الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

AN INDUSTRIAL POLICY AND STRATEGY FOR LEBANON

A N N E X

THE FUTURE STRUCTURE OF THE LEBANESE INDUSTRIAL SECTOR: A QUANTITATIVE ANALYSIS

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The future structure of the Lebanese Industrial Sector
A quantitative analysis

I. Introduction

Forecasting and planning the future structure and pattern of the industrial sector in Lebanon is a difficult task. Some of the main difficulties have already been outlined in the main report. They pertain to a deficient data base, unclear and sometimes conflicting industrial objectives, the devastating impact of the civil disturbances, the final extent of which has yet to be determined, and uncertain prospects for the country and economy.

There are three courses of action that can be taken to determine in a broad and imprecise manner the possible future structure.

First, the past trends of the economy are projected to the future as if the civil disturbances had not taken place. The projections are predicated on the premise that the past was acceptable and the civil war simply deflected the economy off its natural path. The planning vector of industrial output, employment and investment would simply be the projected values of these variables over time. The civil disturbances would be assumed not to have occurred, the extent of damage and retardation would be the gap between the planned (desired) and the actual values of these variables, and the gap would have to be filled with deliberate policy measures that would constitute the strategy and plan of government for the economy.

Second, the historical development of small economies have been shown to follow a systematic pattern. Comparisons among countries at different income levels indicate that there are similar patterns of change in the structure of production as income levels rise. The development pattern of a given country at least for the period of several years, could therefore be defined by the time paths of variables describing production, size of the market, international trade and resource allocation in each sector of the economy. Several studies have documented this pattern: Chenery, Shishido and Watanabe; Kuznets; UNIDO; Taylor; and several other researchers, have designed cross-country models to test this general hypothesis. Their results indicate good statistical fits for value added by sectors, and for per capita income and the size of the market. The latter is often represented by population size.

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Lebanon's pattern of industrial growth was assumed to follow this general pattern. The estimates of the parameters that relate value added in each industrial sector and per capita income and population as depicted in the UNIDO study were used to draw the industrial profile that would emerge should Lebanon develop according to the cross-country average pattern. The results were somewhat disappointing. The projected industrial structure emerging from this hypothesis was very different from the existing or the historical one, and it was felt that a third alternative was needed.

The third alternative, is a compromise between the historical projection and the pattern of international development of small economies. The compromise was affected by adjusting the parameter estimates in a systematic manner by subtracting half the standard deviation of each parameter from its estimated coefficient. The projected pattern of industrial structure that emerged was more realistic than the second alternative, yet it too would require a major restructuring of Lebanese industry.

The current pervasive paralysis of Lebanese industry may be an opportune phenomenon conducive to the major change that is needed and desired to bring about a high growth in the economy consistent with a material base that is capable of sustaining it. The labour and investment requirements for restructuring are also presented to indicate the costs of such policies and to assess their chances of successful implementation.

The results presented in the next section include, therefore, data based on a projected historical structure, an unadjusted pattern of international development and finally a pattern that reflects the adjustment made to the international pattern. The methodologies used are presented in section III.

Table 9 gives the contribution to GDP made by the various sectors of the economy. Table 10 shows the projected distribution of the sub-sectors of industry in 1980 for GDP, capital, labour and exports, under the three alternative scenarios A, B and C, and Table 11 provides projected indices of the industrial sector for the three alternatives.

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II. Analysis of the Results

A. The Historical Structure

The sectoral contributions to GDP in 1980 are derived using time trends. The value added of manufacturing was allocated over the two-digit commodity groups on the basis of 1964 and 1970 structures. The most striking result is the growth of the contribution of manufacturing to GDP from 13.6 per cent in 1970 to 19.2 per cent in 1980. This represents an implicit 10 per cent annual growth rate in value added between 1973-1980. This increase appears to be primarily at the expense of agriculture. The largest contribution within the manufacturing sector is associated with Food, Beverages and Tobacco which is expected under this structure to contribute more than 25 per cent of the total value added of manufacturing. It is also worth noting that more than 2/3 of manufacturing value added is concentrated in the consumer goods' producing sector or what is generally considered to be early-stage industrial activity.

The labour requirements to sustain such a pattern exceed 155 thousand man-year or almost 19 per cent of total expected employment in 1980. This represents a modest change from 15.6 per cent in 1970. The largest employment opportunities are expected to be in Textiles, Clothing and Leather. This accounts for 33 per cent of the total expected employment in 1980. Intermediate goods and capital goods are expected to employ less than 30 per cent of the labour force.

The total capital requirement is three times as large as that of 1970 which implies a growth rate of 10.9 per cent per year but the capital-output ratio and the capital-labour ratio are not outside the bounds of observable rates. The investment required on a yearly basis (an average of about LL. 200 million annually) is also one that is sustainable given the domestic savings and the current account deficit that are likely to emerge in 1980. However, the investment rate required to build the capital stock is substantially higher than past rates. Any slackening in the rate of investment would render the structure depicted in alternative A unrealizeable.

The levels of exports needed to sustain the historical structure exceed LL. 1,363 million; a figure that appears to be consistent with past trends.

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Furthermore, the labour allocation and export requirements would have to be met to sustain the various output levels depicted in this structure. The extent of damage to physical capital and the depletion of human capital during the civil war would have to be estimated accurately to define the gaps that need to be filled.

The realism of option A is perhaps its strongest advantage. However, it is one that does not allow for the expected and experienced pattern of most industrial societies. Below we present two profiles of the Lebanese industrial sector that were derived on the basis of the UNIDO estimates of the structure of manufacturing in relation to the growth of per capita income, population and degree of industrialization. The first structure, or alternative B, uses the estimated coefficients and is therefore indicative of the likely development of typical societies. Since Lebanon is by no means typical we have adjusted the estimated coefficients by subtracting one half standard error from the corresponding coefficient, the result is option C.

B. The Typical Industrial Pattern

The structure of GDP and manufacturing value added which are consistent with the estimated equations involves the following characteristics:

(i) The value added of manufacturing rises from LL. 2,097 million under alternative A to LL. 3,168 million. This amounts to almost 30 per cent of GDP, and represents an annual rate of growth of about 16 per cent, for the projection period.

(ii) The ratio of consumer goods to non-consumer goods declines. Fabricated metal products, chemical and chemical products increase in relative and absolute terms. For instance, whereas the relative share of fabricated metal products of total manufacturing value added is 11.7 per cent under alternative A, it now accounts for 28.7 per cent.

(iii) The re-structuring towards the "later-stages" of manufacturing involves heavy investments. The capital stock required in 1980 amounts to LL. 6,564 million or about six times that of the 1970 level. The investment required on a yearly basis is on the average about LL. 600 million. The capital-output ratio is nonetheless an average of 2.00, the shift in the composition of manufacturing output towards "heavy" manufacturing raises the capital-labour ratio in 1980 to LL. 28,437 from LL. 10,333 in 1970.

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In the light of the above discussion, and given that major restructuring can not be expected in the short-term, a third alternative was constructed that represents a sort of a compromise between the extra-polation of the past and the typical behaviour of industrial societies.

C. The Third Option: A Compromise

The nature of the compromise is revealed through the following changes:

(i) The contribution of the manufacturing sector to GDP is higher than the historical structure and lower than the typical industrial behaviour of alternative B. The percentage contribution is almost half the difference between alternatives A and C. It amounts now to 23.6 per cent. This represents an annual rate of growth equal to about 13 per cent.

(ii) The employment expected of this structure is 181,454 man-years. This again is between the low value of alternative A and the high value of alternative B. It now represents 22 per cent of total expected employment in 1980. This represents an increase of 6 percentage points over the 1970 level.

(iii) The capital requirement although smaller than that of alternative B, is still high and implies a rate of investment that is significantly higher than the observed rate during the sixties and early seventies (Annual investment of about LL. 350 to 400 million on the average).

(iv) The sectoral output distribution is one that balances traditional industry and end-stage manufacturing. Food, beverages and tobacco contribute the same value added as fabricated metal products. The employment structure is understandably different.

(v) It is interesting to note that alternative C involves a re-allocation of resources that generates, in the context of the simple model utilized in this note, the highest labour productivity. Furthermore, the capital-output ratio in the manufacturing sector is one that is not much different from those associated with the manufacturing sectors of developed economies.

(vi) The export requirement now is almost LL. 1,660.

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III. The Methodology.

A. The Model.

The basic framework of the study is a simple Harrod-Domar model. The following equations define the elementary structure of the system.

(1) $K(t) = k\, y(t)$

where $K(t)$ is the capital stock at time t.
$y(t)$ is gross domestic product over time t.
k is the capital-output ratio.

(2) $I(t) = K(t+1) - K(t) + \delta K(t)$

where $I(t)$ is gross capital formation over time t.
$K(t+1)$ is the capital stock at time t + 1.
δ is the capital consumption coefficient; it represents the fraction of the capital stock used in production.

(3) $I(t) = p\, y(t)$

where p is the average propensity to save.
using (2) and (3) we derive (4)

(4) $s\, y(t) = K(t+1) - K(t) + \delta K(t)$

Define the rate of growth of output g as:

(5) $g = [y(t+1) - y(t)] / y(t) = \dfrac{\Delta y(t)}{y(t)}$

It follows from the equations of the system outlined above that

(6) $\dfrac{\Delta K}{K} = k \dfrac{\Delta y}{K} = k \dfrac{\Delta y/y}{K/y} = \Delta y/y$

Using equation (2) we have

(7) $g = \dfrac{s}{k} - \delta$

In the applications of the model, the following aspect of the system was used to test the consistency of some of our forecasts.

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(8) $g = n+p = \frac{S}{k} - \delta$

where n is the rate of growth of the labour force.
p is the rate of growth of productivity.

Furthermore, another version of equation (7) was developed to infer a bench-mark value of K(t) which in turn can be used for calculating a capital stock series.

(9) $g = I(t)/ K(t) - \delta$

If g is known and δ is estimated, the gross capital formation may be used in conjunction with g and δ to determine K(t). Following that equation (10) can be used to determine the capital stock series.

(10) $K(t+1) = K(t) + I(t) - \delta K(t)$

B. Time Series Forecasts.

The aggregate economic structure of Lebanon was determined using trend values estimated for the period 1964-1974 for each economic sector. Four types of trends were utilized.

(a) Linear regression (straight lines) $y = a + bt$
(b) Exponential curves $y = a e^{bt}$ $(a > 0)$
(c) Logarithmic curves $y = a + b L_n t$
(d) Power curves (double-log) $y = a t^b$ $(a > 0)$

The types of regression chosen depended on the goodness of fit R^2 estimates and the plausibility of the trend. The aggregated values over the sectors represented the forecasts of GDP for 1975-1980. This procedure simply assumes that whatever forces have in the past determined the structure of the Lebanese economy are assumed to determine its future and as if the Civil disturbances had not taken place.

The GDP series was then used along with other selected variables to forecast the different components of national income. This was carried with an eye on analysing the investment requirements to re-build and re-structure Lebanon. Domestic savings plus the excess of imports over exports are supposed

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to match the needed investment. Any difference should be financed from outside. This ultimately determines the magnitude of foreign assistance needed to sustain the desired level of output.

The sectoral composition of investment was determined using the following simple formula.

$$(11) \qquad \lambda_i = \frac{K_i \Delta y_i}{I} \quad \text{and} \quad \sum_{i=1}^{n} \lambda_i = 1$$

where λ_i is the investment share of sector i.

k_i is the capital-output ratio of sector i.

Δy_i is the change in value added of sector i.

I is total aggregate capital formation.

The sub-sectoral investment shares were developed using (11)

$$(12) \qquad \lambda_{ij} = \frac{k_{ij} \Delta y_j}{I_j}$$

where k_{ij} is the sub-sectoral capital output ratio.
It is interesting to note that

$$(13) \qquad B_{ij} = k_{ij} / k_j$$

The beta coefficients represent the fraction of capital in sector j supplied by sector i.

C. The Planning Forecasts.

The historical projection of the industrial structure assumes that the past performance of the economy has been acceptable. Using international standards of industrial structures that were developed by UNIDO a different structure of production emerged. The UNIDO method is based on a 53 country sample which related value added in a given sector to population, as a proxy for size of the market, and per-capita income. The regression coefficients of the various equations were utilized to generate first in U.S. dollars and

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then in Lebanese pounds the expected value added by sub-manufacturing sectors. The population forecast was that conducted by the U.N. whereas the per-capita forecast was based on our GDP forecasts for the period 1975-1980. Surely one would expect the GDP forecast to be sensitive to the structure of production in general and to the composition of industry in particular. In this study we had to assume that GDP is insensitive to structure, otherwise a simultaneous system that is far too complex to solve would have emerged.

The industrial pattern that arose out of international comparisons required a structural re-organization of industry and a massive investment of funds that appeared to be beyond the present Lebanese resources and institutions. This finding necessitated another solution of the industrial pattern. Instead of the typical equation of the UNIDO study, the regression coefficients were adjusted by subtracting half a standard error from the estimated coefficient. The new equations were then used to generate the sectoral value added and subsequently the percentage distributions.

The final coefficients used are those presented in Table 8, which were used to derive alternative C.

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IV. Conclusion

The approach outlined in this note is simple indeed, but it has several attributes that may be considered advantageous. First, it allows us to entertain configurations of the economy that are outside its historical experience or trends. Second; the configurations considered are developed within a consistent framework of the relationships of components of the economy among each other. Furthermore, the configurations entertained include technological relationships that are consistent with the Lebanese data. Third, the development of several alternatives and the possibility of developing yet many more provides the policy makers with reference data on the opportunity costs (trade-off) of different policies. Fourth, the structure of the model is such that it generates substantial information on the basis of a limited sub-set of key variables. This points out the type of data that need to be collected on a priority basis as well as the type of parameters of policy that need to be monitored and controlled.

There are several short-comings of the approach. The major one is the questionable nature of the data. Another major qualification pertains to the violation of the structural consistency criterion. Reallocations among the industrial sector which change productivity are not allowed to change the total contribution of this sector to GDP. There are of course, many other shortcomings pertaining to the various assumptions made when using the various projection techniques and the various cross country estimates. The study is a first attempt, it is tentative and needs further requirements and work.

Table 6. Adjusted Coefficients of the UNIDO Model

Sector	Constant	Per Capita Income	Population
Total GDP	- 11.23	1.310	1.041
V_1	- 9.39	1.006	.856
V_2	- 12.97	.947	1.112
V_3	- 13.38	1.316	.907
V_4	- 13.25	1.322	.887
V_5	- 18.71	1.809	.957
V_6	- 13.96	1.174	1.013
V_7	- 13.50	.951	.947
V_8	- 17.58	1.443	1.105
V_9	- 15.01	1.256	1.168
V_{10}	- 13.19	1.194	.967
V_{11}	- 20.52	1.375	1.404
V_{12}	- 17.33	1.789	1.121
V_{13}	- 18.71	1.575	1.173

Note: The estimated equations were of the double-log nature (natural logs).

Table 9. Gross Domestic Product by Kind of Economic Activity (1965-1980)
(At Producers Values in Millions of Lebanese Pounds)

	1965		1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		1976		1977		1978		1979		1980	
	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values	Per Cent	Values
Agriculture, forestry, hunting and fishing	11.6	409	11.4	442	11.2	426	10.2	436	9.5	432	9.2	445	8.6	466	9.9	631	9.5	675	8.8	662	8.7	699	8.6	738	8.5	779	8.5	823	8.5	869	8.5	915
Mining, quarrying and manufacturing	13.1	462	13.2	512	12.9	493	12.9	552	13.4	609	13.6	661	13.9	750	13.9	884	14.6	1 038	15.2	1 152	15.8	1 272	16.4	1 403	17.0	1 547	17.7	1 707	18.4	1 884	19.2	2 079
Electricity, gas and water	2.2	78	2.3	88	2.4	93	2.3	99	2.3	104	2.3	113	2.2	118	2.0	129	2.0	140	2.0	150	2.0	158	1.9	165	1.9	172	1.9	179	1.8	187	1.8	195
Construction	5.7	200	6.0	231	5.1	196	4.6	194	4.7	216	4.5	218	4.4	239	4.6	290	4.2	300	4.5	342	4.5	364	4.5	386	4.5	408	4.4	430	4.4	452	4.4	472
Wholesale and retail trade, restaurants and hotels	30.8	1 085	30.6	1 183	30.4	1 161	31.8	1 359	31.4	1 435	31.4	1 527	31.9	1 723	31.5	2 007	31.6	2 241	31.3	2 363	31.0	2 503	30.8	2 643	30.5	2 782	30.3	2 923	30.0	3 062	29.6	3 201
Transport, storage and communication	8.2	291	8.0	310	8.6	329	8.9	380	8.4	383	8.2	401	8.1	438	7.5	478	7.2	513	7.3	554	7.2	582	7.1	609	7.0	636	6.9	663	6.8	690	6.6	717
Finance, insurance, real-estate and business services	3.6	125	3.7	141	3.9	149	3.8	164	3.2	147	3.4	165	3.6	197	3.7	235	4.0	285	3.9	296	3.9	316	3.9	337	3.9	358	3.9	379	3.9	400	3.9	421
Owner occupied dwellings	7.6	269	7.3	284	7.9	300	7.8	335	8.4	385	8.8	430	9.2	495	8.8	558	8.6	610	8.9	674	8.9	719	8.9	763	8.9	808	8.8	852	8.8	897	8.7	942
Community social and personal services	9.1	320	9.2	357	8.8	337	9.3	397	10.1	461	9.9	482	9.7	522	10.6	676	11.2	791	10.7	812	10.7	867	10.7	922	10.7	977	10.7	1 032	10.6	1 087	10.6	1 142
Public administration and defense	8.1	284	8.3	319	8.8	337	8.4	357	8.6	393	8.7	424	8.4	451	7.5	477	7.1	507	7.4	560	7.3	588	7.2	616	7.1	643	6.9	671	6.8	699	6.7	727
Gross domestic product (at producers' values)	100.0	3 523	100.0	3 867	100.0	3 820	100.0	4 273	100.0	4 565	100.0	4 866	100.0	5 399	100.0	6 365	100.0	7 100	100.0	7 565	100.0	8 068	100.0	8 582	100.0	9 116	100.0	9 659	100.0	10 227	100.0	10 811

Source: ECWA, Statistical Abstract of the Arab World (1968-1975). For 1974-1980 the data was projected by ECWA/UNIDO Industry Division.

Table 10. Alternative Structures of the Lebanese Manufacturing Sector in 1980

Industry	ALTERNATIVE A. HISTORICAL PROJECTION						ALTERNATIVE B. INTERNATIONAL COMPARISONS						ALTERNATIVE C. [illegible]					
	G D P in 1980 in Mfg.	Capital in 1980	GDP(Mfg.) Distribution Per Cent	Labour requirements	Distribution of labour Per Cent	Exports	G D P in 1980 in Mfg.	Per Cent Distribution	Capital in 1980	Labour requirements	Distribution of labour Per Cent	Exports	G D P in 1980 in Mfg.	Per Cent Distribution	Capital in 1980	Labour requirements	Per Cent Distribution of labour	Exports
1 Food and beverages and tobacco	524	634	25.0	22 143	14.3	64	666	21.0	806	28 148	12.2	96	664	26.0	803	28 044	15.5	76
2 Textile, clothing and leather	367	179	17.5	49 990	32.2	190	469	14.8	230	64 277	27.8	287	357	14.0	175	48 907	27.0	231
3 Wood and furniture	241	207	11.5	25 456	16.4	27	222	7.0	191	23 487	10.2	41	193	7.5	166	20 413	11.2	33
4 Paper, printing and publishing	189	316	9.0	9 698	6.3	115	283	8.9	473	14 516	6.3	173	180	7.1	301	9 238	5.1	140
5 Chemical and chemical products	178	452	8.5	8 414	5.4	156	283	8.9	719	13 394	5.8	236	243	9.5	617	11 494	6.3	190
6 Non-metallic mineral products	294	423	14.0	17 932	11.6	81	171	5.4	246	10 421	4.5	122	153	6.0	220	9 326	5.1	99
7 Basic metals products	38	89	1.8	2 300	1.5	317	87	2.7	204	5 271	2.3	479	31	1.2	73	1 888	1.0	386
8 Fabricated metal products	245	884	11.7	15 918	10.3	313	909	28.7	3 281	59 079	25.6	473	667	26.1	2 408	43 369	23.9	382
9 Other manufacturing	21	111	1.0	3 281	2.1	98	78	2.5	414	12 270	5.3	148	56	2.2	297	8 779	4.8	119
Total Manufacturing	2 097	3 295	100.0	155 132	100.0	1 363	3 168	100.0	6 564	230 822	100.0	2 059	2 554	100.0	5 060	181 494	100.0	1 660

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Table 11. The Manufacturing Sector Indices Under the Three Alternatives

	Mfg. as a per cent of G D P	Manufacturing employment per cent of total	Capital output ratio	Capital labour ratio	Productivity	Per cent change in the capital labour ratio 1980 / 1970	Per cent change in productivity 1980 / 1970
Alternative A	19.4	18.9	1.57	21 239	13 517	205.5	193.5
Alternative B	29.3	28.2	2.07	28 437	13 725	275.2	196.5
Alternative C	23.6	22.1	1.98	27 886	14 075	269.9	201.5
1970 Actual	13.6	15.6	1.78	10 333	6 985	100.0	100.0

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