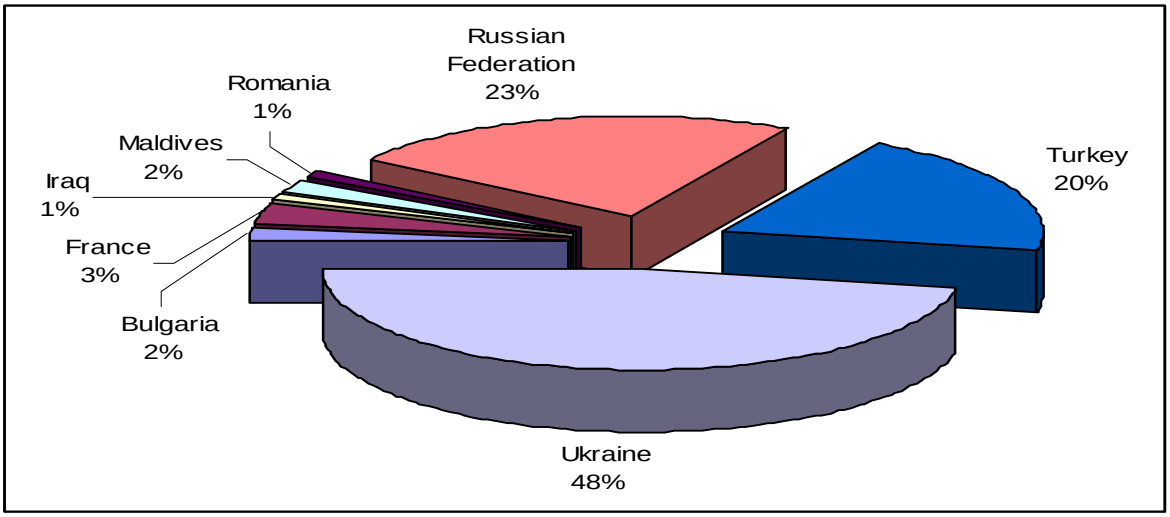
Table 1.4. The major importing and exporting countries of barley, 2005 (000 tons, %)

Exporting countries			Importing countries		
Country	**Quantity**	**%**	**Country**	**Quantity**	**%**
France	5,042	20.3	**Saudi Arabia**	6,360	25.6
Ukraine	3,415	13.7	**China**	2,276	9.1
Australia	3,339	13.4	**Spain**	1,702	6.8
Germany	2,894	11.6	**Japan**	1,411	5.7
Canada	1,876	7.5	**Iran, Islamic Rep of**	1,386	5.6
Russian Federation	1,678	6.7	**Belgium**	1,367	5.5
United Kingdom	840	3.4	**Netherlands**	1,145	4.6
United States of America	746	3.0	**Syrian Arab Republic**	953	3.8
Switzerland	530	2.1	**Germany**	901	3.6
Czech Republic	377	1.5	**Italy**	811	3.3
World	**24,878**	**100**	**World**	**24,877**	**100**

Source: Elaborated from NAPC Statistical Database

Ukraine is considered the most important trade partner of Syria; its share accounted for 48% of total imported quantities (803 thousand tons), in 2005. Russia had a significant share (23%), followed by Turkey (20%), see Figure 1.4.

Figure 1.4. Syria trade partners of barley, 2005 (%)



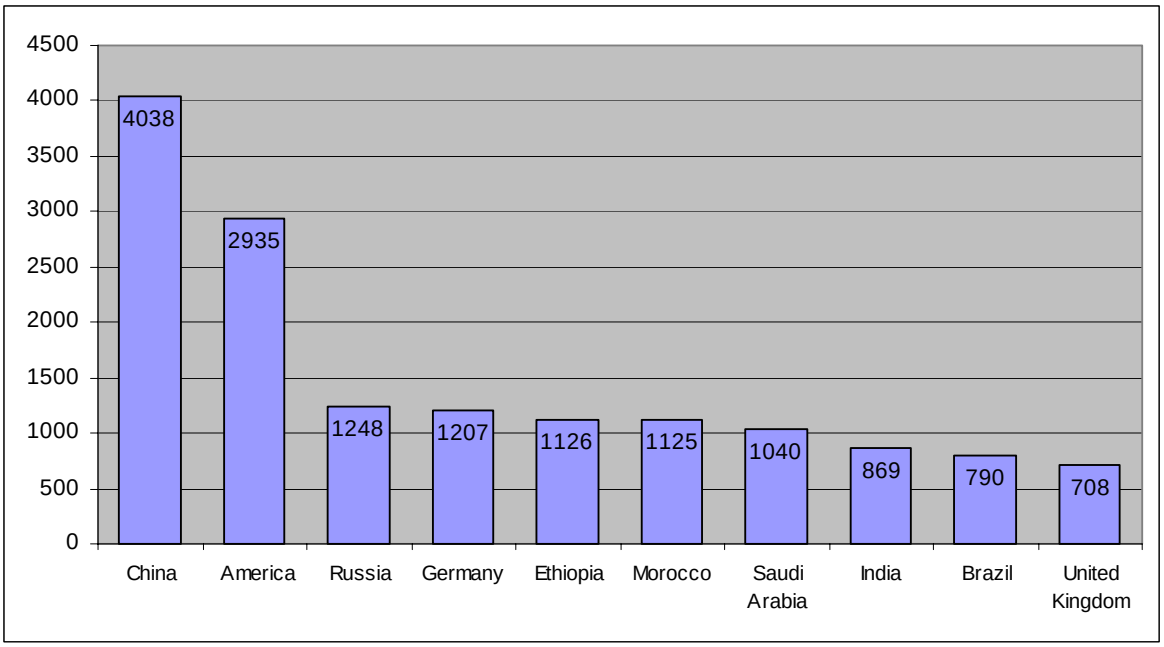
Source: Elaborated from NAPC Statistical Database

Syrian consumption of Barley attained 1,664 thousand tons in 2006. It was mostly used for animals feed[2]. According to FAO Statistics, the quantities of barley that are used for food purposes in the world attained 24,176 thousand tons in 2005. Globally Russia ranked third with 1,248 thousand tons, preceded by the United State of America with 2,935 thousand tons. China

[2] There is no information about barley quantities used for nutritious purposes.

ranked first with significantly larger share of barley consumption for food (4,038 thousand tons) than its competitors (Figure 1.5).

Figure 1.5. Global barley consumption for food, 2005 (thousand tons)

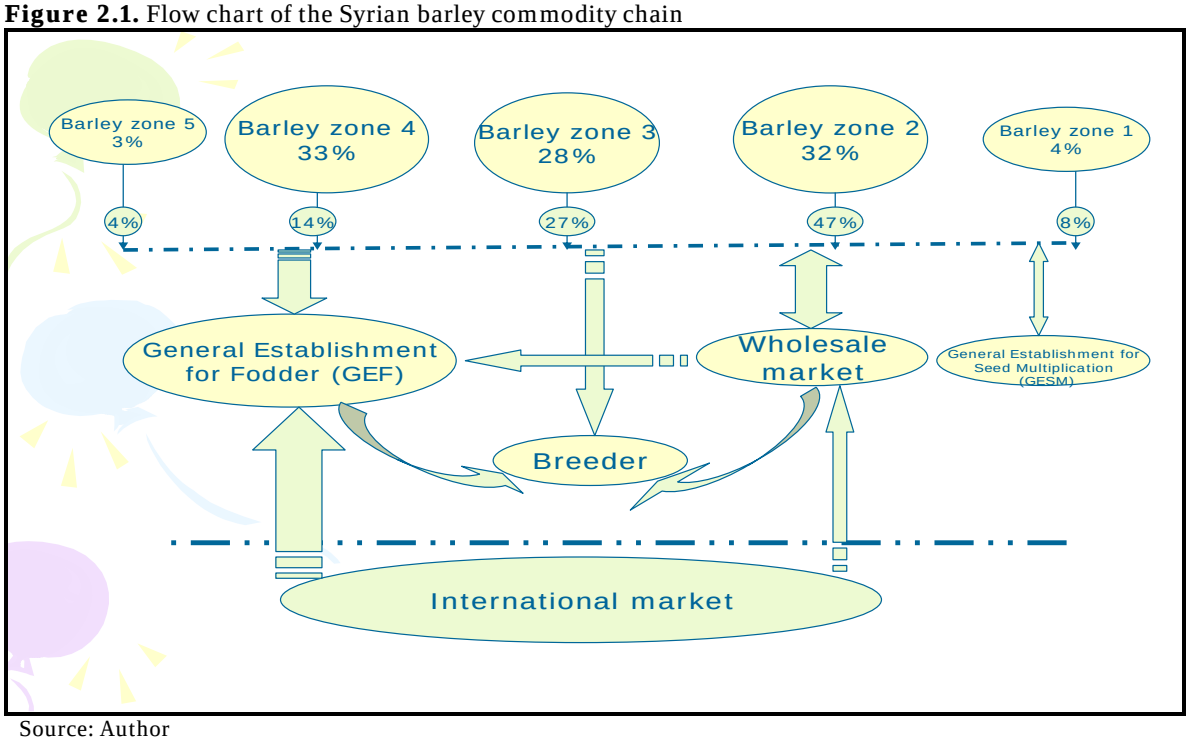


Source: Elaborated from NAPC Statistical Database.

2. Description of the Commodity Chain

Figure 2.1 shows the basic commodity chain structure and the flow percentages between its stages.

Figure 2.1. Flow chart of the Syrian barley commodity chain



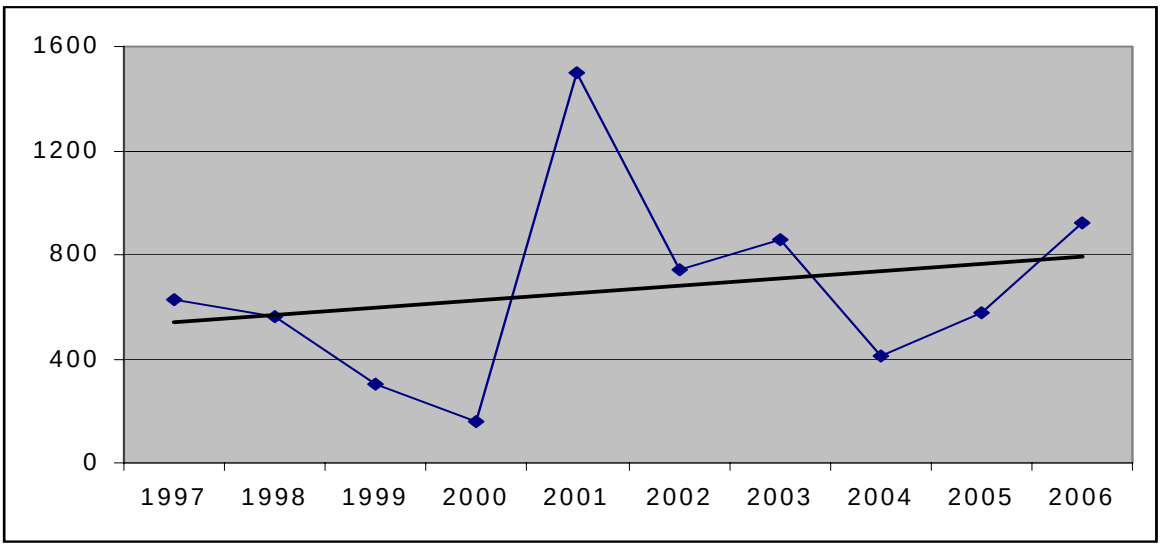
Source: Author

2.1. Description of the main commodity chain

Barley is planted mainly rain-fed in Syria, with an average annual production (over the last 10 years) of about 894 thousand tons and an average area of about 1.4 million hectares (about 27% of the total Syrian cropped land), which implies a yield of about 0.67 tons per hectares, with a slightly increasing trend influenced by the high yield in 2001 (see Figure 2.2). In 2006, the production of barley attained 1.2 million tons; the yield is 920 kg/ha.

Barley yield varies due to climatic circumstances (precipitation and temperature); in the drought years when the precipitation is very low, the production is impacted negatively (1999, 2000, 2004 and 2005). Furthermore, this has severe influence on the barley farmers in the Climatic Zone 4.

Figure 2.2. Implicit yields of barley in Syria 1997-2006 (kg/ha)



Source: Elaborated from NAPC Database

The peak of production was in 2001 about 1.9 million tons. In contrast, the trough was in 2000 about 0.2 million tons.

Most of the barley area is located in Climatic Zones 2, 3 and 4; however, the production mostly comes from zone 2 (50% of rain-fed barley production) and zone 3 (29%). This is because the yield is very low in zone 4 (Table 2.1).

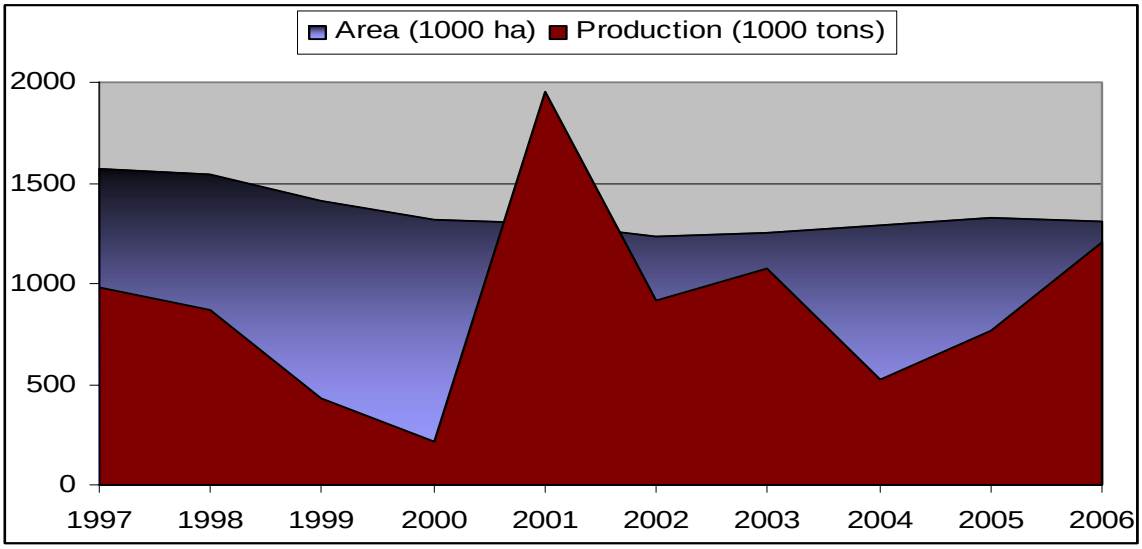
Table 2.1. Area, production and yield of barley by climatic zones, 2006

Climatic Zone	Planted area (000 ha)	(%)	Production (000 tons)	(%)	Yield (ton/ha)
Zone 1	46	%3.7	95	%9	2.1
Zone 2	409	%32.5	548	%50	1.3
Zone 3	363	%28.9	312	%29	0.9
Zone 4	420	%33.4	135	%12	0.3
Zone 5	18	%1.4	0	0	0.0
Syria total	**1,256**	**100.0**	**1,090**	**100**	**0.9**

Source: Elaborated from NAPC Database.

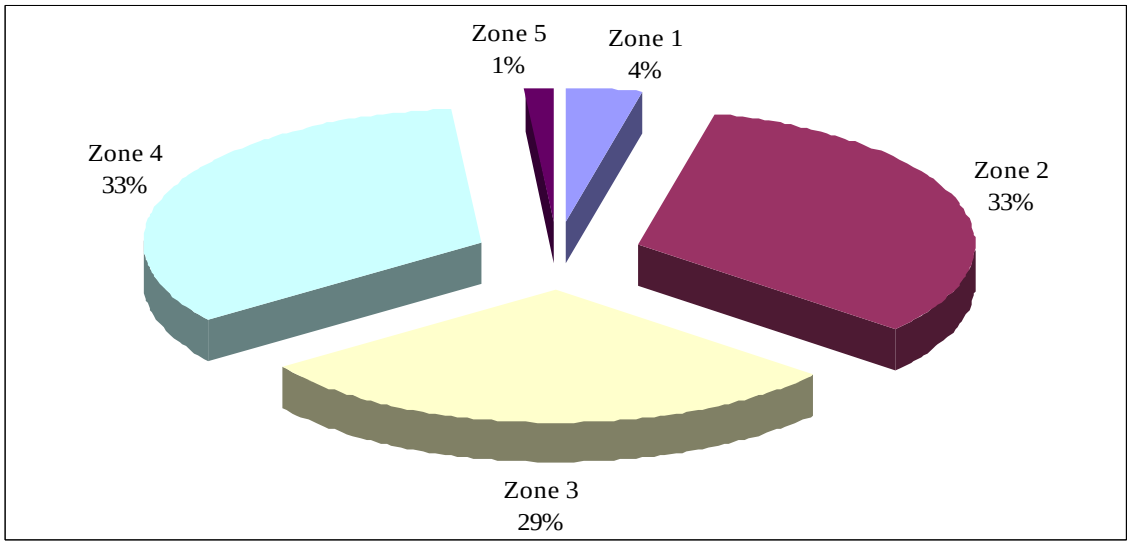
The area of the barley decreased over the last ten years from 1.57 million ha in 1997 to 1.3 million ha in 2006 (Figure 2.3). Barley is planted in different climatic zone and governorates; Barley area concentrates in zone 2 (29%), zone 3 (32.5) and zone 4 (33.4), in 2006 (Figure 2.4).

Figure 2.3. Evaluation of the area and production of barley, 1997-2006



Source: Elaborated from NAPC Database

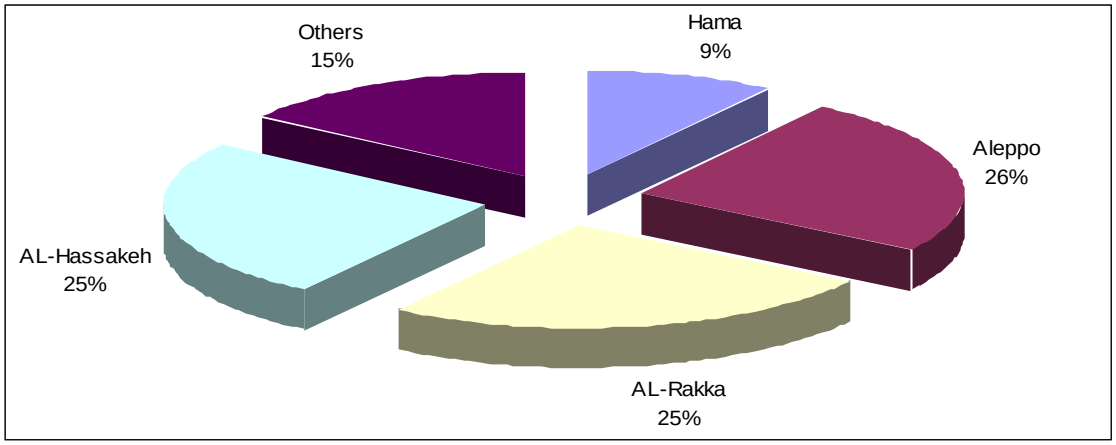
Figure 2.4 Barley areas according to climatic zones, 2006(%)



Source: Elaborated from NAPC Database

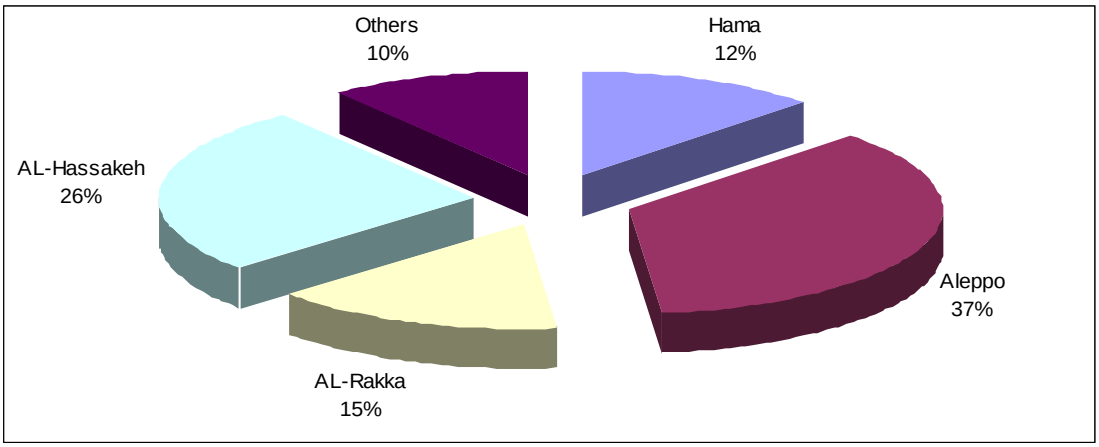
Barley area concentrates in the North and North east of Syria; AL-Hassakeh, AL-Rakka, and Aleppo areas account 76% of total barley area, Figure 2.5. However, barley production concentrates in Aleppo 37% and AL-Hassakeh 26%. AL-Rakka production is significantly low down, accounts for 15%, Figure 2.6. This due to 55% of Aleppo barley area locates in zone 2 while 46% of AL-Rakka barley area locates in zone 4.

Figure 2.5 Barley areas by governorates, 2006 (%)



Source: Elaborated from NAPC Database

Figure 2.6 Barley production by climatic zones, 2006 (%)



Source: Elaborated from NAPC Database

Table 2.2 shows the winter crops areas with their respective shares in 2006. Barley and wheat occupy the most of the area, 51% for barley and 37% for wheat. Wheat has the highest share of the irrigated area whereas barley covers first among the rain-fed crops.

Table 2.2. Winter crops area, 2006 (%)

Winter crops	Irrigated		Rain-fed		Total	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Wheat	810,127	%85	976,532	%38	1,786,659	%51
Barley	51,206	%5	1,256,165	%49	1,307,371	%37
Grazing barley	38,772	%4	479	%0	39,251	%1
Others green fodder crops	4,922.5	%1	983	%0	5,905.5	%0
Fodder legume crops	411	%0	34,556	%1	34,967	%1
Nutritious legume crops	14,896.8	%2	216,494.5	%9	23,1391.3	%7
Other crops	34,999	%4	57,204.1	%2	92,203.1	%3
Total	**955,334**	**%100**	**2,542,414**	**%100**	**3,497,748**	**%100**

Source: Elaborated from NAPC Database

2.2. Marketing

Both the private and the public sectors play a crucial role in the marketing of barley. But, the involvement of the public sector is diminishing in marketing and processing. The barley trade is currently liberalized[3]. Feed crops pass through many marketing stages: buying, storing, processing, filling and shipping etc. The external trade has been partly liberated since the beginning of 1996 when the private sector has been allowed to import barley. However, farmer has the choice of keeping his product or selling it to private traders, feeders, private fodder factories or to GEF.

During the recent years, the private sector has played a crucial role in barley marketing and has the competitiveness ability with the public sector. A lot of trader has the ability to store the barley until its price increases. GEF distributes the fodder rationed on feeders according to certain Tables; moreover, it may sell the surplus barley to feeder seeing that the availability of barley.

Private importers specialize in importation and do not get involved in domestic distribution other than when a large farm is prepared to buy at least one standard truck load of 13-15 tons, for example. They normally seek to sell a minimum of 50 to 100 tons. Traders normally sell the barley that they acquire from importers directly to farmers or feeders. Most barley is trans-shipped through Aleppo, with Al-Hassakeh being the most important consuming governorate.

2.3. Storage

Before 2004, the GECPT used to keep a strategic stock of barley for the use at times of shortage. All barley held by the GECPT was sold to the GEF or exported. The GEF, in turn, used only to acquire barley from the GECPT. The strategic stock was, in effect, used to stabilize the national availability of barley, with the quantity acquired and sold annually by the GEF being inversely related to annual barley production. When world prices, and therefore the demand for subsidized domestic barley, were high, the GEF gave priority to registered farmers, who were qualified for supplies through data about their livestock capacity.

In 2004, and due to the increase in barley prices, farmers preferred to sell their barley output in the market. Hence, in June 2004, the Government decided to stop purchasing barley from farmers, exclusively in 2004. The GEF now acts as a "buyer of last resort", able to buy barley at the administrated price, which is usually below the one prevailing at the market, (Grad and Karkout, 2007).

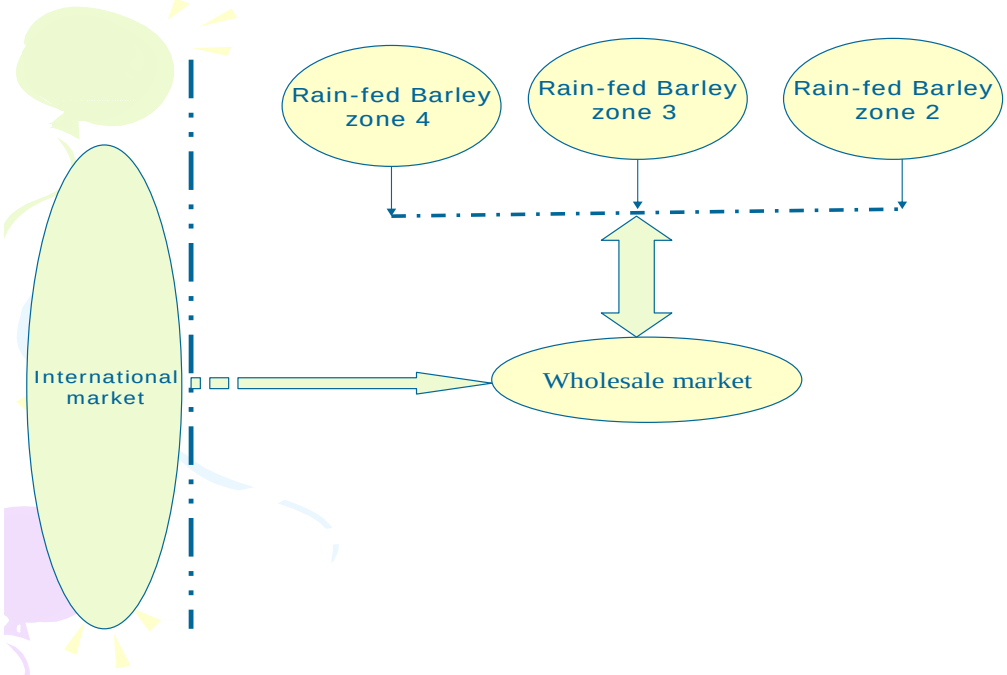
2.4. Commodity chain of the representative systems

The representative systems are determined according to the climatic production zones. The parity price of barley is accounted as if it is imported product. Consequently, three representative production systems of barley have been analyzed, Figure 2.7, as the following:

- Rain-fed barley system of Zone 2
- Rain-fed barley system of Zone 3
- Rain-fed barley system of Zone 4

[3] Barley outlook (Samir Garad and Mouzad karkout)

Figure 2.7 Representative production systems of barley



Source: Author

3. Commodity Chain Analysis

3.1. Data sources

The primary data was collected through various questionnaires with barley farmers in Aleppo (Zone 2 and 3), AL-Rakka (Zone 3 and 4) and AL-Hassakeh governorates (Zone 3 and 4). The data for traders and importers was collected through interviews in the aforementioned governorates and Damascus.

Most of the secondary data at the national level was obtained from the NAPC statistical database and from the data of the Centre Bureau of Statistics Database. Global data was obtained from the online sources and the FAO statistical database. Sector information was taken from relevant institutions (GEF and etc).

The data from the questionnaires (farmers and traders) was used and calculated to obtain a representative unique budget for each combination of production, traders and importers. These budgets include the fixed and intermediate costs as well as the profit. The tradable inputs are distinguished from the non-tradable inputs for each budget items, to comply with the concept of comparative advantages.

3.2 Farming budget

As mentioned before there are three farm budgets because of the differentiation among Climatic Zones. These budgets comprise fixed inputs, which are paid independent from production quantities, and variable inputs (direct labour and intermediate inputs). In other words, the budget includes quantities, prices, and total cost per one hectare for each input and output.

Labor is a local, non-tradable input. It is divided into permanent (qualified) labour, that is registered in an insurance company, and temporary (non−qualified) labour (daily and seasonal labourers). The labour cost was calculated by multiplying the number of work hours needed for the unit area with the cost of one work hour. The fixed cost of rain-fed barley is considered negligible.

3.2.1. Farm budget in zone 2

In 2006, according to the farm questionnaire samples in zone 2, the total cost, revenue and profit account for 8,114 Sp/ha, 11,275 Sp/ha and 3,161 Sp/ha, respectively. The yield attains 1.16 ton/ha. The cost of seeds and fertilizers account 55% of farm cost, Table 3.1.

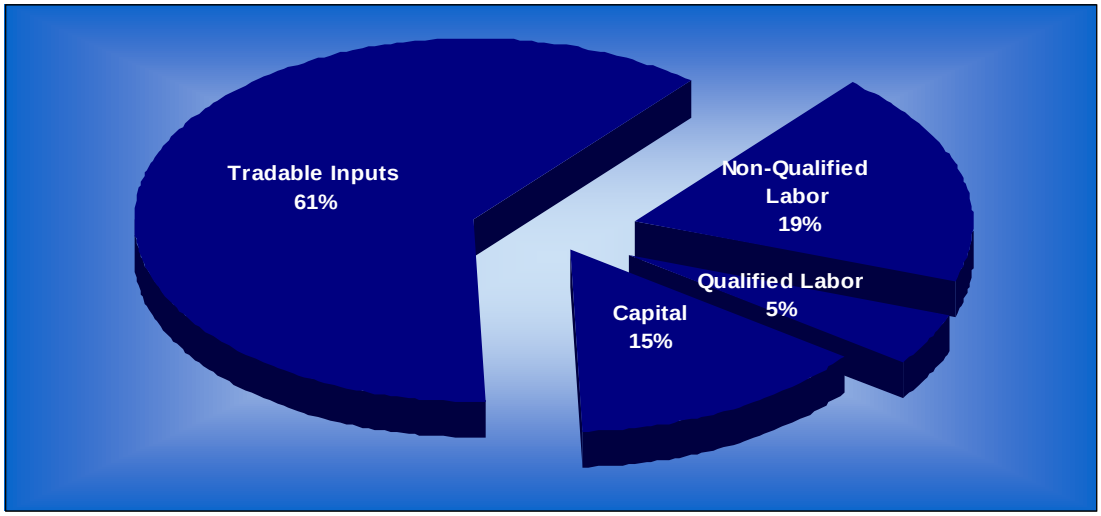
Figure 3.1 illustrates the farm budget in zone 2; the domestic factors (labor and capital) and the tradable inputs account for 39% and 61% of farm cost, respectively. The comparative advantage becomes better as the domestic factors decrease.

Tabel 3.1. Farm cost of rain-fed barley by items and climatic zones, 2006

Item	Zone 2	Zone 3	Zone 4
Tillage	9%	11%	11%
planting	3%	4%	6%
Harvesting	11%	12%	13%
Seeds	32%	48%	53%
Fertilizers	23%	10%	4%
Bags	7%	5%	4%

Source: Elaborated from NAPC Database

Figure 3.1. Rain-fed barley farm cost in zone 2, 2006



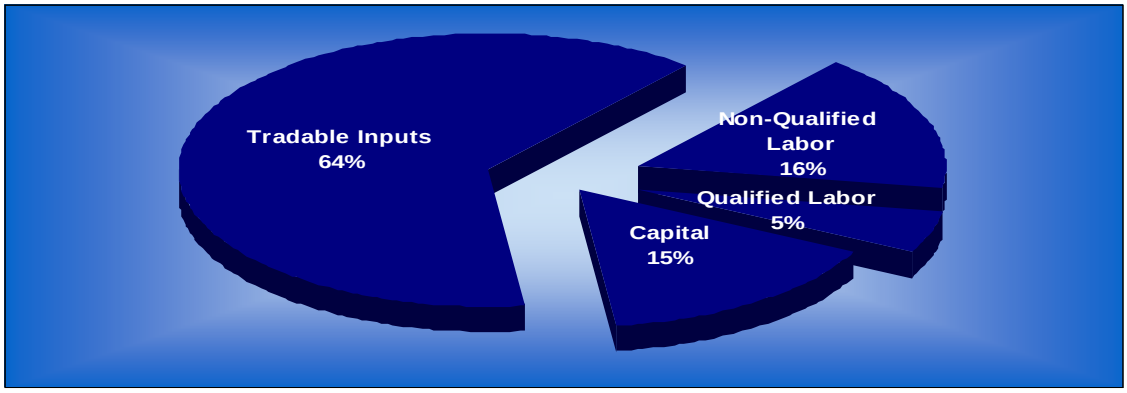
Source: Elaborated from NAPC Database

3.2.2. *Farm budget in Zone 3*

In 2006, according to the farm questionnaire samples in zone 3 (Table 3.1), the total cost, revenue and profit account for 4,628 Sp/ha, 5,113 Sp/ha and 485 Sp/ha, respectively. The yield was 0.53 ton/ha. The highest cost is related to seed cost (48% of farm cost), followed by harvesting cost 12%,.

The tradable inputs amount to 64% of farm cost. The domestic factor cost (labor and capital) reach 36% of farm cost (Figure 3.2).

Figure 3.2. Rain-fed barley farm cost in zone 3, 2006



Source: Elaborated from NAPC Database

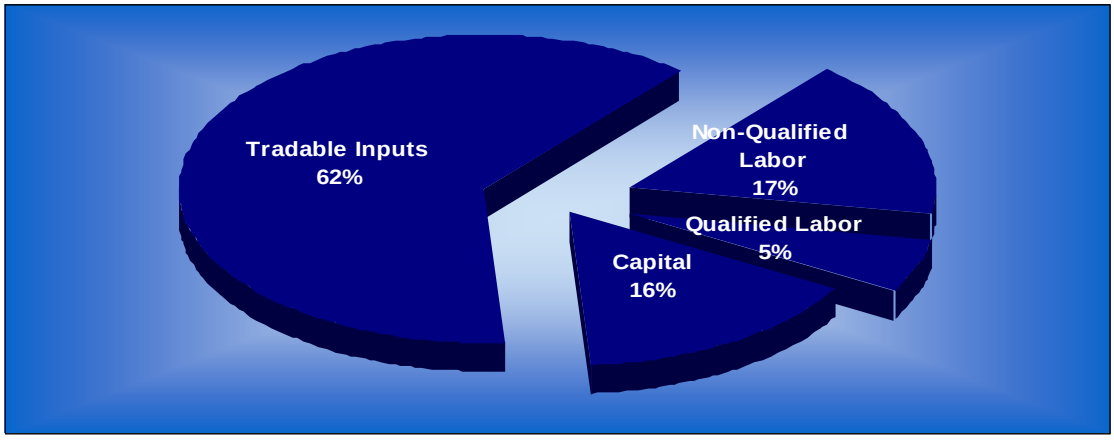
3.2.3. Farm budget in Zone 4

The majority of farmers in zone 4 don't harvest their land due to the modest amounts of fall rain, which lead to low yield that can't be harvested. Therefore, most of the farmers rent their barley land to sheep feeders. These farmers were not taken into account in zone 4 samples. Meaning that, only harvested samples only were considered in zone 4 samples.

In 2006, according to the farm questionnaire samples in zone 4, the total cost accounted for 3,611 Sp/ha; the revenue was 3,137 Sp/ha; and the deficit was 474 Sp/ha. This deficit was because of the low yield in zone 4 which was 0.3 ton/ha. The seed cost makes the most significant cost item, accounting for 53%, followed by harvesting cost 13% (Table 3.1).

Figure 3.3 illustrates the farm budget in zone 4; the domestic factors (labor and capital) and the tradable inputs amount to 38% and 62% of farm cost, respectively.

Figure 3.3. Rain-fed barley farm cost in zone 4, 2006



Source: Elaborated from NAPC Database

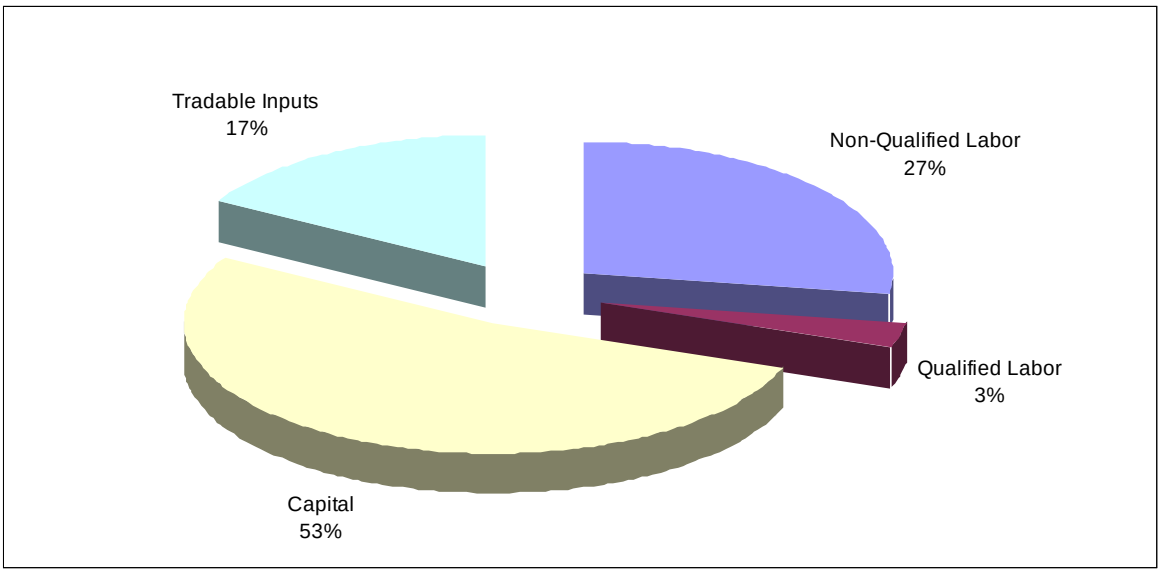
3.3. Trader (middleman) budget

There are three basic wholesale markets for barley namely Aleppo, AL-Rakka and AL-Hassakeh. In the harvesting season, cereal traders purchase daily the barley at trader gate or farm gate. The trader then sells this barley with a low profit margin or with a significant profit if he stores the barley until its price goes up.

The analysis of the selected trader budget, in 2006, shows that the building cost accounts for 55% of total cost. While the labor (loading and uploading) and transportation costs amount to 16% of trader cost each. The total traded barley quantity of this selected trader is 150 tons/year.

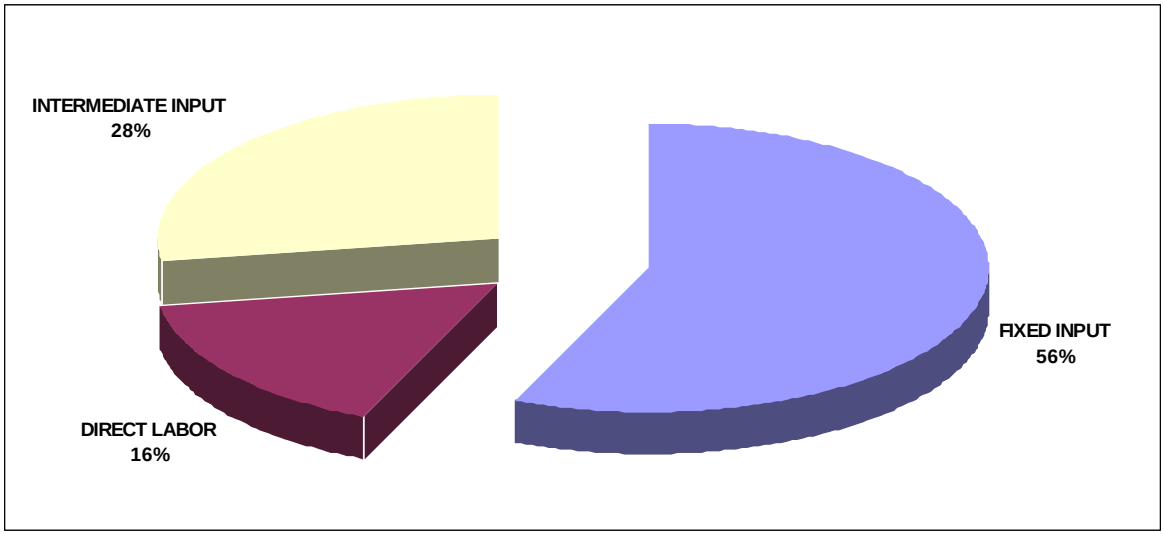
Figure 3.4 and 3.5 give an idea bout the trader cost composition; the domestic factors share is 83% of total trader cost (53% capital and 30% labor). The tradable inputs share is 17%. The fixed cost makes the major cost share, amounted to 56% of total trader cost.

Figure 3.4 Barley trader cost, 2006



Source: Author elaboration.

Figure 3.4 Barley trader cost, 2006



Source: Author elaboration

4. Comparative Advantage of the Representative Systems

4.1. Methodology

The concept of domestic resources is considered to be the core idea of comparative advantage theorem. This concept specifies the available resources utilized in the national economy. Since these domestic resources are scarce, the optimal allocation of them is principal to achieve the greatest efficiency. The assessment of the comparative advantage of a certain system includes several concepts emerging from studying production costs to theory of international trade. The core concept is that any economic activity has a comparative advantage when it is profitable and able to compete with its alternatives coming from imports without benefiting from any form of subsidy transfers from other sectors of the economy.

Comparative advantage analysis is the framework by which it is possible to identify the economic and financial profitability for any activity through identifying the return of this activity in the absence of any market distortions. In other words, comparative advantage analysis means the calculation of the real (economic) costs using the reference world prices for tradable commodities and opportunity cost for non tradable commodities in order to define the probable profitability of any activity in the absence of any policy that causes the domestic prices to be diverge from the international ones.

The measurement of a comparative advantage of a certain production system is performed through an analytical framework called the Policy Analysis Matrix (PAM), which is a tool to construct an aggregate budget for the representative systems, allowing the estimation of the impact of any Government intervention and/or market distortion through the calculation of the social prices (Frédéric Lançon, 2005). Therefore, a system is said to have a comparative advantage and an economic efficiency if it achieves a positive profit at the social prices.

Table 4.1 illustrates the structure of the PAM. Table 4-2 shows the PAM indicators, which are used both to assess the performance of the system and to compare between the various systems.

Table 4.1. The Policy Analysis Matrix

Item	Revenue	Tradable inputs	Domestic factors	Profit
Private prices	A	B	C	D
Social prices	E	F	G	H
Divergence	I	J	K	L

Source: Author elaboration

Table 4.2. Indicators of the PAM

Indicators	Formula	Meaning
1. Financial Profitability (FP)	[D = A - B - C]	Absolute value of the profit generated by the system at private price
2.Financial Cost-Benefit Ratio (FCB)	[(C+B) /A]	Indicator of the competitiveness of the system. If FCB<1, the system is competitive, if FCB>1 the system is not competitive, FP is negative
3.Social Profitability (SP)	[H = E - F - G]	Absolute value of the profit generated by the system at social price.
4. Domestic Resource Cost (DRC)	[G / (E - F)]	Indicator of the comparative advantage of the system. If DRC<1, the system has comparative advantage, meaning that we use less value of Domestic Factors (labor, capital...) than the added value generated (VA= E-F), if DRC>1 the system has no comparative advantage, SP is negative.
5. Social Cost-Benefit Ratio (SCB)	[(F + G) / E]	Another indicator for measuring the comparative advantage of the system. It takes into account the full cost of production (F + G) instead of the Domestic factors only. It is a more appropriate ratio to rank the relative position of different systems when they have different cost structures (i.e. tradable and non-tradable), because the DRC is biased in favour of the system that has a high share of tradable.
6. Transfers	[L = I - J - K]	Absolute value of the transfer between the economy and the system
7. Nominal Protection Coefficient (NPC)	[A / E]	Indicates the level of protection for the main output, if NPC> 1, the system benefits from a protection, if NPC<1 the system is taxed.
8. Effective Protection Coefficient (EPC)	[(A - B) / (E - F)]	Indicates the total level of protection taking into account the effect of the policy on the private value of the tradable output and tradable input.
9. Profitability Coefficient (PC)	[D / H]	Measures the impact of the policy on the profitability of the system. If PC>1, the system benefits from a net transfer from the economy, if PC<1, the economy benefits from a net transfer from the system.
10. Producers Subsidy Ratio (PSR)	[L / E]	Indicator of the impact of the policy/market distortion on the increase (+) or reduction (-) of the total revenue of the system at social price. i.e. magnitude of the divergence from the reference situation at social price to the current situation at market price
11. Equiv. Producer Subsidy (EPS)	[L / A]	Indicator of the impact of the policy/market distortion on the increase (+) or reduction (-) of the total revenue of the system at market price. Equivalent to the Producer Equivalent Subsidy (PSE) as defined by OECD for trade negotiations. If + it is producer subsidy, if – its consumer subsidy.

Source: Author elaboration

4.2. Macroeconomic environment

Since social prices are calculated with domestic currency while the tradable items are treated with the US dollar, the exchange rate of the domestic currency against the US dollar has a great impact. With reference to the mechanisms of setting up the exchange rate during the last year, there was no distortions noticed between the current exchange rate and the social exchange rate, so the unified exchange rate (51 SP per 1 US dollar) was adopted.

The estimation of social prices for the domestic resources requires a great expertise since these resources do not have reference prices such as world prices. For the capital market, the interest rate for deposits in the Commercial Bank of Syria (CBS) reached 7% per annum. This rate is used to calculate the opportunity cost for capital used in production at private prices. However, to calculate the opportunity costs for capital at social prices, the weighted interest rate (3%) that is calculated by the IMF for the Asian modern industrialized economies was applied.

For the labour market, we assume the presence of no distortions and that the current wages reflect the true opportunity costs of labour. Nevertheless, a distinction is made between qualified and permanent labour from one side and unqualified and temporary labour on the other. This distinction is used to calculate the policy distortions on permanent labour[4].

The current trade policy has caused the distortions on the tradable inputs to decrease. This is due to the reduction of taxes on imported agricultural inputs. Consequently, the social prices of tradable inputs are calculated from the domestic prices by subtracting the import tariff and adding the Government subsidy. The implicit subsidy on oil price is also considered especially the price of diesel, which is at about 30% that of the world price. Keeping in mind, fuel utilization is pretty slight in rain-fed barley systems.

4.3. Policy Analysis Matrix (PAM) of Barley

The comparative advantage of barley commodity chains is studied according to the production systems in Figure 2.7 as the following:

- Rain-fed barley system in Zone 2
- Rain-fed barley system in Zone 3
- Rain-fed barley system in Zone 4

4.3.1. Parity price of rain-fed barley

the social price of pistachio is calculated depending on the GEF database and barley importers information, whereas the average price at Ukraine border during the harvesting season in 2006 is the parity price (FOB) accounting for $140 per ton. Then the costs of insurance and freight are added to reach the parity price at the Syrian border (CIF). The latter is multiplied by the exchange rate in 2006 (51 SP), given that there is 1% tariff on barley import. The loading, uploading and transportation costs are added until the parity point, Table 4.3.

4.3.2. The budget of rain-fed barley in Zone 2

This budget represents a summary of the costs, revenue, and profit for each agent in the commodity chain and for the entire chain as well. All costs are converted to the costs of one ton of the final product (Table 4.4 and Figure 4.1).

[4] This tax is composed of 3% as health insurance by the state, 14% is paid by the employer, and 7% is paid by the labour.

Table 4.3. The calculation of the rain-fed barley parity price

Item	Unit	Data source	Market price	Social price
FOB to CIF				
Parity price at Ukraine border (FOB)	$	GEF database	140	**140**
Insurance and Freight costs	$	Data	20	20
Parity price at Syrian borders (CIF)	$	Calculated	160	**160**
Exchange rate	SP	Data	51	51
Parity price in SP (CIF)	SP	Calculated	8,160	**8,160**
Tariff	SP	Data	1%	-
Harbor duty	SP	Data	75	-
Parity price at Syrian harbor	SP	Calculated	8,317	**8,160**
Labor cost from steamboat to truck	SP	Data	292	292
Transportation	SP	Data	400	467
Uploading	SP	Data	58	58
Parity price at parity point	SP	Calculated	9,017	**8,977**

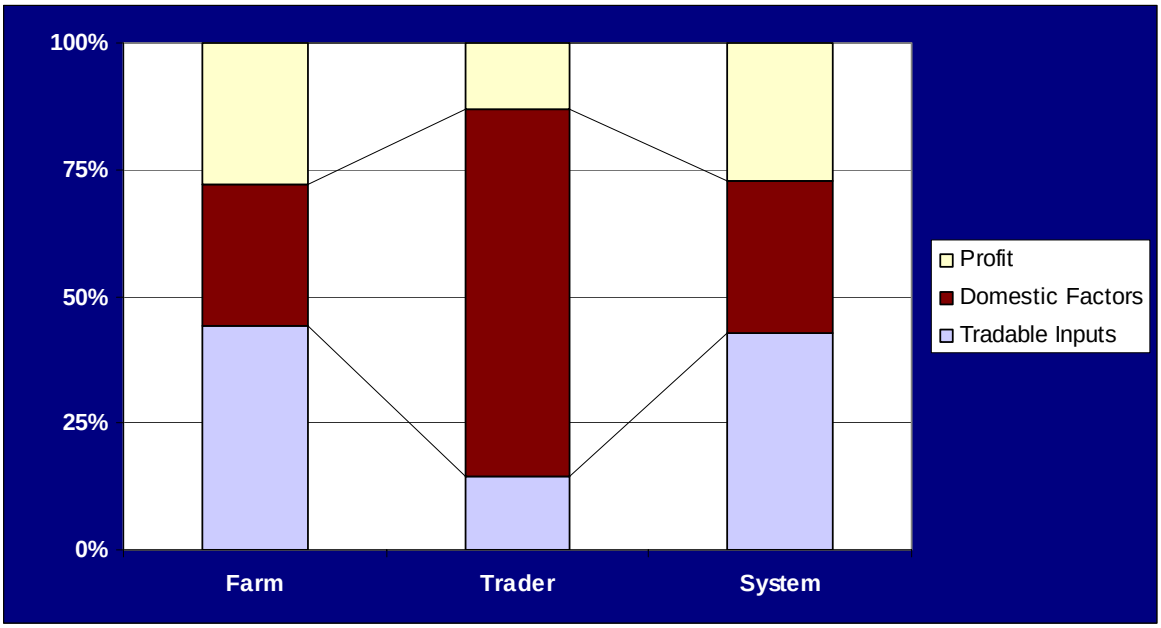
Source: Author elaboration

Table 4.4 The budget of rain-fed barley in zone 2, 2006 (SP/ton)

Item	Farmer	Trader	System
Total revenue	9,734	10,000	10,303
Final output	9,431	10,000	10,000
Total costs	7,005	9,926	7,501
Commodity under processing		9,431	
Costs of tradable materials	4,313	82	4,396
Domestic costs	2,691	414	3,105
Temporary Labour	1,338	136	1,475
Permanent Labour	334	15	349
Costs of capital	1,019	262	1,281
Profit	2,729	74	2,803

Source: Author elaboration

Figure 4.1 The budget of rain-fed barley in zone 2



Source: Author elaboration

Table 4.5 gives an idea about the relative measures of rain-fed barley commodity chain in zone 2 in 2006. Hence, the farm's budget dominates the system. Most of the cost is concentrated at

farm level (98% of tradable inputs, 87% of domestic factors, 92% of labor cost and 80% of capital cost), and most of the system profit is also concentrated at farm level (97%). In general it can be said that the profitability of this system is very good, for the profit accounts for 27% of revenue and 40% of total cost.

Table 4.5. Relative measures of the budget of rain-fed barley in zone 2, 2006 (%)

Item	Farmer	Trader	System
Cost/returns	%72	%99	%73
Share of tradable materials	%98	%2	%100
Share of domestic factors	%87	%13	%100
Share of labour	%92	%8	%100
Labour/domestic factors	%62	%37	%59
Share of capital	%80	%20	%100
Capital/domestic factors	%38	%63	%41
Share of profit	%97	%3	%100
Profit/returns	%28	%1	%27
Profit/total cost	%39	%1	%40

Source: Author elaboration

4.3.3. The PAM of rain-fed barley in Zone 2

Table 4.6 is the PAM of rain-fed barley in zone 2 at private and social prices.

Table 4.6. PAM of rain-fed barley in zone 2, 2006.

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 10,303	B 4,396	C 3,105	D 2,803
Social price	E 9,280	F 4,541	G 2,749	H 1,990
Divergence	I 1,023	J -146	K 356	L 813

Source: Author elaboration

This system has a comparative advantage because its social profitability (H) is positive. It also has a competitive advantage because the private profit (D) is positive. There is a divergence between private and social revenue of I. This means there is a support of barley market price. The divergence between domestic resources at private and social prices (K) is positive. This is only due to the difference between the market interest rate (7%) and the social one (3%). L is positive meaning that there are transfers from the economy to barley sector in the relevant year.

Depending on the PAM, the relative indicators of rain-fed barley in zone 2 have been calculated (Table 4.7).

Through the PAM indications, we can deduce the following:

- Financial profitability at market prices is positive and the FCB at private prices is lower than 1, meaning that the system has a domestic competitive advantage.
- DRC is lower than one (0.58), and the social cost-benefit ratio is also lower than one (0.79). This indicates that this system has good comparative advantage.
- The transfer from the economy to this system rest is 813 SP/ton.
- NPC is 1.11 indicating that this system is protected and the price of barley at domestic markets is 11% higher than its social price.

- PSR and EPS are less than one; the producer is subsidized by 9% of the social revenue and8% of the private revenue.

Table 4.7. PAM indicators of rain-fed barley in zone 2, imported from Ukraine, 2006

Financial profitability (FP)	[D = A - B - C]	2,803
Financial cost-benefit ratio (FCB)	[(C + B)/ A]	0.526
Social profitability (SP)	[H = E - F - G]	1,990
Domestic resource cost (DRC)	[G / (E - F)]	0.580
Social cost-benefit ratio (SCB)	[(F + G) / E]	0.786
Transfers	[L = I + J + K]	813
Nominal protection coefficient (NPC) including by-product	[A / E]	1.110
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.114
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.247
Profitability coefficient (PC)	[D / H]	1.408
Producer subsidy ratio (PSR)	[L / E]	0.088
Equiv. Producer subsidy (EPS)	[L / A]	0.079

Source: Author elaboration

4.3.4. The PAM of rain-fed barley in zone 3

Table 4.8 illustrates the PAM of rain-fed barley in zone 3 at private and social prices.

Table 4.8. PAM of rain-fed barley in zone 3, 2006

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 10,671	B 5,658	C 3,671	D 1,342
Social price	E 9,647	F 5,855	G 3,241	H 552
Divergence	I 1,023	J -197	K 430	L 790

Source: Author elaboration

This system has both comparative and local competitive advantage like the rain-fed barley in zone 2. The Government supports the tradable inputs by 197 SP/ton. The considerable divergence in the domestic resource costs (430 SP/ton) is mainly due to the high interest rate of capital at the market price compared to that at the social prices. L is positive meaning that there are transfers from the economy to barley sector in the relevant year (Table 4.9).

Through the PAM indications, we can deduce the following:

- Financial profitability at market prices is positive, meaning that the rain-fed barley in zone 3 system has a local competitive advantage, but it's not as much as that of the barley in zone 2.
- The Domestic Resources Cost Ratio (DRC) and the social cost-benefit ratio are less than one, meaning that this system has reasonable comparative advantage but it's, also, not as much as that of the barley in zone 2.
- This system receives a transfer of 790 SP/ton from other economy sectors.
- This system gets a slight subsidy on intermediate inputs, like the barley system in zone 2.

Table 4.9. PAM indicators of rain-fed barley in zone 3, imported from Ukraine, 2006

Financial profitability (FP)	[D = A - B - C]	1,342
Financial cost-benefit ratio (FCB)	[(C+ B) / A]	0.732
Social profitability (SP)	[H = E - F - G]	552
Domestic resources cost (DRC)	[G / (E - F)]	0.855
Social cost-benefit ratio (SCB)	[(F + G) / E]	0.943
Transfers (L)	[L = I + J + K]	790
Nominal protection coefficient (NPC) including by-product	[A / E]	1.106
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.114
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.322
Profitability coefficient (PC)	[D / H]	2.432
Producer subsidy ratio (PSR)	[L / E]	0.082
Equiv. producer subsidy (EPS)	[L / A]	0.074

Source: Author elaboration

4.3.5. The PAM of rain-fed barley in zone 4

Table 4.10 points out to the PAM of rain-fed barley in zone 4 at private and social prices.

Table 4.10. The PAM of rain-fed barley in zone 4, 2006

Item	**Revenue**	**Costs**		**Profit**
		Tradable inputs	**Domestic resources**	
Market price	A 11,169	B 7,541	C 4,961	D -1,333
Social price	E 10,145	F 7,825	G 4,419	H -2,098
Divergence	I 1,023	J -284	K 542	L 765

Source: Author elaboration

The rain-fed barley system in zone 4 is unprofitable at private and social prices. In other words, it hasn't any comparative or local competitive advantages. There is a tradable input subsidy by 284 SP/ton. The divergence in the domestic resource costs (K) is mainly due to applying higher interest rate at market price than at social prices. L is positive meaning that there are transfers from the economy to barley sector (Table 4.11). It can be deduced the following:

- Financial profitability at market prices is negative, and domestic resources costs ratio at the private price is higher than one (1.367), meaning that this system hasn't any competitive advantages.
- The Domestic Resources Cost Ratio (DRC) is considerably higher than one (1.9), and the social cost-benefit ratio is higher than one (1.2) too, meaning that this system hasn't any comparative advantage. This due to pretty low yield in zone 4 (0.3 ton/ha in 2006).
- This system is received a transfer of 765 SP/ton from other economy sectors.
- This system is received a slight subsidy on intermediate inputs, as it's in barley system in zone 2 and 3.

Thus, a lot of economists raise this question: since planting barley in zone 4 is unprofitable, then why does the farmer still cultivate it in zone 4? There are some justifications as the following:

- Barley is considered the sole crop that can survive in the drought area and endure the dryness and salty soil.
- There are no alternative crops in zone 4 unless few of pastoral plants.

- Cultivating barely in zone 4 may achieve irregular revenue in few years, especially for sheep owners. In addition, barley remains fodder for animals when it can't be harvested.
- Barley may consider an employer supply of unemployed family members.

Table 4.11. PAM indicators of rain-fed barley in zone 4, imported from Ukraine, 2006

Financial profitability (FP)	[D = A - B - C]	-1,333
Financial cost-benefit ratio (FCB)	[(C+ B) / A]	1.367
Social profitability (SP)	[H = E - F - G]	-2,098
Domestic resources cost (DRC)	[G / (E - F)]	1.904
Social cost-benefit ratio (SCB)	[(F + G) / E]	1.207
Transfers (L)	[L = I + J + K]	765
Nominal protection coefficient (NPC) including by-product	[A / E]	1.101
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.114
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.563
Profitability coefficient (PC)	[D / H]	0.635
Producer subsidy ratio (PSR)	[L / E]	0.075
Equiv. producer subsidy (EPS)	[L / A]	0.069

Source: Author elaboration

4.4. Sensitivity analysis

Constructing the PAM depends on primary and secondary data, coupled with a number of assumptions about the values of parity prices of tradable items and at the aggregate level of the economy, such as:

- Exchange rate
- Interest rate
- Parity price
- Yield
- Conversion rate

Therefore, it is necessary to assess the sensitivity of the PAM indicators to any change in the different elements of the budget at social and private prices.

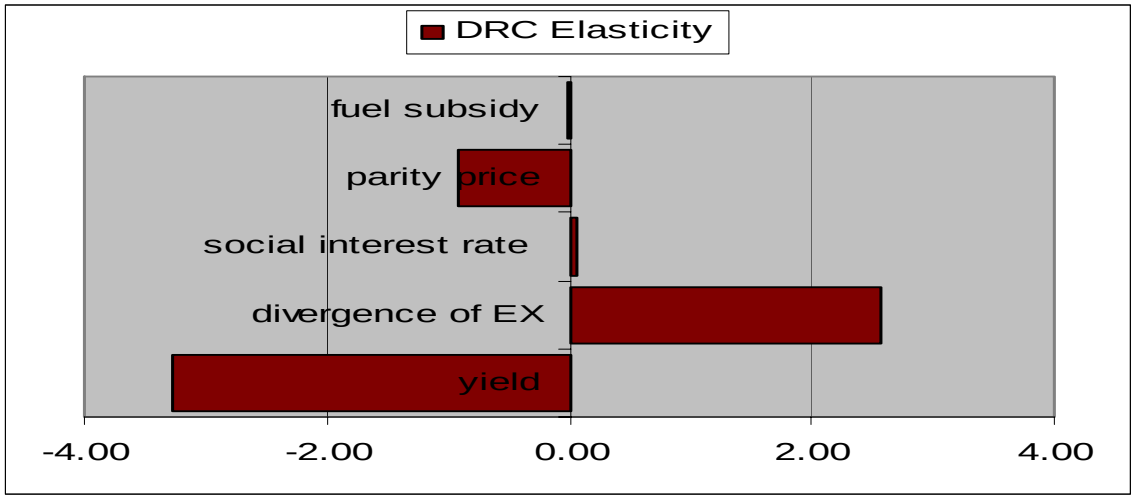
The sensitivity analysis (Figure 4.2) clarifies the presence of a strong inverse relationship between the DRC from one side and the yield from the other. This means that increasing the yield results in a reduction of the DRC value, leading to an increase in the comparative advantage of this system. On the other hand, there is positive relationship between the interest rate and the divergence of exchange rate[5] from one side and DRC from the other. This means that increasing the interest rate and the divergence of exchange rate leads to an increase in the DRC value and a decrease in the comparative advantage of this system. In addition, the comparative advantage of rain-fed barley is not affected by the change of fuel subsidy because the utilization of fuel in rain- fed barley commodity chain is pretty slightly.

Under the given yield and the data of barley systems, barley in zone 2 and 3 has comparative advantage, unlike the barley in zone 4. But the gradual reduction of the yield in zone 2 and 3 results in gradual worsening of comparative advantage in these zones. At certain yields 0.89 ton/ha for barley system in zone 2 and 0.49 ton/ha for barley system in zone 3, the DRC is equal one, meaning that these systems don't have comparative advantage any more(Figure 4.3).

[5] Divergence of exchange rate is the social exchange rate over the market exchange rate.

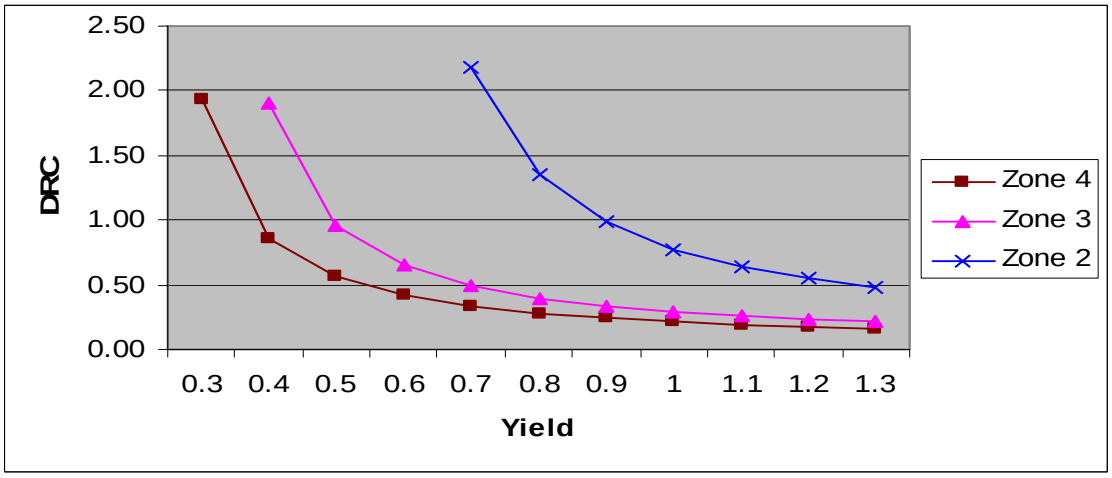
Nevertheless, as the yield increases in zone 4, it turns to have comparative advantage at a yield of 0.374 ton/ha (DRC=1).

Figure 4.2. Sensitivity analysis for the DRC of rain-fed barley in zone 2



Source: Author elaboration

Figure 4.3. Sensitivity analysis for the DRC accordingly to yield change

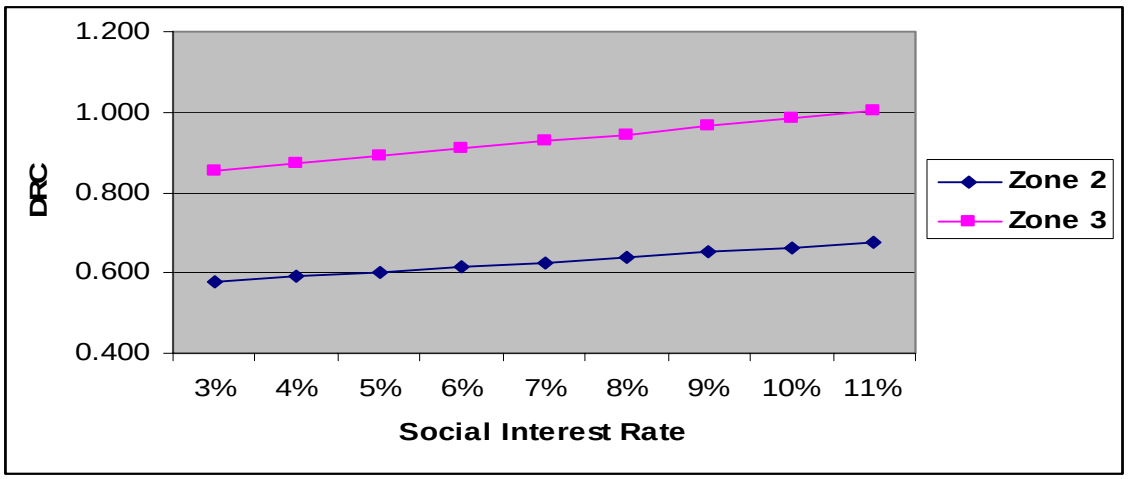


Source: Author elaboration

Barley system in zone 4 doesn't have any comparative advantage, when we apply a social interest rate of 3%. It will be less competitive as the social interest rate increases; as it's expected for the future. Increasing the social interest rate leads to a decrease of the comparative advantage of barley systems in zone 2 and 3. DRC of barley system in zone 3 becomes equal one when the social interest rate attains 11%, which it's not expectable in the near future (Figure 4.4).

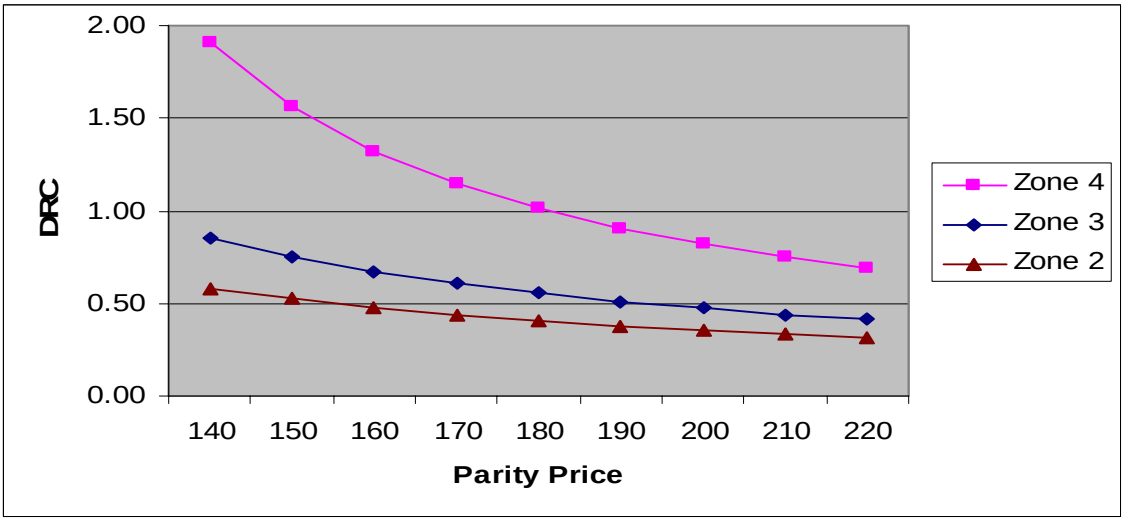
DRC indicator has an inverse relationship with the Parity price; increasing the parity price, as it's expected, leads to a decrease of the value of DRC. This will improve the comparative advantage of barley systems in zone 2 and 3, and the barley system in zone 4 will gradually turn to have comparative advantage when the social parity price becomes $181/ton (Figure 4.5).

Figure 4.4. Sensitivity analysis for the DRC accordingly to the social interest rate change



Source: Author elaboration

Figure 4.3 Sensitivity analysis for the DRC accordingly to the social parity price change



Source: Author elaboration

5. Conclusions and Recommendations

Conclusions

Relying on the current technology, the trend of the world price, the farm and trade samples in 2006 and the available data, the following conclusions were reached in the study:

- The major cost of barley production are those of seed, fertilize and harvesting. While the highest costs of traders are fixed and capital costs.
- Syria has a strong comparative advantage in producing the rain-fed barley in zone 2 (DRC=0.58).
- Syria has a reasonable comparative advantage in producing the rain-fed barley in zone 3 (DRC=0.85).
- Syria hasn't any comparative advantage in producing the rain-fed barley in zone 4 (DRC=1.9).

Recommendations

There are many ways to improve the comparative advantage of Syrian barley, in the mid and long term:

- Barley should be given more attention in the regions that have comparative advantage (zone 2 and 3). High yielding varieties adapted to environment might be invented, introduced and distributed. Furthermore, in order to maximize utilizing of the barley comparative advantage in the mentioned regions, barley should be expanded in these regions to substitute the crops that haven't any comparative advantages. This will contribute to reduce the government budget deficit and the amount of money spent on barley import. In addition, this will cover the shortage in livestock's fodder. Giving that, the international barley demand has been increasing due to using barley for generating the bio fuel.
- Legume crops should be entered in the agricultural rotation to enhance the soil fertility and to increase the yield.
- The existing barley's varieties can survive under the heat and drought phenomenon, but they can't yield good productivity that covers the variable cost of farmers. Given that, large area of barley in zone 4 in AL-Rakka governorate hasn't been harvested since many years, instead it has been rented to sheep feeders. This has severe impact on farmers, in zone 4, who are debtor for agricultural bank. Besides, the low yield increases the production cost and weakens the comparative advantage of barley. Farmers are obliged to cultivate barely in zone 4 because barley is considered the sole crop that can survive in the drought area and endure the dryness and salty soil and there are no alternative crops in zone 4 unless few of pastoral plants. Thus, It's very important to cooperate between the General Commission for Agricultural Scientific Research (GCASR) and international organizations to create new varieties, which are drought resisting and high yielding, especially in zone 4 to both increase production and improve the income.
- It's urgent to coordinate with Arab, international institutions and trading partners in order to improve marketing, yield and profit of barley as well as develop a marketing database of it.

References

- FAO *Database*
- Lancon, Frederic. *Comparative advantage technical note*. NAPC, 2005.
- Grad Samir and Karkout Mouzad. *Agricultural Commodity Outlooks of Barley*. NAPC, 2007
- NAPC *Database.*
- United States Department of Agriculture (USDA). *GRAIN Report, barley 2007.* Foreign Agricultural Service, 2007.