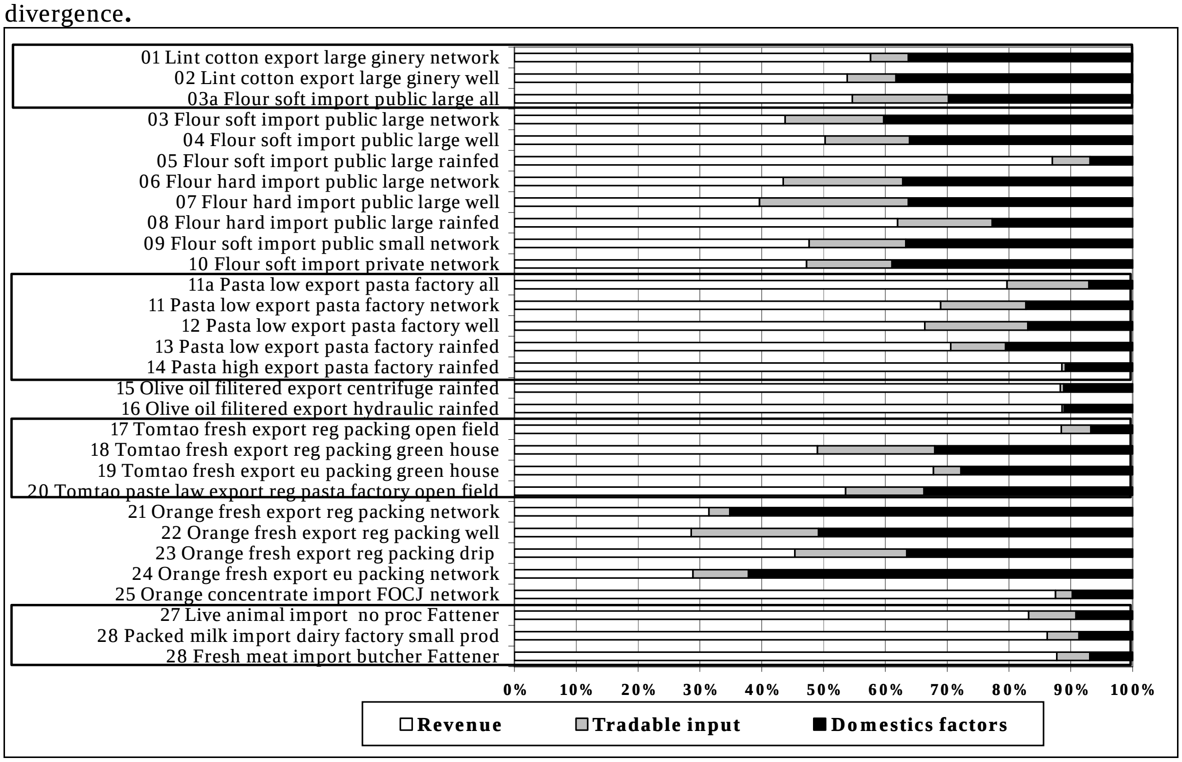
The ratio of the EPC to the NPC can be used as an indication of the respective impact of the current policy on tradable outputs and tradable inputs prices distortions. When the value of the EPC is close to the value of the NPC, most of the protection is due to the output trade policy, and the ratio is close to 1, while a value of the EPC/NPC far above one indicates that prices distortions are also due to the policy interventions on tradable inputs (subsidies). For most of the systems, the ratios of NPC to EPC are rather small, meaning that most of the distortion between the private price and the social price situation is due to divergence on tradable outputs. In other words the current policy, inputs and factors markets' configuration has a limited influence on the production costs. As expected, the gap between the EPC and NPC is higher for lint cotton and flour systems, which are the only selected systems with a public intervention on the output side in the form of price control and subsidy.

The relative importance of distortions due to domestic factors prices on the total value of transfers varies across the systems. It is largely higher for systems that are water intensive indicating the importance of the transfers observed when the social value of water is taken into consideration.

Figure 6: Respective share of the divergence on revenue, Tradable input and Domestic factors in Total divergence**.**



Given the importance of the cotton and wheat in the Syrian Agricultural policy and the high level of distortion characterizing these two subsectors, an attempt was made to estimate the absolute value of the transfers related to these two subsectors. The estimation used the average area planted between 1999 and 2001 for each crop, our estimation of cropped area across the different ecologies (Table 2), data provided by the GECPT on the allocation of the wheat across the different wheat based systems and the value of the nets transfers computed from the respective PAMs. The results (Table 10) confirm the strong bias of the current policy and market environment in favor of the cotton subsector. **While cotton represents only 14% of the total area of both crops, it benefit from 60% of the value of resources transferred from the rest of the economy to these two subsectors. In terms of ecologies, the estimations presented in Table 10 also indicate that half of the resources transferred are in favor of irrigated well based systems while these ecologies represent only 26% of the whole cropped area**.

Table 10: Estimation of total transfers value for cotton and wheat subsectors

Systems	Ecologies			Total	
	Network	**Well**	**Rainfed**	Value	Share
	Area in hectare				
Wheat Durum pasta	47 209	80 383	166 400	293 992	15%
Wheat Durum flour public	105 078	178 917	370 374	654 369	34%
Wheat Soft public	169 497	59 553	378 600	607 650	31%
Wheat soft private	32 285	11 343	72 114	115 743	6%
Cotton	96 734	164 709	0	261 444	14%
Total	450803	494 905	987 488	1 933 197	100%
Share	23%	26%	51%		
	Value of the transfer SP per hectare				
Wheat Durum pasta	21 467	21 277	7 655		
Wheat Durum flour public	14 077	15 174	3 457		
Wheat Soft public	19 750	21 133	5 076		
Wheat soft private	22 877	24 479	5 880		
Cotton	107 288	110 978			
	Total transfer (million of SP)				
Wheat Durum pasta (private)	1 013	1 710	1 274	3 998	9%
Wheat Durum flour public	1 479	2 715	1 280	5 474	12%
Wheat Soft public	3 348	1 259	1 922	6 528	14%
Wheat soft private	739	278	424	1 440	3%
Cotton	10 378	18 279		28 658	62%
Total	16 957	24 241	4 900	46 098	100%
Share	37%	53%	11%	100%	

3.2. Determinant of Comparative Advantages

The impact on economic efficiency of alternative technology, targeted market or other characteristics is assessed by comparing the result of representative systems producing the same main output, with the same characteristics, but the one under consideration.

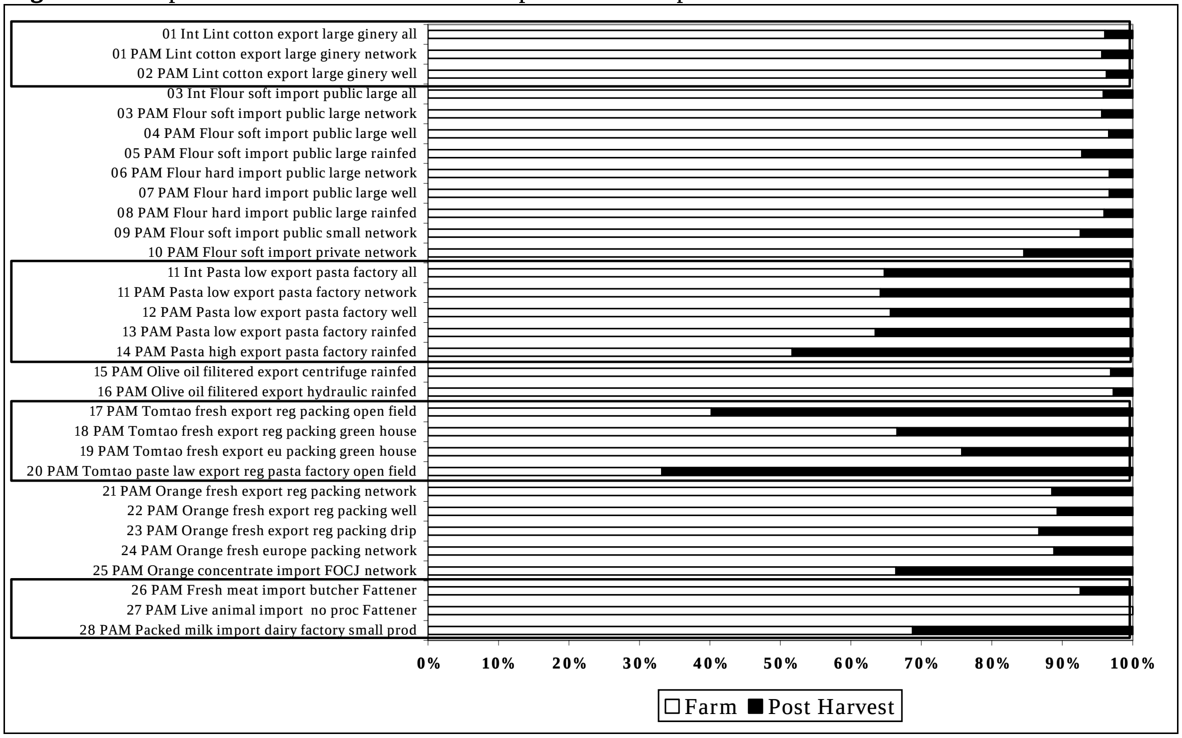
3.2.1. Processing Technology

Processing technology are less variables than farming level technology, only a few of them were retained at the system selection stage to deserve special attention. For soft flour there is almost no differences in profit level between the large capacity public mill (400 t of flour/day – system 4) and the small capacity public mill (100 t of flour per day- system 6) although the profit level is slightly higher for the larger mill at social price. This small difference can be explained by the similarity of the milling technology used in both cases, the capacity of the larger mill being actually increased by multiplying the processing lines rather than through a shift in the technology used. For the olive oil production centrifuge technology has a positive impact on both the profitability and the efficiency of the systems, but it should be noted that the old hydraulic press technique is also, both, profitable and efficient.

Thus in the case of wheat and olive, neither the scale of operation nor the type of technology used at the processing stage is a major determinant of the economic efficiency of the systems. In other word, a system cannot get a comparative advantage by modifying the sole technology applied at the processing level.

The limited impact of processing technology on the efficiency of the selected systems is also due to the limited share of the processing operations in the total cost of these systems as they represent on average less than 18% of the total systems' costs at private prices. Processing costs represent even less than 10% of the whole system's cost for lint cotton, wheat flour and refined olive oli production, while logically the share of processing costs in total cost is higher (from 30% to 60%) for the production of more elaborated agro-food products such wheat pasta, FOJC or tomato paste (Figure 7).

Figure 7: Respective share of Farm level and post-harvest operations in total cost.



Along the same line, the level of capacity utilization was one the issue raised during the interview of wheat mills' mangers. A simple simulation made on the basis of the private wheat flour systems' PAM shows that the DRC is highly sensitive to the level of capacity utilization only for the lowest value of the level of capacity utilization of milling capacity (Figure 8). From a system perspective, increasing the utilization of processing capacity at the milling level does not significantly reduce the value of the DRC when the quantity processed exceeds 10000 tons (around 15% of its total capacity).

The same issue was raised for the production of FOJC, characterized by the difficulties encountered by this industry to procure the required volume of oranges. A similar simulation was done using the FOJC PAM, but looking also at the effect of changes in the recovery rate, the quantity of concentrate that can be produced from one ton of fresh oranges (the current ratio mentioned was 60 kg of FOJC from 1 ton of fresh oranges). **The results of the simulation indicate that the improvement of the system efficiency can be substantially improved by the use of oranges with high juice content, compared to the much more limited improvements that can be realized only by the increased utilization of the existing processing capacity** (Figure 9).

Figure 8: Utilization of milling capacity and DRC value

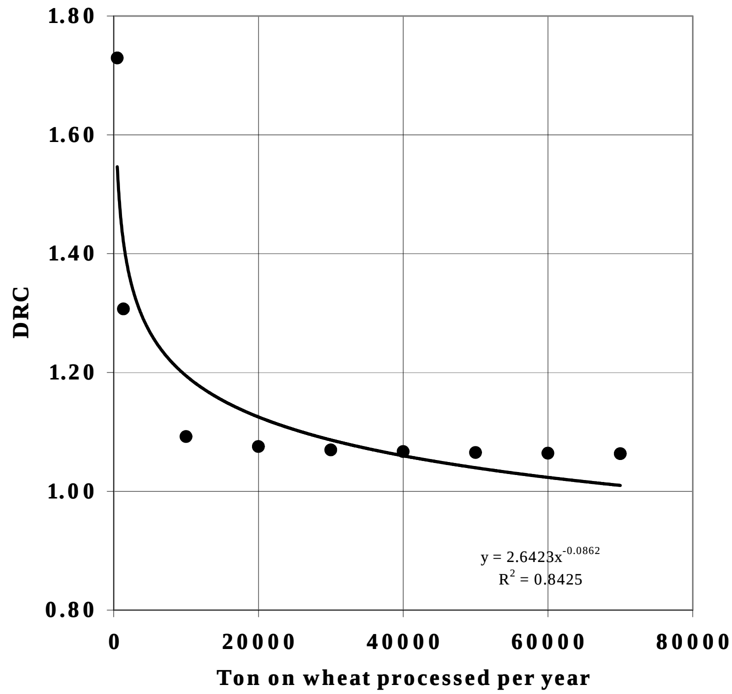
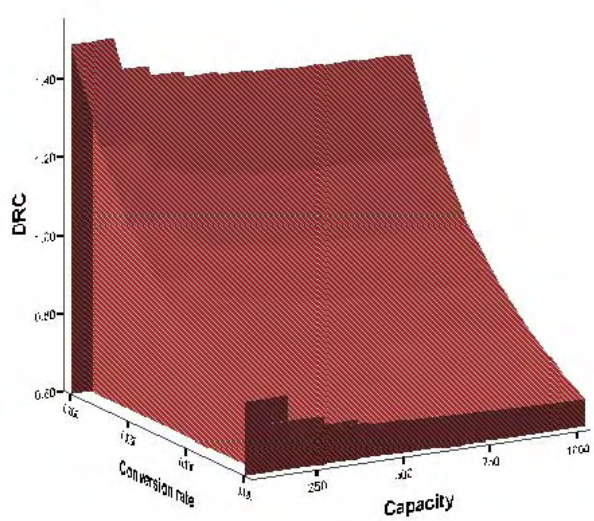


Figure 9: Effect of capacity utilization and recovery ratio on FOJC DRC value**.**



From an institutional perspective, the comparison between performances of the flour produced by the GECPT' mills and the one produced by private millers does not reveal any significant differences, as both systems achieved a comparable positive profit per ton of output at private and social price.

3.2.2. Farm Level Technology.

The impact of farm level technology on the systems' performance is far more important. Water procurement technique was the factor used to differentiate systems at the farm level. **For field crops, in all cases systems relying on wells irrigation generate the lowest profit**. System based on network irrigation yield the highest profits for cotton and soft wheat, while rainfed systems achieved the highest profit for hard wheat at private price. **At social prices, for field crops only rainfed based systems enjoy comparative advantages, while cotton and wheat based irrigated systems have a very high DRC for both network and well based system**. The imputation of water value at social price increases the cost of irrigated systems and thus magnifies their lower efficiency compared to rainfed system.

It should be noted however, than even without inputting a value for water, cotton and wheat based systems would not have comparative advantages (Table 11). This is particularly the case for cotton systems for which the valuation of water represents only around one third of the total transfer of resources to this subsector. The subsidy given to raw cotton price at farm level also represents 50% of transfers received from the rest of the economy for the cotton lint produced from irrigated network system.

Table 11: Effect of water valuation on field crops systems' efficiency**.**

Systems	**With water valued at social price**		**Without water valued at social price**		**% change**	
	DRC	Transfer	DRC	Transfer	DRC	Transfer
01 PAM Lint cotton export large ginnery network	2.24	88 058	1.41	59 499	37%	32%
02 PAM Lint cotton export large ginnery well	2.81	86 701	1.81	54 160	36%	38%
03 PAM Flour soft import public large network	1.97	7 054	1.29	3 818	35%	46%
04 PAM Flour soft import public large well	2.72	6 143	1.91	2 825	30%	54%

Well based irrigated systems’ profitability is also highly constrained by the cost of pumping for irrigation, which represents 39% of the total cost in the case of cotton and 25% for soft wheat production. The implicit subsidy on fuel also contributes to the transfer of resources to these two systems and further hampers their economic efficiency. Orange is the only other selected commodity where different irrigation techniques are concurrently applied. Also in this case, irrigation network is more efficient than well based systems with a DRC of 0.80, while well based systems have a DRC of 0.93. The introduction of drip irrigation systems slightly improved the efficiency of well based system by decreasing its DRC to 0.91, but further field investigations combining multi-disciplinary expertise are needed to thoroughly assess the likely positive impact of improved water management technology of system efficiency.

Table 12: PAMs' selected values and indicators**.**

Systems	PAM selected value						Selected ratios					
	Per ton of main final output			Per hectare (or animal head)								
	FINANCIAL PROFIT	SOCIAL PROFIT	TRANSFERS	FINANCIAL PROFIT	SOCIAL PROFIT	TRANSFERS	FCB	DRC	NPC	EPC	PSR	ESP
01 Int Lint cotton export large ginery all	32 369	-53 207	85 577	40 371	-66 917	107 288	0.62	2.60	1.96	2.59	1.36	0.78
01 PAM Lint cotton export large ginery network	45 310	-42 748	88 058	55 097	-51 982	107 079	0.50	2.24	2.04	2.62	1.40	0.78
02 PAM Lint cotton export large ginery well	27 719	-58 982	86 701	35 480	-75 497	110 978	0.68	2.81	1.96	2.64	1.38	0.79
03 Int Flour soft import public large all	1 950	-3 725	5 675	5 488	-8 293	13 781	0.78	1.89	1.45	2.09	0.57	0.41
03 PAM Flour soft import public large network	2 446	-4 607	7 054	6 850	-12 900	19 750	0.73	1.97	1.33	1.89	0.66	0.51
04 PAM Flour soft import public large well	-904	-7 047	6 143	-3 110	-24 243	21 133	1.11	2.72	1.33	1.96	0.58	0.45
05 PAM Flour soft import public large rainfed	6 430	3 671	2 759	11 831	6 755	5 076	0.30	0.40	1.30	1.48	0.26	0.21
06 PAM Flour hard import public large network	-873	-5 385	4 512	-2 723	-16 800	14 077	1.11	2.13	1.18	1.59	0.37	0.32
07 PAM Flour hard import public large well	-800	-5 426	4 626	-2 624	-17 798	15 174	1.11	2.19	1.17	1.65	0.38	0.33
08 PAM Flour hard import public large rainfed	3 446	1 946	1 500	7 940	4 484	3 457	0.68	0.77	1.16	1.25	0.11	0.10
09 PAM Flour soft import public small network	2 446	-4 921	7 368	6 850	-13 780	20 629	0.73	2.08	1.38	2.03	0.70	0.52
10 PAM Flour soft import private network	2 795	-6 542	9 337	6 848	-16 028	22 877	0.75	2.20	1.44	2.05	0.74	0.55
11 Int Pasta low export pasta factory all	3 228	-1 093	4 321	6 568	-3 338	9 906	0.78	1.11	1.26	1.48	0.23	0.19
11 PAM Pasta low export pasta factory network	3 020	-4 481	7 501	8 644	-12 823	21 467	0.83	1.40	1.26	1.55	0.33	0.27
12 PAM Pasta low export pasta factory well	2 185	-5 605	7 790	5 968	-15 309	21 277	0.87	1.54	1.26	1.62	0.34	0.28
13 PAM Pasta low export pasta factory rainfed	5 717	1 832	3 885	11 266	3 610	7 655	0.71	0.88	1.23	1.36	0.15	0.13
14 PAM Pasta high export pasta factory rainfed	26 358	-758	27 117	28 861	-830	29 691	0.50	1.03	2.03	2.39	0.55	0.34
15 PAM Olive oil filtered export centrifuge rainfed	97 268	77 290	19 978	127 456	72 594	54 862	0.25	0.28	1.19	1.20	0.17	0.14
16 PAM Olive oil filtered export hydraulic rainfed	67 664	34 900	32 764	90 514	46 686	43 829	0.53	0.67	1.33	1.35	0.28	0.21
17 PAM Tomato fresh export reg packing open field	4 476	1 453	3 024	235 011	76 269	158 742	0.57	0.81	1.29	1.37	0.25	0.20
18 PAM Tomato fresh export reg packing green house	10 123	5 211	4 912	601 333	309 537	291 796	0.48	0.67	1.17	1.21	0.22	0.20
19 PAM Tomato fresh export eu packing green house	14 779	26 285	-11 505	558 658	993 556	-434 898	0.46	0.45	0.44	0.57	-0.20	-0.32
20 PAM Tomato paste law export reg pasta factory	11 344	16 764	-5 420	177 092	261 705	-84 612	0.55	0.54	0.82	0.69	-0.11	-0.14

21 PAM Orange fresh export reg packing network	11 341	4 600	6 741	111 593	45 259	66 334	0.66	0.85	1.13	1.08	0.17	0.16
22 PAM Orange fresh export reg packing well	9 225	1 807	7 418	90 773	17 783	72 991	0.70	0.93	1.13	1.13	0.19	0.18
23 PAM Orange fresh export reg packing drip	6 753	1 739	5 014	66 448	17 113	49 336	0.70	0.91	1.14	1.16	0.16	0.15
24 PAM Orange fresh export eu packing network	13 516	9 366	4 150	133 000	92 166	40 834	0.63	0.75	0.97	0.98	0.09	0.09
25 PAM Orange concentrate import FOCJ network	15 985	-31 331	47 315	4 797	-9 403	14 200	0.82	1.71	1.60	1.96	0.68	0.43
26 PAM Fresh meat import butcher Fattener	68 337	-13 800	82 137	13 667	-2 760	16 427	0.50	1.30	1.77	2.93	0.55	0.34
27 PAM Live animal import no proc Fattener	17 541	-2 832	20 372	8 770	-1 416	10 186	0.56	1.17	1.44	2.38	0.35	0.25
28 PAM Packed milk import dairy factory small prod	8 343	1 805	6 538	31 705	6 860	24 845	0.55	0.84	1.48	1.66	0.25	0.19

3.3. Sensitivity of Systems' Efficiency to Changes In Tradable and Factor Prices.

3.3.1. Sensitivity Analysis

As mentioned in section 2.2, the construction of the PAMs relies on the collection of primary and secondary data including a number of hypotheses made with regards to the value of parity prices for tradable outputs, macro-economic aggregates such as exchange rate, interest rate and prevailing distortions on domestic factors markets. It is therefore necessary to asses to what extent the PAMs' indicators are sensitive to any changes in the value of the various components of the budgets at private and social price. The level of sensitivity is determined by computing the value of the selected indicators for different values of the selected PAM budgets component (quantity, price, etc.). The simulated values of the selected budget components are randomly generated within an interval centered on the initial value inputted in the system's budget. For the CAS, an interval of -/+ 20% of the initial value have been used, with triangular shape distribution[7]. The series of value obtained for the PAM indicator is then regressed to the different corresponding values of the selected set of variables, the β coefficients of the multiple regression being the indicators of sensitivity. Figure 10 present the outcome of the sensitivity analysis of the DRC for the network cotton system. It shows that the DRC is highly sensitive to yield achieved in farmers field, the parity price for the lint cotton, and the ginning throughput. The DRC is much less sensitive to other variables selected in the budget of the cotton system.

[7] For instance for a yield of 1 ton the values randomly generated will be contained between 0.8 ton and 1.2 ton with 50% of the values below 1 ton and 50% of the values above 1 ton, the mean of the values generated being 1 ton.

Figure 10 : Sensitivity of the DRC to selected variable for Irrigated network cotton system.

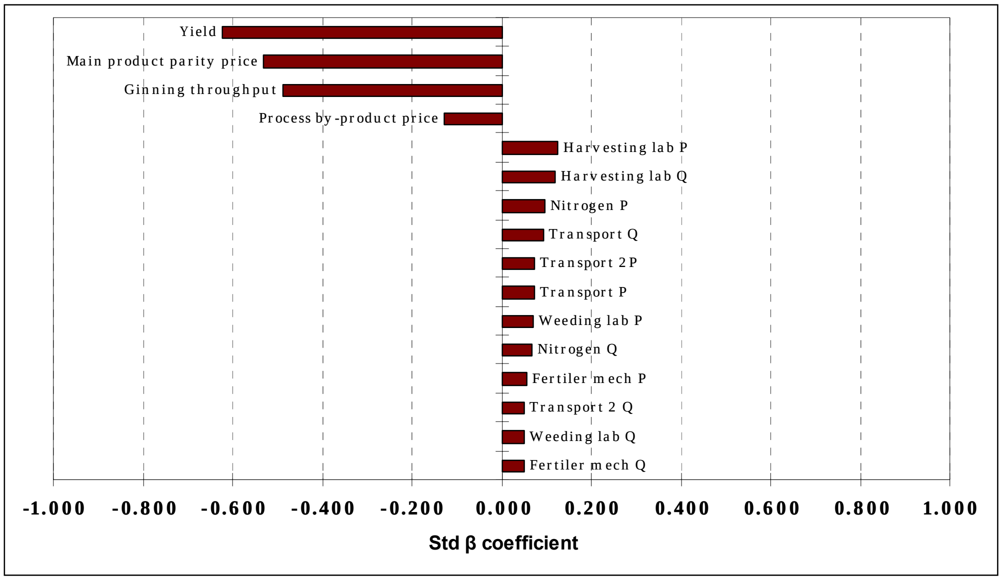


Table 13 presents the β value obtained for the DRC, aggregated by major selected outputs. While a certain number of core variables – output parity price, yield at plot level, exchange rate, interest rate, level of distortion on the labor and capital market – have been systematically included in the analysis, the value, the quantity or the level of protection of inputs items have been included when they represent an important share of the total cost. For instance packaging has been included in the case of Tomato and Oranges systems because it represents a significant share of the costs. As a matter of fact, the impact of value changes of any cost items is mechanically determined by its share in the total cost. However, the fact that one cost item is included in the analysis does not necessarily mean that its variation will have significant impact on the PAM indicator.

The DRC is on average highly sensitive to the value of the main final output parity price (average β = 0.5) and to the yield achieved at the farm level (β=0.42). The inclusion of the recovery rate[8] in the case of cotton and FOJC systems show that **the technical performance at processing level can have an effect on the DRC value comparable to the effect of the yield at farm level**. In term of macro-economic environment, the DRC is highly sensitive to the exchange rate level (β = 0.3) and to the level of distortions on the labor market (β =0.3) while the interest rate has much lower impact on the value of the DRC (β=0.06)[9].

[8] The quantity of output (lint cotton, flour) obtained from the quantity of raw agricultural material (i.e. raw cotton, wheat) processed

[9] The adoption of higher value of interest rate (20% instead of 3%) was tested on the case of the cotton irrigated network systems show that an increase by a factor of 6 of the level of the social interest rate does only increase the DRC by a factor 0f 1.09 every other factors being constant.

The impact of the other cost items is more system specific, as shown by the high sensitivity of wheat pasta, tomato and orange systems to the cost of packaging.

3.3.2. Probability of Having Comparative Advantages.

The **sensitivity analysis confirmed the main output parity price and farm level yield values are the major determinant of the comparative advantages**. Several variables of the PAM varies across the years; this is particularly the case for yields that are affected by climatic conditions and for the world market prices of agricultural commodity and derived processed products which varies according to changes in demand and supply across the world. Thus, beyond the uncertainty of the estimation of several costs and prices inputted in the PAM, it is also necessary to look at the effect of the instability of these important parameters such as yields and parity prices, the variations of which can be traced back with available statistics.

The parity price of the main output and the yield achieved at farm level being the most unstable parameters among the ones that influence significantly the value of the DRC, a simulation was carried out for several systems to evaluate the probability to have a DRC below one. The variations of the parity price and yield inputted in the simulation follow the pattern of variations observed during the last decade. The data were collected from NAPC database and selected sources of information for international price (see Figure 11 and Figure 12 for the case of wheat).

Table 13 : β coefficients of the regressions of the sensitivity analysis**.**

Category	Variable	Commodity												
		Cotton	Wheat Flour	Wheat Pasta	Olive oil	Tomato open	Tomato green	Tomato pasta	Orange fresh	FOJC	Meat	Cattle	Milk	Average
Tradable output	3.Out Main product parity price	0.512	0.393	0.695			0.664	0.766	0.537	0.662	0.280	0.000	0.573	0.508
Technology	1.Tec Yield	0.575	0.512	0.615	0.330	0.299	0.509	0.170	0.594	0.482	0.271	0.169	0.516	0.420
Technology	1.Tec Conversion rate	0.463									0.339			0.401
Macro-eco policy	2.MA Exchange rate	0.136	0.363	0.317	0.625	0.664	0.196	0.470	0.256	0.391	0.000	0.220	0.072	0.309
Market distortion	2.MA NQL labor distortion	0.190	0.162	0.236	0.561	0.543	0.339	0.273	0.503	0.370	0.123	0.000	0.382	0.307
Tradable input	4.TT Packaging			0.051		0.290		0.282	0.051					0.169
Tradable input	4.TT Agricultural input p		0.110	0.091							0.212	0.175	0.207	0.159
Tradable input	5.TNT Irrigation q	0.276	0.209	0.126		0.118	0.045							0.155
Domestic factor	6.DF Labor q	0.082			0.213									0.147
Tradable input	5.TNT Irrigation cost	0.262	0.060	0.130		0.117			0.130					0.140
Domestic factor	6.DF Labor p	0.086			0.216	0.100			0.095	0.070			0.268	0.139
Tradable input	5.TNT Machinery p	0.054	0.079	0.067		0.200		0.144						0.109
Tradable input	4.TT Agricultural input q		0.121	0.082										0.101
Macro-eco policy	2.Ma Energy implicit subsidy	0.091	0.166	0.047	0.022				0.021		0.116	0.176		0.091
Tradable input	4.TT Energy p					0.079								0.079
Tradable input	5.TNT Transport p	0.073		0.098	0.026	0.091		0.084	0.065					0.073
Tradable input	5.TNT Transport q	0.073		0.116	0.026									0.071
Tradable output	3.Out Process by-product price	0.131	0.073	0.108	0.000	0.000	0.347	0.000	0.080	0.000	0.109	0.000	0.000	0.071
Tradable input	4.TT Chemical input p	0.095	0.079	0.089	0.020									0.071
Tradable input	5.TNT Machinery q		0.059	0.082										0.070
Tradable input	5.TNT Agricultural input p								0.065					0.065
Macro-eco policy	2.MA Interest rate social				0.021	0.092	0.043	0.026	0.061	0.066		0.143	0.037	0.061
Tradable input	4.TT Chemical input q	0.068	0.070	0.073	0.028									0.060
Tradable input	4.TT Investment									0.054				0.054

Tradable input	5.TNT Processing cost			0.081	0.027									0.054
Tradable input	5.TNT Establishment cost perennial				0.029				0.078					0.053
Macro-eco policy	2.MA Subsidy on pumping					0.044	0.042		0.051					0.046
Technology	1.Tec Capacity									0.035				0.035
Tradable input	4.TT Agricultural equipment					0.018			0.040					0.029
Macro-eco policy	2.MA Labor tax					0.028			0.026	0.016				0.023
Macro-eco policy	2.MA Subsidy on irrigation								0.021					0.021
Macro-eco policy	2.MA Interest rate private				0.018								0.023	0.020

Figure 11: Observed pattern of yield variations for Wheat (source: NAPC database**)**

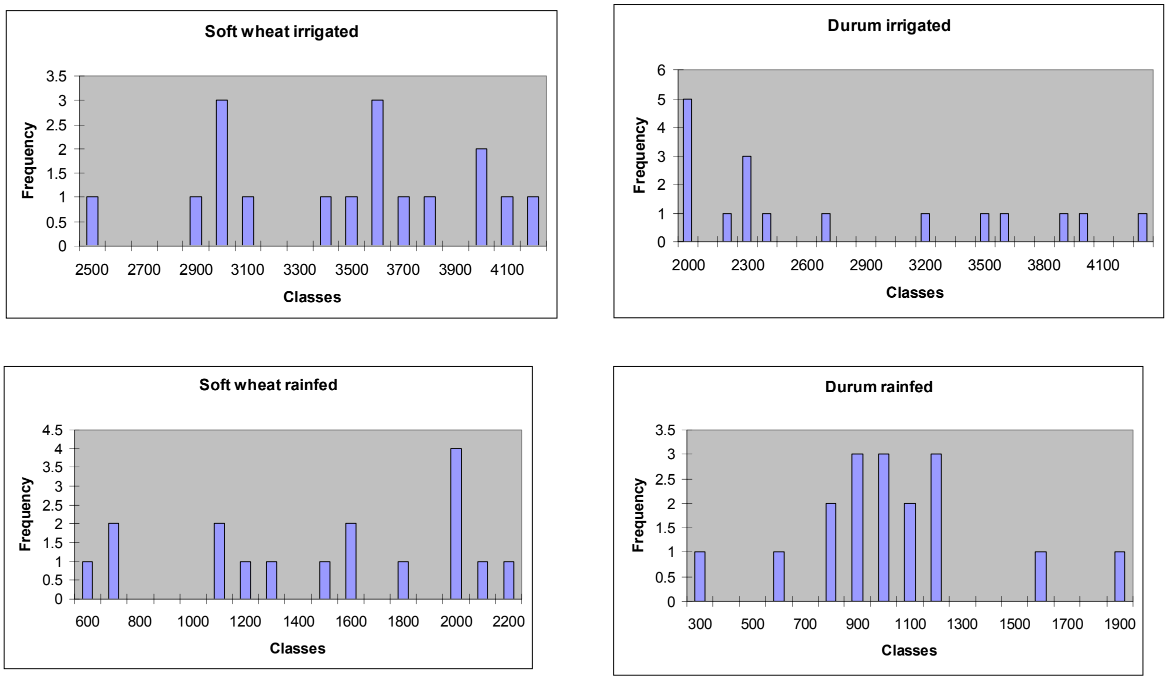
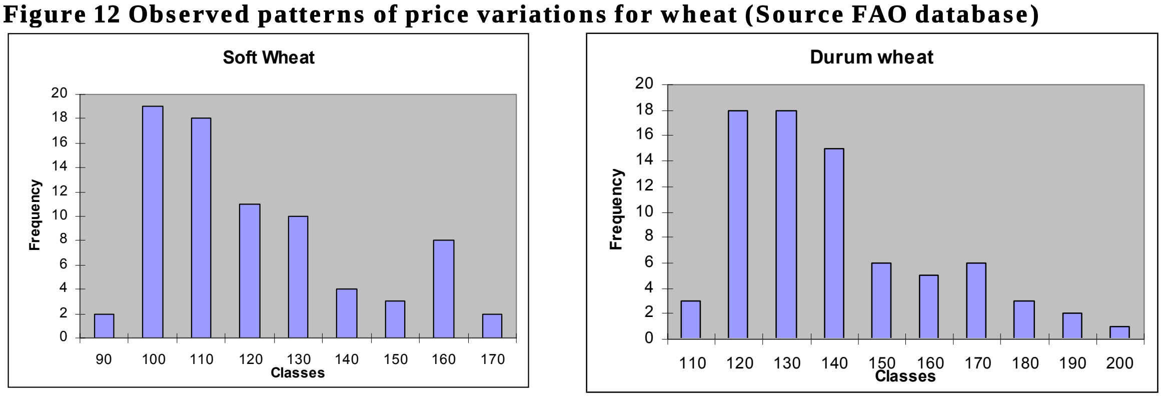


Figure 12 Observed patterns of price variations for wheat (Source FAO database)



These patterns of variation were used to randomly generate 100 sets of values for the parity price and the yield fitted to the observed distribution, and the corresponding DRC values. When the observed distributions do not correspond to any obvious law of probability, hypothesis are made on the probable distribution of the value of the input variable. For instance in the case of wheat the assumption was that the there is a higher probability to have yield above the average than under the average for irrigated based systems, while the yield would be equally distributed around the average for rainfed system (Figure 13)

Figure 14 presents the cumulative distribution of the DRCs values obtained for the Cotton and Wheat flour subsectors by computing the respective PAMs with the selected distribution for yield and output parity price values. The figure shows that for cotton there is a probability of

10% to get a DRC below 1 while for wheat the lowest DRC computed is 1.4, meaning that the **wheat subsectors would have no chance to have a comparative advantages under the yield and price levels observed during the last decade**.

The same method was applied to assess the probability for other selected systems to have a comparative advantages on the bases of the past yield and output parity price values. Table 14 presents the results obtained, indicating the probability to obtain a DRC below 1, the minimum DRC and the maximum DRC that was obtained during the simulation.

Olive oil, fresh tomatoes and oranges based systems have a probability of 100% to enjoy comparative advantages, under the same price and yield condition as the one recorded in the past ten years. This indicates the strong comparative advantages enjoyed by these systems. For FOJC, the CIF value per ton of concentrate imports in Syria's neighboring countries display large variations during the last decade (from 800 USD t up to 1770 USD per ton) giving evidence of the high instability that prevail on this market. Under these world market conditions the FOJC commodity chains has a probability of 30% to have a comparative advantages, which corresponds to the probability to have a parity price above 1700 USD per ton.

Table 14 : DRC sensitivity to parity price and yield instability for selected system**s.**

Systems		**Lowest DRC**	**Highest DRC**	**Probability for a DRC<1**
1	**Lint cotton produced from network irrigated system exported to Europe**	0.5	4.5	10%
3	**Wheat flour public domesctic market**	1.4	2.6	0%
15	**Filtered olive oil centrifuge exported to Europe**	0.25	0.7	100%
17	**Fresh tomato from open field exported to GAFTA countries**	0.51	0.6	100%
20	**Tomato paste export to GAFTA countries**	0.13	2.1	98%
21	**Fresh orange from network irrigation exported to GAFTA countries**	0.3	0.7	100%
25	**Fresh Orange Concentrated Juice from network irrigation**	0.85	4	30%