PRODUCTIVITY IN MANUFACTURING INDUSTRIES IN KUWAIT

1. Introduction

In general, the growth of an industry depends on a number of factors, including productivity of factors of production within the industry, demand for products produced by the industry, availability of necessary inputs and expertise, and the government's industrial and commercial policies. Among the various factors, the productivity of factors of production is considered to be of critical importance, and is taken as an indicator of the overall performance and strength of the industry in question. Although, the productivity of factors depends mainly on management of resources within the industry, it has been shown to be influenced by a number of other factors. Some of the important factors affecting productivity are capital stock, technology, quality of labor (in terms of skills and qualifications), management practices, scale of operation (economies of scale), ownership structure (public, private, or joint), market structure (competitive, monopolistic, or monopoly) of both output and inputs, size of the product market, infrastructure and institutional framework, and policy environment.

Kuwait's economy is characterized by heavy dependence on one sector, i.e., mining and fuel extraction (mainly oil). In terms of contribution to the country's gross domestic product (GDP) and government revenues, on average, the shares of this sector are approximately 41% and 90%, respectively. The manufacturing sector, which is vital for increasing the value-added of national resources, employment generation, investment, and forward and backward linkages with other sectors of the economy, on average, accounts for approximately 10% of the country's GDP. For sustained socioeconomic development, it is imperative that not only Kuwait's economy be diversified but also that the manufacturing sector expands both in terms of absolute size as well as in the number and size of various industries within it.

Although for a variety of reasons it may be desirable to promote all types of industries in the country, given the endowment of human and natural resources, and sensitivity of the authorities towards population composition in terms of maintaining a balance between national and expatriate populations, the types of industries that are feasible (financially, economically, politically, and strategically) are limited, and thus, their selection requires careful considerations[1]. For Kuwait to have a growing manufacturing sector, it is important to look into the underlying factors that affect its growth, and ensure that industries with relatively better overall performance get due preference in the allocation of resources and incentives.

This study examines productivity in the manufacturing industries in Kuwait by computing labor productivity for each of the manufacturing industry and estimating a single equation model to explain variations in productivity over the years. The explanatory factors considered in the regression models are quality of labor, capital intensity, acquisition of technology, learning experience, and competition within the industry. The analysis in the paper is based on time-series data, covering the period from 1980 to 1997.

2. The manufacturing sector in Kuwait

The size and structure of Kuwait's economy differs from that of other countries of the world in many respects. On the one hand, in terms of size, it is one of the smaller countries of the world, but it is rich in oil reserves and has one of the highest per capita incomes in the world. At the same time, the country has a relatively open economy that depends heavily on international trade and expatriate labor to maintain its industrial and physical infrastructure. In terms of social and economic development, the country shares many characteristics with developing countries. The philosophy underlying Kuwait's development strategy is influenced by the country's heavy dependence on one sector, i.e., its exhaustible resource, oil. For instance, the mining of oil accounts for approximately 40% of country's GDP. The domestic non-mining production base is limited, with agriculture and manufacturing (including petroleum refineries,

[1] It may be added that while the Kuwaiti labor force prefers white-collar occupations, the manufacturing industries, in general, require production workers (or blue-collar occupations). Thus, the manufacturing industries rely on an expatriate labor force, which has implications for population composition.

which constitute 67% of manufacturing value-added) accounting for 0.4% and 12% of the country's GDP, respectively.

Over the years, while the dominance of oil has been reduced somewhat, oil still remains the main source of economic activity in the country, and both directly as well as indirectly, it contributes significantly towards the country's economic development. The share of the manufacturing sector in the GDP has increased from 4.2% in 1970 to 11.72% in 1999. In 1997, there were a total of 41 specific (4-digit ISIC) industries in Kuwait, with over 4,000 establishments, of which the textile group (ISIC 32) accounted for largest number (2224 or 55%). In terms of value-added, however, approximately 85% of the total manufacturing value-added is attributable to the petroleum and chemical group (ISIC 35). The establishments employing less than 10 persons account for 84% of the total establishments, of which approximately 63% are in the textile industrial group. Whereas, in terms of number of establishments, except for a small number of establishments (i.e., 18), all the other establishments are under complete private ownership; in terms of value-added, approximately 77% of the value-added in the manufacturing sector originates in the public sector. Furthermore, in 1997, approximately 64,000 persons were employed in the manufacturing sector, of which around 82% were in privately owned establishments. This is in sharp contrast with the share of privately-owned industries in the total value-added of the manufacturing sector, and suggests that the publicly-owned manufacturing industries are relatively more capital intensive than the privately-owned industries.

Over the years, while the manufacturing sector in Kuwait has expanded, it has lacked the necessary depth and diversity to ensure smooth expansion, and be a significant source of investment and employment generation. First, the manufacturing sector is dominated by large public corporations that are restricted to a single industry. Second, there are a large number of small establishments across most industries that account for the bulk of the employment in the manufacturing sector. Third, each industrial group is dominated by one or two industries[2]. Given the importance of a dynamic manufacturing sector, a number of studies have examined different issues related to the performance of the manufacturing industries[3].

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[2] For a detailed overview of manufacturing sector in Kuwait, see Burney and Al-Mussallam (2002).

[3] Some of the important studies are Burney and Al-Mussallam (2002),

3. Analytical framework

Productivity is defined as the ratio between output and input (most typically output per man-hour), both measured in real terms. Being one of the main determinants of relative well-being among nations, productivity of factors of production is an economic concept of central importance. Despite its significance, however, the productivity concept remains highly elusive, and the term is used in a number of ways, including partial measures, such as labor productivity (output per worker or output per man-hour), capital productivity (output per unit of capital), and total factor productivity (TFP)[4]. The basic economic framework behind these concepts is production theory (production function), which relates output as a function of physical capital, labor, raw material, technology, and other inputs, such as energy.

At any particular point in time a host of factors influence the level of productivity (labor and total factor) in an industry (establishment). In general, the level of productivity varies across industries (establishments) as well as over time within a given industry. It is well known that variations in inputs can be both quantitative (i.e., physical units) and qualitative[5]. As such, some of the factors that are found to exert profound influence on the level of productivity are technical progress (i.e., the state of industrial art or technological innovation that is imbedded in the equipment and machinery employed), quality of labor, capital intensity, availability of raw materials, and organizational structure.

Theoretical and empirical studies have shown that technology is an important determinant of productivity growth. While Solow (1956) shows that technological improvement is important, the endogenous growth models emphasize that human and knowledge capitals lead to improvements in technology creation, adoption, and absorption; and hence, are important determinants of the level of innovation activity in the country that affects productivity[6]. Whereas

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Mahmood *el al*. (2000), Salama *et al*. (1996), and Al-Matrouk and Hajeeh (1995).

[4] For a brief review of the general concept of TFP, see Cornwall (1991) and Bruton (1995).

[5] See, Horton and King (1981) for various issues related to labor productivity.

[6] For detailed discussions on endogenous growth models, see Arrau (1989), Bruton (1995), Dahlman *et al*. (1985), Lichtenberg (1994), Lucas (1988), and

human capital formation is generally taken as an increase in the level of education of the workforce (or more specifically, increase in the number of engineers, technicians, and qualified workers); the accumulation of knowledge is represented by R & D activity that contributes to intellectual capital formation.

An industry that relies relatively more on capital goods as factors of production, and promotes an environment that makes use of more skilled machines (capital-using but labor-saving) experiences greater improvements in productivity (output per worker). In other words, industries (establishments) with higher stock of capital per worker and relatively greater annual investment, which ensures the smooth flow of the latest technological innovations, are likely to have higher productivity (output per worker). In addition to the physical capital, the quality of labor, which is also termed as human capital, is a major factor that contributes towards higher productivity. Some of the important dimensions of quality of labor are education, training, experience, and health and nutritional status of the labor force. In fact, recent studies and experiences of newly industrialized countries have shown that the rate of technological innovations is tied to education and, hence, human capital formation. Thus, industries with a relatively better quality of labor are likely to have higher productivity.

In order to explain variations in productivity within a given industry over the years, the following regression model has been used[7]:

$$Y^i = \alpha^i + \beta^i X_1^i + \gamma^i X_2^i + \lambda^i X_3^i + \delta^i X_4^i + \theta^i X_5^i + \sum \tau_j^i D_j^i + e_i \quad (1)$$

where Y^i is estimate of labor productivity for i^{th} industry (defined as real value-added per worker)[8]; X_1^i is an indicator of quality of labor in i^{th} industry (defined as real remuneration per employee); X_2^i is investment rate (defined as the ratio of investment and value-added), a measure of acquisition of technology, in i^{th} industry; X_3^i is the capital-labor ratio (a measure of capital intensity) in i^{th} industry; X_4^i is cumulative output (a measure of learning-by-doing) of i^{th} industry; X_5^i is number of establishments in the i^{th}

Romer (1986).

[7] See, Mahmood and Siddiqui (2000), and Leung (1997) for similar approach.

[8] Because of lack of consistent time series data on capital stock, only labor productivity is computed and examined.

industry (a measure of internal competition); D^i_j is a set of dummy variables describing non-quantifiable events; e_i is an error term; and $\alpha^i, \beta^i, \gamma^i, \lambda^i, \delta^i, \theta^i, \tau^i$ are the parameters to be estimated[9]. *A priori*, the parameters are expected to bear positive signs.

4. Results

The estimates of labor productivity for each of the 41 (4-digit ISIC) industries obtained on the basis of three-year moving average series of the annual real value-added and employment are presented in Table 1[10]. The estimates show that during the period under study (i.e., from 1980 to 1997), average labor productivity across different manufacturing industries ranged between KD 2212.9 and KD 63899.6. Among the different industries, average labor productivity is highest for the petroleum refining industry (ISIC 3530), and lowest for the wearing apparel industry (ISIC 3220). The evidence presented in the table show that in a majority of the industries labor productivity over the years has been either declining or has remained relatively unchanged. In order to ascertain factors affecting changes in labor productivity over time, Eq. 1 was estimated on the basis of annual time-series data covering the period from 1980 to 1997 for all those industries for which data were available. The estimated regression results are presented in Table 2[11].

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[9] The above formulation does not include explicit indicators of knowledge and human capitals. This is because of a lack of industry-specific data related to knowledge and human capital. It the literature, growth rates of development expenditure on industrial R & D activity and R & D manpower are used as proxies for knowledge accumulation. The stock of human capital, on the other hand, is measured by enrollment in higher educational institutions or accumulated expenditure on the development of human capital.

[10] The estimates of labor productivity are based on time-series data covering the period from 1980 to 1997, which were obtained from various issues of the *Annual Survey of Establishments: Industry* (CSO, 1997). In the case of capital intensity, three different indicators, namely capital-output ratio, capital-labor ratio, and incremental capital output ratio (ICOR) were taken into consideration. For most industries, the three capital intensity measures showed similar trends. Therefore, capital-labor ratio was taken as a measure of capital intensity. The data used in the estimation of the capital-labor ratios refer to the book value of capital stock in each industry.

[11] The regression was estimated for 35 of the 41 industries, and only the final regression results are being reported. In the preliminary estimation, serial autocorrelation was found for a number of industries. Subsequently, the

Table 1 - *Estimates of Labor Productivity in Manufacturing Industries in Kuwait (in 000 Kuwaiti Dinars)*

ISIC	3112	3117	3121	3122	3134	3212	3220	3231	3311	3319	3320	3412	3419	3420	3511	3512	3521	3523	3529
1982	11.396	2.671	3.631	4.158	4.224	4.203	3.245		7.226	5.175	4.623	4.921		4.509	6.774	13.24	10.98		
1983	6.269	2.720	4.315	4.159	5.003	4.248	3.311		6.378	5.148	4.658	4.707		4.569	6.362	10.67	11.15		
1984	5.935	2.787	4.823	3.883	4.807	4.313	3.483		4.535	6.772	4.349	4.656	4.566	4.211	6.459	9.955	9.734		6.529
1985	7.482	2.957	4.480	2.598	4.703	4.280	3.455		3.712	4.657	3.993	4.513	4.063	4.032	5.353	9.953	9.021		5.462
1986	7.782	3.023	4.479	2.281	4.367	4.101	3.453		3.188	3.959	3.808	5.034	4.294	3.852	5.536	10.34	8.274		5.033
1987	7.479	3.212	4.862	3.028	3.935	4.272	3.237		2.633	3.791	3.742	5.078	4.843	3.947	6.104	9.339	8.086		4.535
1988	6.742	3.241	5.565	3.544	3.567	3.837	2.784		2.597	4.180	3.505	5.531	5.178	3.686	7.263	11.95	7.384		5.163
1989	6.444	3.226	5.682	6.110	3.240	3.438	2.317		2.664	4.395	3.160	5.508	4.619	3.436	7.843	12.92	7.036	4.058	5.598
1990	4.901	2.774	4.226	6.690	2.917	2.627	1.697		2.257	3.874	2.524	6.264	3.812	2.779	7.738	14.01	6.234	3.973	6.457
1991	4.588	2.618	3.627	7.762	2.777	1.943	1.282		1.953	3.189	2.037	5.149	2.926	2.098	7.415	10.48	6.718	4.792	6.136
1992	4.059	2.545	2.958	4.405	2.858	1.769	1.055		1.973	3.437	2.107	4.489	2.308	1.934	7.660	10.87	8.256	4.633	4.981
1993	6.550	2.732	3.885	3.192	3.445	1.794	1.134		2.034	3.207	2.313	2.982	2.962	2.352	8.924	10.78	11.69	5.172	4.784
1994	6.336	2.715	3.492	3.677	3.283	1.899	1.256	3.447	2.211	3.129	2.482	3.434	3.181	2.581	9.923	14.08	11.45	4.884	6.075
1995	6.140	2.661	3.134	3.799	3.113	1.855	1.271	3.233	2.343	2.528	2.351	3.732	3.603	2.505	10.11	20.25	10.84	5.408	9.167
1996	6.100	2.672	3.525	3.763	2.978	1.717	1.260	2.633	2.291	2.442	2.102	3.782	3.330	2.684	9.426	27.27	9.992	6.813	14.56
1997	5.923	2.693	3.531	3.644	3.017	1.671	1.170	2.168	2.126	2.380	2.005	3.623	3.386	2.977	9.833	28.13	10.35	6.945	10.98
Average	6.508	2.828	4.138	4.168	3.640	2.998	2.213	2.870	3.133	3.891	3.110	4.588	3.791	3.260	7.670	14.01	9.199	5.187	6.818

ISIC	3530	3540	3559	3560	3620	3692	3699	3710	3812	3813	3819	3824	3829	3831	3839	3841	3843	3901	3909
1982	45.701		7.827	6.041	6.098	22.756	5.711	3.242	4.271	5.676	5.815	4.485	6.172			4.620	6.783	4.588	3.932
1983	33.264		7.432	6.236	6.298	17.265	5.666	4.269	3.857	5.254	5.369	4.071	5.100			3.508	5.191	4.126	3.981
1984	22.306		5.949	6.251	6.149	13.908	5.947	5.170	4.107	4.705	5.039	3.819	4.444	3.553	18.595	2.996	4.106	4.537	3.909
1985	25.143		5.821	5.728	4.537	10.627	5.917	5.366	4.488	4.562	5.577	4.577	3.962	4.171	13.644	2.968	3.054	4.564	3.689
1986	35.904		5.361	5.331	4.263	10.290	5.920	5.200	5.035	4.820	6.966	4.816	4.208	3.451	10.467	4.322	3.580	4.444	3.745
1987	60.188	5.968	5.550	4.789	4.850	9.767	5.616	4.821	4.891	4.665	7.616	4.754	4.406	2.769	11.420	4.908	3.353	3.460	4.071
1988	73.738	4.645	4.979	4.875	6.168	10.343	5.827	4.834	3.997	4.204	6.272	3.542	4.433	3.356	11.358	4.348	2.943	3.209	4.026
1989	88.030	4.283	5.041	4.721	6.340	9.930	5.845	5.065	3.471	3.515	4.549	2.831	4.119	3.004	9.891	2.765	2.439	3.204	4.099
1990	86.748	4.067	4.198	4.306	6.505	12.293	5.027	4.358	2.271	2.760	3.509	1.778	3.428	2.878	9.820	1.782	2.073	3.470	2.854
1991	75.136		3.302	3.688	6.077	16.840	3.842	3.480	2.216	2.274	2.392	1.488	3.110	2.033	10.031	1.096	1.725	3.257	2.483
1992	56.217		2.113	4.087	6.138	19.749	3.196	3.066	2.160	2.296	2.697	1.482	2.711	2.971	9.726	1.923	2.072	3.127	2.226
1993	48.701		2.232	5.253	6.296	15.392	4.423	3.954	2.814	2.483	3.573	1.848	3.226	2.967	8.293	2.431	3.172	2.924	2.394
1994	70.098	5.384	3.208	6.294	6.706	13.408	5.542	4.569	2.255	2.586	4.129	1.912	2.936	3.004	7.103	3.410	3.110	2.751	2.281
1995	80.279	5.456	4.204	6.644	6.478	14.803	5.680	3.981	2.015	2.436	3.686	1.640	2.762	2.689	7.643	2.973	2.305	2.654	1.903
1996	99.565	4.874	4.518	6.827	6.236	12.156	5.713	3.099	1.940	2.337	3.629	1.456	2.300	2.686	7.925	2.597	2.094	2.627	1.859
1997	121.38	5.103	4.808	7.004	6.087	9.602	5.503	2.653	1.949	2.289	3.631	1.322	2.331	2.699	9.414	2.295	2.057	2.789	1.921
Average	63.900	4.972	4.784	5.505	5.952	13.684	5.336	4.195	3.233	3.554	4.653	2.864	3.728	3.016	10.381	3.059	3.129	3.483	3.086

TABLE 2 - *The Estimated Regression Results (Dependent Variable: Labor Productivity)*

	Industry										
	Dairy Products	**Bakery Products**	**Food Products**	**Animal Feeds**	**Soft Drinks**	**Made-up Textiles**	**Wearing Apparel**	**Sawmill**	**Wood Products**	**Wood Furniture**	**Paper Boxes**
Variable/ISIC	**3112**	**3117**	**3121**	**3122**	**3134**	**3212**	**3220**	**3311**	**3319**	**3320**	**3412**
Labor Quality	4.565*	0.399^	3.298*	2.228^	0.997^	2.539*	0.964*	1.891*	1.856^	1.717*	-1.475^
	(5.606)	(1.674)	(5.091)	(1.645)	(1.642)	(7.183)	(5.109)	(3.299)	(1.582)	(3.443)	(-1.513)
Capital Intensity	0.104*	0.207*	0.063	-0.200^{+}	-0.133	-0.137		-0.815*	1.338	-0.156	0.306*
	(4.859)	(3.770)	(0.362)	(-1.973)	(-1.140)	(-1.283)		(-5.570)	(0.912)	(-0.982)	(2.954)
Technology Acquisition			0.176	-0.559	5.417**	1.423				-0.275	
			(0.325)	(-0.999)	(2.307)	(0.577)				(-0.368)	
Learning Experience		0.000001	0.000002	0.0005^{+}	-0.00001*		-0.000001**	-0.00002*	-0.0005^	-0.000004^	0.00001
		(1.072)	(0.454)	(2.000)	(-4.153)		(-2.601)	(-2.867)	(-1.688)	(-1.674)	(0.951)
Internal Competition	0.212	-0.003**	0.182*	0.689^{+}	-0.258**	-0.010*				0.004	-0.467^{++}
	(0.536)	(-2.192)	(4.838)	(1.950)	(-2.243)	(-3.080)				(0.560)	(-1.386)
AR(1)	0.200*	-0.363	-0.356		-0.065	0.230	0.764*	-0.370^{++}	0.175	-0.015	-0.274
	(3.318)	(-1.070)	(-1.235)		(-0.713)	(0.750)	(4.013)	(-1.423)	(0.596)	(-0.043)	(0.808)
Intercept	-6.929*	2.414*	-6.821*	-2.962	5.988*	1.738^	3.121**	4.571**	2.617	0.344	6.317**
	(-2.956)	(5.432)	(-3.015)	(-1.080)	(4.346)	(1.682)	(2.622)	(2.545)	(1.123)	(0.144)	(2.229)
R-square	0.871	0.704	0.863	0.567	0.841	0.931	0.970	0.876	0.598	0.959	0.512
DW-Statistics	2.681	2.161	2.509	2.021	2.269	1.625	1.114	1.708	1.969	1.979	2.002
F-Statistics	14.859*	5.226*	10.480*	3.147**	8.821*	29.889*	141.795*	21.153*	4.462**	39.246*	2.310^

TABLE 2 - *continued*

	Industry											
	Paper Articles	**Printing**	**Industrial Chemicals**	**Chemical Fertilizer**	**Paints & Varnish**	**Chemical Products**	**Petroleum Refining**	**Rubber Products**	**Plastic Products**	**Glass Products**	**Cement**	**Non-Metal Mineral**
Variable/ISIC	**3419**	**3420**	**3511**	**3512**	**3521**	**3529**	**3530**	**3559**	**3560**	**3620**	**3692**	**3699**
Labor Quality	1.782*	1.288*	1.190**	-3.389^{+}	1.516	3.472*	18.890*	3.695*	1.651*	-1.348**		4.060*
	(3.654)	(8.453)	(2.385)	(-2.051)	(1.289)	(4.173)	(4.173)	(4.971)	(3.160)	(-2.844)		(6.914)
Capital Intensity	-0.046	-0.306**	0.004	-0.215^	0.146	-0.378**	-0.150			-0.068**	0.166	-0.229^{+}
	(-0.538)	(-2.170)	(0.094)	(-1.667)	(0.146)	(-2.781)	(-0.581)			(-2.759)	(0.582)	(-2.061)
Technology Acquisition	0.493		2.321	-8.879**	0.010		-25.846*				4.273	0.248
	(0.328)		(0.466)	(-2.842)	(0.001)		(-3.654)				(0.733)	(0.469)
Learning Experience		-0.00001*	0.0002*	0.00005*	-0.0005^{+}	0.0002	0.00004*		0.00002^{+}	0.000004	0.0008^	0.000002**
		(-5.640)	(4.612)	(3.602)	(-1.983)	(1.143)	(4.263)		(1.884)	(0.310)	(1.610)	(2.551)
Internal Competition	0.078		-0.612^{+}	9.546^{+}	-0.490^	-1.357*			0.046	0.037	-4.601**	-0.011^
	(0.580)		(-1.853)	(2.063)	(-1.385)	(-3.144)			(0.823)	(0.526)	(-2.435)	(-1.659)
AR(1)	0.060	0.486^{+}	0.504**	0.193		0.326	0.945*	0.196	0.818*	0.559^{+}	0.540**	-0.386^{++}
	(0.123)	(-1.905)	(2.183)	(0.645)		(0.948)	(42.897)	(0.783)	(5.485)	(1.938)	(2.233)	(-1.426)
Time					4.509^{+}							
					(1.956)							
Intercept	-0.005	2.809*	2.399	26.046^{++}	13.876*	4.963	-1381.62**	-0.091	-1.542	6.076*	4.130	-0.206
	(-0.004)	(3.548)	(0.837)	(1.484)	(3.626)	(1.176)	(-2.131)	(-0.086)	(-0.586)	(4.822)	(0.222)	(-0.115)
R-square	0.719	0.914	0.872	0.818	0.683	0.850	0.898	0.704	0.844	0.606	0.509	0.934
DW-Statistics	1.843	2.130	1.767	1.658	2.009	1.757	2.163	2.001	1.393	1.490	1.497	2.062
F-Statistics	4.549**	29.029*	11.380*	7.464*	3.941**	10.156*	19.351*	16.649*	16.223*	3.389**	2.286^	23.452*

TABLE 2 - *continued*

	Industry											
	Iron & Steel	**Metal Furnit**	**Structur Metal**	**Metal Products**	**Industr Machin**	**Machiner & Equip**	**Electrical Mach**	**Electrical Appliances**	**Ship Building**	**Motor Vehicles**	**Jewelry Articles**	**Misc Products**
Variable/ISIC	**3710**	**3812**	**3813**	**3819**	**3824**	**3829**	**3831**	**3839**	**3841**	**3843**	**3901**	**3909**
Labor Quality	3.267*	1.998*	1.629*	3.179*	1.255*	3.268*	2.400*	0.891	1.115**	1.271*	-2.076^	1.030*
	(6.914)	(5.983)	(7.515)	(3.780)	(1.645)	(1.642)	(7.183)	(5.109)	(3.299)	(1.582)	(3.443)	(-1.513)
Capital Intensity	-0.031		-0.649^{++}				-0.491^{+}	-0.561^{+}	0.060		0.312	-0.059^{+}
	(-0.436)		(-1.481)				(-1.812)	(-1.879)	(0.886)		(0.934)	(-2.121)
Technology Acquis		8.263*			1.404	2.102^{+}	4.337^{+}				-39.156^{+}	-6.343^{+}
		(2.747)			(0.484)	(1.988)	(1.857)				(-2.021)	(-2.010)
Learning Experienc	-0.00001		-0.000004**			-0.00001^	0.00003		0.00002	-0.0002*	-0.000004	-0.0001*
	(-0.849)		(-2.264)			(-1.566)	(-1.143)		(1.202)	(-2.640)	(-1.079)	(-5.185)
Internal Competit	0.366**				-0.040	-0.103**	0.083*	-2.079^	-0.238	-0.218^{+}	-0.025*	0.008^{+}
	(2.803)				(-1.198)	(-2.806)	(1.237)	(-1.570)	(-1.084)	(-1.945)	(-3.174)	(1.949)
AR(1)	0.844*		0.387^{++}	0.254	0.006	-0.153	-0.690**	0.381^	0.250	0.188	-0.039	-0.598**
	(5.957)		(1.443)	(0.927)	(0.029)	(-0.495)	(-2.938)	(1.716)	(0.879)	(0.612)	(-0.240)	(-2.175)
Intercept	3.716	-0.332	3.297**	-1.331	0.431	-0.257	-1.781	20.829*	0.372	15.91**	10.139*	2.321*
	(0.416)	(-0.649)	(2.485)	(-0.977)	(0.768)	(-0.182)	(-0.736)	(2.977)	(0.184)	(2.494)	(3.296)	(5.221)
R-square	0.831	0.790	0.945	0.711	0.949	0.891	0.783	0.606	0.772	0.802	0.891	0.948
DW-Statistics	1.553	2.076	1.353	1.645	1.870	1.985	2.246	2.117	1.812	1.605	1.630	2.671
F-Statistics	11.475*	28.242*	51.673*	17.199*	56.322*	17.952*	4.797*	3.840**	7.448**	12.142*	12.204*	30.329*

The evidence reported in the table shows that, in general, depending on the industry, the set of explanatory variables included in the regression explain around 80% of the variation in labor productivity[12]. The F-statistics corresponding to each of the regressions confirms that the explanatory powers of the estimated regressions are statistically significant. Also, the DW-statistics are within the permissible range, which suggests that the estimated regression do not suffer from serious auto-correlation. Not all of the estimated coefficients bear anticipated sign and are statistically significant.

For a majority of the industries (30 out of 35) the coefficient with respect to real remuneration per employee is positive and statistically significant, implying a positive relationship between labor productivity and quality of labor. In other words, increases (decreases) in labor productivity in the manufacturing industries in Kuwait have been caused by improvements (deterioration) in the quality of labor. During the period under study, most of the manufacturing industries in Kuwait experienced decrease in real remuneration per employee. This suggests that the declining labor productivity in the manufacturing industries in Kuwait is associated with deterioration in the quality of labor in the industries.

No clear relationship is found to exist between capital intensity

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regressions were re-estimated following adjustment for autocorrelation using the Cocrhane-Orcut procedure. Accordingly, the autocorrelation coefficient with the appropriate order AR(1 or 2), i.e., rho, appears in the regressions. Finally, since the recent developments in time-series econometrics (i.e., unit roots and co-integration tests, and error-correction models) the stationarity of series has become an important issue. In this study, because of the limited number of observations, and the fact that the dependent and independent variables are ratios that are expressed in terms of different variables, seasonality (or disturbance) is not a serious issue. As such, the different time-series were not tested for stationarity.

[12] During the Iraqi invasion of August 1990, and subsequent occupation and war of liberation the industrial infrastructure in the country was severely damaged. Also, the industries lost most of their manpower. As a result, it is generally believed that productivity in the manufacturing industries was adversely affected. To take into account the impact of the Iraqi invasion, a dummy variable (D = 1 for 1990 and 1991: and D = 0 otherwise) was included in the regression. In the initial estimation, for most industries the dummy variable was statistically insignificant, implying that the Iraqi invasion had no impact on the productivity of the industries. Accordingly, in the subsequent estimations the dummy variable was not included in the regressions.

and labor productivity. For 11 of the 35 industries, the coefficient of capital-labor ratio is negative and statistically significant. At the same time, for only three of the 35 manufacturing industries the coefficient is positive and statistically significant. In other words, in general, an increase in capital intensity has led to decline in labor productivity in the manufacturing industries in Kuwait. Not all the manufacturing industries are found to exhibit relationship between labor productivity and acquisition of technology. The coefficient with respect to investment rate is generally found to be positive and statistically significant for only four industries. The evidence implies that capital intensity and acquisition of technology have not led to improvements in labor productivity in manufacturing industries in Kuwait. The lack of unambiguous relationships capital intensity and labor productivity and acquisition of technology and labor productivity can be attributed to low capacity utilization in the manufacturing industries. It is estimated that, on average, the capacity utilization rate among the manufacturing industries in Kuwait is approximately 34%, implying that at any given time 66% of the installed capacity remains unutilized, see Jamal (1999).

As reflected by the coefficient with respect to cumulative output, the relationship between learning experience and labor productivity is not positive across the manufacturing industries. In 11 of the 35 industries the coefficient is found to be negative and statistically significant, and for only 7 industries it is found to be positive and statistically significant. The evidence suggests that in general learning experience has not led to improvements in labor productivity in the manufacturing industries. Surprisingly, the estimated coefficient with respect to number of establishments in the industry (i.e., competition within the industry) is negative and statistically significant for 13 of the 35 industries. The evidence suggests that increasing internal competition has led to lower labor productivity in the manufacturing industries. This could be due to the fact that most of the industries that have large numbers of establishments are also small-sized and relatively labor-intensive.

5. Concluding remarks

This paper has examined productivity in manufacturing industries in Kuwait. In particular, labor productivity for each of the 41 manufacturing industries has been computed and attempts

have been made to explain variations in productivity over time. To explain variations in productivity, a general reduced-form, single-equation, model was specified and estimated using OLS methods. The different explanatory factors considered in the regression models were quality of labor, capital intensity, acquisition of technology, learning experience, and competition within the industry. The analysis in the paper is based on time-series data covering the period from 1980 to 1997.

The estimates of labor productivity presented in the paper showed that among the different manufacturing industries, average labor productivity is the highest for the petroleum refining industry (an activity in which the country enjoys comparative advantage because of abundance of hydrocarbon resources) and the lowest for the wearing apparel industry during the period under study. Over the years, labor productivity in a majority of manufacturing industries in Kuwait has declined. The regression model estimated to explain variations in labor productivity over the years within a given industry showed that the set of explanatory variables (i.e., quality of labor, capital intensity, acquisition of technology, learning-experience, and internal competition) included in the model explain at least 60 to 70% of the variation in labor productivity. For almost all of the industries, labor productivity was linked positively to the quality of labor employed in the industry, implying that the decline in labor productivity experienced by the industries was due to deterioration in the quality of labor. In other words, if labor productivity in the industries is to be improved, then the declining trend in the quality of labor must be reversed.

The relationship between other explanatory factors and labor productivity was either non-existent or not uniform (i.e., positive or negative for different industries) across industries. For instance, for a majority of industries, capital intensity had no impact on labor productivity. Although no industry-specific information on capacity utilization in the industries was available, the lack of a positive relationship between labor productivity and capital intensity could be due to the low capacity utilization experienced by most of the industries and poor management of available resources. Similarly, for a majority of the industries, no link was found between labor productivity and acquisition of technology, which suggests that the declining trend in labor productivity in the industries is not attributable to the acquisition of technology or lack thereof. As

technology is an important determinant of productivity, this lack of a relationship needs in-depth investigation to determine the types of technology different industries employ and the processes employed in their acquisition.

In the case of learning-experience and internal competition, the relationship with labor productivity was not always positive (as expected) or negative. The negative impact of learning-experience on labor productivity could be due to the market conditions faced by the industries, and management of their available resources. Whatever the reasons, there is a need to investigate why, despite many years in the business, the industries experienced declining labor productivity. A majority of the industries exhibited lack of a clear relationship between internal competition and labor productivity. This could be due to the size of the market, excess capacity within the industry, and the inward-looking policies of the government.

Nadeem A. Burney

Kuwait Institute for Scientific Research, Techno-Economics Division, Safat, Kuwait

Othman E. Mohammed

Kuwait Institute for Scientific Research, Safat, Kuwait

Nadia Al-Mussallam

Kuwait Institute for Scientific Research, Safat, Kuwait

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ABSTRACT

This paper examines productivity in manufacturing industries in Kuwait. In particular, labor productivity for each of the industry is estimated and a general reduced-form single equation model is estimated to explain changes in productivity over time. The explanatory factors taken into consideration are quality of labor, capital intensity, acquisition of technology, learning experience, and internal competition. The evidence shows that labor productivity in the industries is positively linked to quality of labor, learning experience, private ownership, and exposure to international markets. Capital intensity, acquisition of technology, and size of the industry are found to have no impact on productivity.

JEL Classification: D24, L60, O40

RIASSUNTO

La produttività delle industrie manifatturiere in Kuwait

Questo lavoro esamina la produttività nelle industrie manifatturiere in Kuwait. In particolare viene stimata la produttività del lavoro per ogni impresa con una singola equazione in forma ridotta che spiega i cambiamenti della produttività nel tempo. I fattori esplicativi presi in considerazione sono la qualità del lavoro, l'intensità di capitale, l'acquisizione di tecnologia, l'esperienza e la competitività interna. L'evidenza mostra come la produttività del lavoro nell'industria sia legata positivamente alla qualità del lavoro, all'esperienza, alla proprietà privata e all'esposizione ai mercati internazionali. L'intensità del capitale, l'acquisizione di tecnologia e la dimensione dell'industria non risultano avere invece alcun effetto sulla produttività.