INVESTMENT EFFICIENCY, HUMAN CAPITAL & MIGRATION

A PRODUCTIVITY ANALYSIS OF THE JORDANIAN ECONOMY

by

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Discussion Paper Series

Document de Travail

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A PRODUCTIVITY ANALYSIS OF THE JORDANIAN ECONOMY

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Gaston Gelos
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March, 1995

This paper originated during a summer at the World Bank. I am particularly grateful to Chang-Po Yang and Harald Uhlig for their encouragement and suggestions. I also would like to thank Ishac Diwan, Ashutosh Dubey, Jesko Hentschel, Francesco Mongelli, Nouriel Roubini, Xavier Sala-i-Martin and Radwan Shaban for helpful comments. All errors remain mine.
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1. Introduction

Recently, economists have become increasingly interested in studying the growth experience of individual countries in order to test the implications of the endogenous growth literature and to complement the insights gained by large cross-country regressions. This approach was pioneered by Alwyn Young (1991).

This paper makes an attempt to contribute to such empirical investigation of growth processes by studying the case of Jordan, a small open economy that experienced huge migration flows and inflows of foreign funds during the past two decades. The aim is to identify the sources and patterns of productivity and growth of the Jordan economy, giving special attention to the effects of labor flows and the quality of investment. The results are interpreted in view of the role of human capital, migration and investment externalities in modern growth analysis. Given the chances for the region brought about by the peace process, the implications for the design of future policies are particularly interesting.

The period examined is that between 1970 and 1992. The natural year to start with may have been 1968, following the war and the occupation of the West Bank. However, for the two years immediately after the war, the available data for the West Bank was not consistent with that of later years.

The structure of the paper is as follows: after giving a brief description of the salient features of Jordan’s economy and its performance in the last 23 years, various productivity and investment indicators are examined. In the main part, a total factor productivity analysis is carried out, the validity of the basic neoclassical and simple endogenous growth models for the Jordanian case is evaluated, and explanations for the results are given. A more detailed sectoral analysis would have been insightful, but could not be pursued because of lack of adequate data.

The analysis reveals that Jordan has a poor productivity record, and that productivity growth was negative during the eighties. The result is somewhat surprising, since Jordan has made substantial improvements in education and infrastructure. Interestingly, human capital as measured by average schooling years multiplied by the size of the work force, does not help
to explain the productivity residual. One of the main results of this paper is therefore that corrections to the standard measurement of human capital are indispensable for those countries that experience large migration flows.

Given the salient characteristics of Jordan’s economy, this paper concentrates on two major explanations for stagnant/declining productivity: first, it is argued that the large amounts of foreign aid and remittances were not used efficiently, and that investment quality declined. The view that foreign capital can weaken rather than strengthen an economy\(^1\) is thus supported, to the extent that "strengthening" is understood as an improvement in productivity. Second, the paper claims that the outflow of skilled Jordanians and the inflow of unskilled workers from abroad formed an obstacle for productivity improvements. Due to lack of detailed information, only incomplete empirical evidence for this hypothesis can be given.

A result which is interesting from a theoretical perspective is that simple endogenous models with investment spillovers do not offer an adequate description of the Jordanian experience. The forces driving growth and productivity are of a more subtle nature.

From a policy point of view, Jordan could enhance its economic performance and adjust to the new environment by concentrating efforts on improving the allocation of resources in its economy, particularly through a further development of its financial system.

\(^1\)see Lavy and Sheffer(1987)
1. Introduction

Les économistes s'intéressent depuis peu de plus en plus à la croissance des pays afin de tester les implications des écrits sur la croissance endogène et d'approfondir les connaissances qu'ils ont retirées d'importantes régressions transnationales. Alwyn Young (1991) a été en ce domaine un précurseur.

Le présent rapport tente d'apporter sa contribution à la connaissance empirique de la croissance en étudiant la Jordanie, petite économie ouverte qui a connu au cours des deux dernières décennies un fort courant d'émigration et un important afflux de devises. Le but est de mettre au jour les sources et les formes de productivité et de croissance dans ce pays en s'attachant tout particulièrement aux effets des flux de main d'œuvre et à la qualité de l'investissement. Les résultats sont interprétés en tenant compte du rôle des ressources humaines, des migrations et des facteurs externes intervenant dans l'investissement selon l'analyse moderne de la croissance. Compte tenu des chances que le processus de paix donne à la région, les conséquences qui en résultent pour la conception des politiques futures sont particulièrement intéressantes.


Après avoir donné un bref aperçu des spécificités de l'économie jordanienne et de ses performances au cours des 23 dernières années, le rapport passe en revue différents indicateurs de productivité et d'investissement. Il analyse la productivité globale des facteurs, soulève le problème de l'applicabilité à la Jordanie du modèle simple néoclassique de croissance endogène et rend compte des résultats. Il eût été intéressant de pousser plus avant l'analyse sectorielle mais les données faisaient défaut.

L'analyse révèle que la Jordanie se signale par une productivité faible qui, de surcroît, est allée déclinant tout au long des années 80. Le résultat est quelque peu surprenant dans la mesure où la Jordanie a fait de sensibles progrès en matière d'éducation et d'infrastructures. Fait intéressant, les ressources humaines mesurées par la durée moyenne de la scolarité multipliée par le chiffre de la population active ne permettent pas d'expliquer la faiblesse de la productivité. Le rapport en conclut à la nécessité de revoir le mode d'évaluation des ressources humaines dans les pays d'émigration.

Compte tenu des principales caractéristiques de l'économie jordanienne, le rapport avance deux raisons principales pour rendre compte de la productivité stagnante, voire déclinante. Primo, il fait valoir que l'aide étrangère et les transferts des travailleurs émigrés n'ont pas été utilisés au mieux et que la qualité de l'investissement a baissé. Ainsi, il donne quelque crédit à l'idée selon laquelle les capitaux étrangers pourraient non pas renforcer
mais affaiblir une économie, le renforcement étant ici entendu comme une amélioration de
la productivité. Secundo, le rapport voit dans l'émigration de la main d'œuvre qualifiée et
l'immigration de travailleurs non qualifiés un obstacle à l'amélioration de la productivité.
Le manque d'informations détaillées ne permet toutefois pas d'étayer pleinement cette
hypothèse.

Le rapport débouche sur une conclusion intéressante du point de vue théorique : les
modèles simples de croissance endogène avec les retombées des investissements ne rendent
pas compte véritablement de l'évolution de l'économie jordanienne. La croissance et la
productivité obéissent à des forces qui sont de nature plus subtile.

La Jordanie pourrait, par une meilleure allocation des ressources et un développement
de son système financier, améliorer ses résultats économiques et s'adapter au nouvel
environnement.

(1661) бунова сьст ваму ён.

(1662) бунова сьст ваму ён.

(1663) бунова сьст ваму ён.

(1664) бунова сьст ваму ён.

(1665) бунова сьст ваму ён.

(1666) бунова сьст ваму ён.

(1667) бунова сьст ваму ён.

(1668) бунова сьст ваму ён.

(1669) бунова сьст ваму ён.

(1670) бунова сьст ваму ён.

(1671) бунова сьст ваму ён.

(1672) бунова сьст ваму ён.

(1673) бунова сьст ваму ён.

(1674) бунова сьст ваму ён.

(1675) бунова сьст ваму ён.

(1676) бунова сьст ваму ён.

(1677) бунова сьст ваму ён.

(1678) бунова сьст ваму ён.

(1679) бунова сьст ваму ён.

(1680) бунова сьст ваму ён.

(1681) бунова сьст ваму ён.

(1682) бунова сьст ваму ён.

(1683) бунова сьст ваму ён.

(1684) бунова сьст ваму ён.

(1685) бунова сьст ваму ён.

(1686) бунова сьст ваму ён.

(1687) бунова сьст ваму ён.

(1688) бунова сьст ваму ён.

(1689) бунова сьст ваму ён.

(1690) бунова сьст ваму ён.

(1691) бунова сьст ваму ён.

(1692) бунова сьст ваму ён.

(1693) бунова сьст ваму ён.

(1694) бунова сьст ваму ён.

(1695) бунова сьст ваму ён.

(1696) бунова сьст ваму ён.

(1697) бунова сьст ваму ён.

(1698) бунова сьст ваму ён.

(1699) бунова сьст ваму ён.

(1700) бунова сьст ваму ён.
ويظهر التحليل ضعف سجل انتاجية الأردن، وكون معدل نمو الانتاجية سالباً خلال العشرينات، وهذه نتيجة مفاجئة نوعا ما، نظرًا لأن الأردن حقق تحسينات كبيرة في التعليم والبيئة الأساسية. ومن المثير للإهتمام أن رأس المال البشري حسب قياسه بمتوسط سنوات الدراسة مضروبًا في حجم قوة العمل لا يساعد في تفسير الفرق الملاحظ في الانتاجية، ولذا فإن النتائج الرائدة لهذه الدراسة الضرورة العامة لإجراء تحسينات في المقياس المعياري لرأس المال البشري بالنسبة للدول التي تشهد موجات هجرة كبيرة.

وفي ضوء النماذج المبكرة للاقتصاد الأردني، تركز هذه الدراسة على تشخيص مبكر للأطراف: أولًا، تحليل الصراع بأن المدى الكبير من المعوقيات الاجتماعية والتحويلات من الخارج لم تستخدم بفعالية، وأن نوعية الاستثمار تدهورت، وفي ذلك سند لوجهة النظر التي تفادى أن رأس المال الأجنبي يمكن أن يسخر عن استغلال الاقتصاد بدلاً من تقوية، 1 بقدر ما يفهم أن "اللغة" تعني تغيير في الانتاجية. ثانياً، تراجع الدراسة أن تدفق المهاجرين من الأردنيين السري إلى الخارج، وتدفق العاملين غير المهرة إلى الأردن من الخارج، شكلاً عقبة أساسية لتنمية الإنتاجية، غير أن نظراً لعدم وجود معلومات مفصلة كافية، لا يمكن اعطاء سويًا عملية تشخيصية غير كاملاً على هذه الفرضية.

ومن بين النتائج الهامة من المدارس النظري أن النماذج المحلية البسيطة التي تراقبها آثار استثمارية عرضية لا تقدم وصفًا كافياً لتجربة الأردن، فالقوى التي تدفع النمو والانتاجية ذات طبيعة أكثر دقة مما يبدو.

ولم توجه النظر المتعلقة بالسياسات، باكستان الأردن تعزيز أداء الاقتصاد والتكيف مع البيئة الجيدة عن طريق تركيز جهوده على تحقيق تخصيص الموارد في اقتصاده، بصورة خاصة من خلال زيادة تنوير نظامه المالي،

Lavy and Sheffer (1987)
2. The Jordanian economy - an overview

2.1 Main features of the Jordanian economy

Summary

Jordan is situated in a critical passage between three continents; during most of its history it was more important as a trade route than as an area in itself. Over 80% of its area consists of desert or unfertile land; traditionally, its productive base has been narrow. Natural resources and water are scarce. Over the last twenty years, Jordan has experienced high population growth and large outflows of workers (particularly skilled people). The main part of these movement was directed to the Gulf States. At the same time, there has been a substantial inflow of lower-skilled labor, mainly from Egypt, at a rate increasing since the late seventies. The migration of workers had the effect that remittances - comparable in magnitude to foreign aid - became a very important source of financing for Jordan's large current account deficits. Private investment rates and remittances are strongly correlated; housing accounts for a large part of private investment. Jordan's educational system is well developed; enrollment rates are extraordinarily high for a developing country. Although Jordan is, compared to other countries in the region (e.g. Egypt or Syria) a relatively open and competitive economy, government has intervened in the economy in the past through a large public sector, government-dependent public enterprises, joint ownership in private firms, financial regulation and through the imposition of tariffs and price controls. As other countries in the region, Jordan's economy suffered from a heavy military burden, spending around 14% of GDP on military expenses in the 1980s.

Composition of GDP

Despite some efforts to promote the expansion of manufactured exports, Jordan's productive base has not broadened significantly. The share of manufacturing in GDP lay around 8-9% in

\(^2\)estimate from SIPRI, Yearbook 1989
the early seventies and grew only slowly over the last twenty years (1992: 13.1%)\(^3\), stagnating in the eighties. The main manufactured products are food, tobacco, non-metal products and chemicals. This last sector is the only one where substantial advances have been made, with a significant increase in the production of medicines. Furthermore, the small and medium scale manufacturing sector is heavily dependent on construction and agriculture, exporting only a small percentage of its output. The economy's orientation towards services has been maintained with shares fluctuating between 55% and 63%; government services and trade and tourism are the main components. The military burden is also extraordinarily high, but no explicit figures appear in the national accounts. This orientation towards services is quite untypical for a country at Jordan's development stage. The relative importance of agriculture (which was already atypically low in the early seventies)\(^4\) has slowly decreased, from about 12.5% in the early seventies to 6.3% in 1992, while mining has fluctuated around 3-6% (potash and phosphates). The contribution of the construction sector to GDP declined over the eighties, returning to its 1971 level of 4.5% in 1992 after a high of nearly 11% in 1983. For its exports, Jordan relies heavily on the regional markets.

Migration, remittances, and foreign aid

Although migration was already large in the sixties, the flow of emigrants increased substantially after the Oil Boom. Remittances, which did not play an important role up to 1973, gained more and more significance; in 1976, even the officially registered portion of workers' remittances reached 32% of GNP. By then, 216,300 workers were abroad, a number that has increased to around 339,000\(^5\) (or about 54% of total labor force) in 1990. At the same time, immigration increased; 1990, more than 200,000 foreign workers, mainly from Egypt, but also from Syria and Asia, were in Jordan. With the Gulf War, more than 300,000 returnees led to severe problems in the labor market.

\(^3\)for the evolution of GDP composition see annex

\(^4\)for typical development country ratios see Chenery and Taylor (1968), p.396

\(^5\)Data from: El-Khasawneh (1992)
Table 1: Total Jordanian Migrant Labor

<table>
<thead>
<tr>
<th>Year</th>
<th>Migrant Labor ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>103.5</td>
</tr>
<tr>
<td>1971</td>
<td>117.9</td>
</tr>
<tr>
<td>1972</td>
<td>134.5</td>
</tr>
<tr>
<td>1973</td>
<td>152.9</td>
</tr>
<tr>
<td>1974</td>
<td>174.2</td>
</tr>
<tr>
<td>1975</td>
<td>198.4</td>
</tr>
<tr>
<td>1976</td>
<td>216.3</td>
</tr>
<tr>
<td>1977</td>
<td>235.8</td>
</tr>
<tr>
<td>1978</td>
<td>257.0</td>
</tr>
<tr>
<td>1979</td>
<td>280.2</td>
</tr>
<tr>
<td>1980</td>
<td>305.4</td>
</tr>
<tr>
<td>1990</td>
<td>339.0</td>
</tr>
</tbody>
</table>

Table 2: Jordanian Departures & Arrivals and Net Migration ('000) 1989-1991

<table>
<thead>
<tr>
<th>Year</th>
<th>Departures</th>
<th>Arrivals</th>
<th>Net Migration</th>
<th>Net Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>642.9</td>
<td>633.2</td>
<td>+9.7</td>
<td>+9.7</td>
</tr>
<tr>
<td>1981</td>
<td>669.5</td>
<td>731.9</td>
<td>-62.4</td>
<td>-52.7</td>
</tr>
<tr>
<td>1982</td>
<td>694.3</td>
<td>625.4</td>
<td>+68.9</td>
<td>+16.2</td>
</tr>
<tr>
<td>1983</td>
<td>706.6</td>
<td>682.5</td>
<td>+24.1</td>
<td>+40.3</td>
</tr>
<tr>
<td>1984</td>
<td>697.7</td>
<td>694.3</td>
<td>+3.3</td>
<td>+43.6</td>
</tr>
<tr>
<td>1985</td>
<td>893.3</td>
<td>909.7</td>
<td>-16.4</td>
<td>+27.2</td>
</tr>
<tr>
<td>1986</td>
<td>963.3</td>
<td>837.8</td>
<td>+125.5</td>
<td>+152.7</td>
</tr>
<tr>
<td>1987</td>
<td>1212.4</td>
<td>1027.4</td>
<td>+185.0</td>
<td>+337.7</td>
</tr>
<tr>
<td>1988</td>
<td>1296.1</td>
<td>1135.7</td>
<td>+160.4</td>
<td>+498.1</td>
</tr>
<tr>
<td>1989</td>
<td>1190.9</td>
<td>1107.0</td>
<td>+83.9</td>
<td>+582.0</td>
</tr>
<tr>
<td>1990</td>
<td>1143.2</td>
<td>76.5</td>
<td>-133.3</td>
<td>+448.7</td>
</tr>
<tr>
<td>1991</td>
<td>412.2</td>
<td>454.5</td>
<td>-42.3</td>
<td>-406.4</td>
</tr>
</tbody>
</table>

Royal Scientific Society: "Study on the Reality and Future of the Jordanian Labor Market"

Graph 1: Foreign grants & Public Inv. as percent of GNP
Concerning the use of remittances and foreign aid, graph 1 and 2 reveal a strong correlation between foreign aid and public investment on one hand and between remittances and private investment on the other; a large part of private investment has gone into residential construction (two thirds in 1991); nonresidential private investment then amounted to only 5% of GDP. In the seventies, the government used foreign aid to finance infrastructure projects; after the completion of large projects and the decline in grants in the early eighties, public investment has been reduced.

**Education**

Jordan is known for having achieved one of the highest educational records in the Arab world. While the illiteracy rate was 68% in 1961, by 1991 it was 17%. (Syria: 39%, Egypt: 45%, Yemen: 61%). Compulsory education lasts for ten years; the primary school enrollment rate is about 99%, the secondary school enrollment rate was 90% in 1991. Teachers account for 8% of the total Jordanian labor force.

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6Source for investment, remittances and foreign grants: World Bank Country Economics Department
Although 80% of university students were studying abroad in 1981/82, there were 800,000 students at all study levels in Jordan. Currently, there are 8 universities and 67 community colleges.\textsuperscript{7}

2.2 Economic Performance over 1970-92

Jordan's economic performance has been influenced by the development of the regional economies. The first oil price shock was followed by an economic upturn for Jordan that lasted well into the 1980s. GDP growth increased strongly in 1976. This rise, favored by the expansion of the regional markets after the Oil Crisis and high inflows of remittances and foreign aid, lasted until 1982, when per capita GDP reached around 940 JD or 2670 US\$ (in 1989 prices)\textsuperscript{8}. The large inflows of external resource helped to sustain the high level of domestic investment, which reached 47 percent of GDP in 1982 with public and private sectors accounting for roughly half each. The private sector investment was largely centered in the construction industry, and public sector investment in infrastructure and public utilities.

\textsuperscript{7}ILO (1992)

\textsuperscript{8}It should be noted that there is no single consistent GDP series for the period 1970-92 available. Particularly, in the World Bank's national account estimates there is a break in 1983: later figures are evidently greater than old numbers. For the purposes of this paper, the author relied on estimated growth rates of real GDP from previous World Bank Studies for the construction of GDP and investment series.
The decline in oil prices beginning in 1982, and the subsequent slowdown in the regional economies, had an adverse effect on Jordan's economy. Foreign aid, exports and remittances all declined. GDP stagnated and both private and public investment rates fell. In 1989, real GDP per capita fell by 17%; the public deficit reached 24% of GDP. The economic reform program undertaken by the Jordanian government was disrupted by the Gulf crisis in 1990/91. Export markets in Iraq, Saudi Arabia and Kuwait were lost, as well as income from tourism. Unemployment rose to 25%. Arab donors reduced grants substantially and the return of over 300,000 Jordanians from the Gulf states created strong pressure on utilities and services, leading to widening public and balance of payments deficits. This increase in population of around 9% added to the constantly high population growth rate of around 3.5-4% yearly, so that in 1992 the population was around 3.95 millions compared to 1.51 millions in 1970. By 1991, real GDP per capita was below its 1979 level.

In 1992 the picture looked much better: private investment rose strongly, as did foreign aid and remittances from workers who again had found work in the Gulf region. The returnees

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*Gross fixed investment and public capital expenditure (Source: World Bank)*
brought their savings and established themselves in Jordan, often starting new businesses. Jordanians and Palestinians still living abroad also transferred large funds to Jordan, due to a perceived decrease in security abroad. One of the main pillars of the GDP growth of 11.3% was the construction sector with a growth rate of nearly 16%.

3. Productivity change

The analysis below attempts to shed some light on the extent to which past inflows of resources have been used to expand productive sectors and to improve productivity and efficiency. In addition, the gains to the Jordanian economy from advances in education are analyzed.

In the last four decades, there have been enormous advances in the measurement of overall productivity change, since Solow (1957) proposed a decomposition of output growth into growth of labor, capital and technical progress\textsuperscript{10}. In this paper, I cannot make use of all the technical refinements that have been introduced since then\textsuperscript{11}. This is mainly due to incomplete and low quality data. Before starting with the traditional total factor productivity analysis, however, it may be useful to take a rough first look at the information concerning investment and employment available, without much manipulation of the data. This is done in the next two subsections. An aggregate production function approach is then used in the main section.

3.1 Investment efficiency

The efficiency of investment can be crudely measured by the Incremental Capital-Output-Ratio (ICOR). This ratio measures the number of additional units of capital that are required to produce an additional unit of output, i.e. \(\frac{dK}{dY}\). Identical units of capital may produce substantially different levels of output depending on the existing stock of capital and on the efficiency with which they are employed; conversely, in the same environment, equal quantities of investment may differ by type and quality and induce different GDP increases.

\textsuperscript{10}Attempts to break down growth rates had already been made earlier (see, for example Thörnqvist (1936))

\textsuperscript{11}for a discussion see Jorgenson, Gollop, and Fraumeni (1987)
Here, the ICORs are calculated using the formula $\text{ICOR}_{a \to n-4} = \frac{\sum_{t=n-5}^{n-1} \frac{I}{Y}}{Y_{n-5}}$.

**Table 3: ICORs**

<table>
<thead>
<tr>
<th></th>
<th>71-75</th>
<th>75-79</th>
<th>79-83</th>
<th>83-87</th>
<th>87-91</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jordan</td>
<td>4.45</td>
<td>2.07</td>
<td>5.72</td>
<td>7.15</td>
<td>-147.13</td>
</tr>
<tr>
<td>Egypt</td>
<td>2.38</td>
<td>2.55</td>
<td>3.33</td>
<td>5.50</td>
<td>7.47</td>
</tr>
<tr>
<td>Tunisia</td>
<td>4.10</td>
<td>5.19</td>
<td>7.33</td>
<td>8.22</td>
<td>4.62</td>
</tr>
</tbody>
</table>

The boom after the oil crisis was not accompanied by a decline in investment efficiency, as one might have suspected; instead, the ICORS show a decline from 1972 to 1975. Here, the positive effects of a boom on productivity like faster adoption of new technology, a reduction in the average age of the capital stock and economies of scale\(^{13}\) may have outweighed the inefficiencies induced by the beginning "Oil bonanza", which actually started somewhat later. Some part of the explanation for this might also come from the fact that because of the Lebanese Civil War 1974 many international companies moved from Beirut to Amman for a short period, bringing with them highly productive investments\(^{14}\).

Given the still relatively low levels of the capital stock, it is not plausible to attribute the following increase in the ICORS only to a rapidly declining marginal product of capital; investment efficiency must have declined. This is especially striking since public infrastructure had sharply improved from the mid-seventies to the early eighties. That these improvements in infrastructure had no noticeable effect on the productivity of capital can be attributable to deteriorating quality of investment, or a worsening in the regulatory environment. Investments in major capital-intensive industrial projects (potash, fertilizers, cement, and others) were often affected by lengthy delays due to technical problems\(^{15}\). The issue of investment quality is discussed in more detail below. Along with improvements in infrastructure, the educational system has been strengthened over the past two decades; this is not visible in the ICORS.

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\(^{12}\)Two of the main problems with this indicator are that it is biased due to depreciation and declining marginal product of capital. Nevertheless, it is an intuitive and frequently used measure.

\(^{13}\)see Syrquin (1986), p.261

\(^{14}\)see Mazur (1979), p.86

\(^{15}\)see Kanovsky (1988)
3.2 Labor productivity

The pattern of overall labor productivity corresponds partly to the ICOR-picture: the ratio GDP per worker increases constantly from 1975 to 1981, followed by a soft slowdown in 1982 and 1983. After some recovery in 1984 and 1985, productivity decreases sharply, reaching a lower level in 1991 than in 1980. As in the case of investment efficiency, the picture seems to show a procyclical behavior of labor productivity, a well-known phenomenon.\(^6\)

![Labor Productivity Graph](attachment:image)

Graph 5

Tables 4 and 5 present a more detailed picture, with two series of value added per worker for 9 different sectors. It is noteworthy that the sectors which expanded most were not the ones with the highest productivity increases. Between 1973 and 1982 the sector that experienced the highest growth in terms of employment and valued added was the utilities sector; its

\(^6\)for see Bernanke and Parkinson (1991)
productivity development was negative, the second-lowest after construction. The increase in utilities employment also reflects an expansion of the role of the government, which is heavily involved in this sector. The construction sector also increased strongly, while its initial productivity was one of the lowest in the economy in 1973 and increased very slowly in subsequent years. The expansion of the construction sector in the early eighties probably explains part of the overall productivity decrease in those years. It should be pointed out that tax laws in Jordan favor investments in real estate, exempting them from capital-gains tax; in addition, the Housing Bank is given numerous privileges by the state and the whole credit system is biased towards real estate. Starting from the mid-seventies, price controls became more and more important in Jordan; the resulting distortions probably led to suboptimal allocation of resources, slowing down productivity growth. Again, these observations raise questions concerning the quality of investment.

Table 4: IV.A. (millions of 1980 JD)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>48.7</td>
<td>64.1</td>
<td>48.9</td>
<td>51.6</td>
<td>52.1</td>
<td>65.0</td>
<td>46.4</td>
<td>54.6</td>
<td>72.1</td>
<td>79.2</td>
</tr>
<tr>
<td>Mining</td>
<td>13.8</td>
<td>11.9</td>
<td>13.5</td>
<td>21.1</td>
<td>28.4</td>
<td>34.7</td>
<td>39.3</td>
<td>40.3</td>
<td>35.6</td>
<td>36.2</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>59.2</td>
<td>35.0</td>
<td>52.8</td>
<td>50.7</td>
<td>59.6</td>
<td>77.1</td>
<td>98.0</td>
<td>108.3</td>
<td>142.0</td>
<td>137.5</td>
</tr>
<tr>
<td>Construction</td>
<td>39.2</td>
<td>39.8</td>
<td>42.2</td>
<td>48.4</td>
<td>61.1</td>
<td>77.5</td>
<td>87.9</td>
<td>97.3</td>
<td>103.6</td>
<td>106.1</td>
</tr>
<tr>
<td>Utilities</td>
<td>4.2</td>
<td>4.4</td>
<td>4.6</td>
<td>5.8</td>
<td>7.5</td>
<td>9.3</td>
<td>11.6</td>
<td>16.2</td>
<td>17.6</td>
<td>20.1</td>
</tr>
<tr>
<td>Trade</td>
<td>81.4</td>
<td>59.9</td>
<td>92.1</td>
<td>109.3</td>
<td>125.3</td>
<td>130.6</td>
<td>143.6</td>
<td>164.9</td>
<td>175.4</td>
<td>189.5</td>
</tr>
<tr>
<td>Transport</td>
<td>50.3</td>
<td>61.3</td>
<td>56.2</td>
<td>68.9</td>
<td>74.5</td>
<td>107.0</td>
<td>95.9</td>
<td>93.8</td>
<td>101.1</td>
<td>111.8</td>
</tr>
<tr>
<td>Finance</td>
<td>58.8</td>
<td>65.3</td>
<td>71.6</td>
<td>71.7</td>
<td>86.8</td>
<td>109.2</td>
<td>127.7</td>
<td>124.8</td>
<td>130.2</td>
<td>140.4</td>
</tr>
<tr>
<td>Gov’t Services</td>
<td>67.7</td>
<td>73.3</td>
<td>79.2</td>
<td>99.9</td>
<td>116.3</td>
<td>146.8</td>
<td>170.2</td>
<td>170.8</td>
<td>190.1</td>
<td>215.0</td>
</tr>
<tr>
<td>Other</td>
<td>16.9</td>
<td>18.5</td>
<td>20.0</td>
<td>23.8</td>
<td>24.1</td>
<td>26.8</td>
<td>27.3</td>
<td>30.3</td>
<td>31.8</td>
<td>31.5</td>
</tr>
</tbody>
</table>

Compound annual growth rate and least-square growth rates. The first is simply the n-th root of the ratio of endpoint and starting point minus one, the second is the slope of the regression line from the regression of log of the variable against time and accounts for errors. Which approach is more appropriate depends on the underlying model.

Between 1983 and 1992, the manufacturing, construction and trade sectors experienced decline in productivity, while the other sectors improved their value-added-per-worker-ratio only slightly. (Mining was the only exception with a sharp increase between 1983 and 84). In the second half of the eighties a policy of import substitution, which imposed restrictions on the import of manufactured products combined with institutional exemptions, was pursued. Quantitative restrictions, for instance, protected a significant portion of the manufacturing industry. These protective measures could not discriminate between efficient and inefficient firms. Poorly managed, inefficient firms were not exposed to external competition and imports of new technology were hindered; the productivity decrease in the manufacturing sector may therefore be attributable in part to the trade policy, although the empirical evidence on links between trade policy and productivity growth is still somewhat mixed.18

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18 See Edwards (1993) and Tybout (1991) for surveys on these issues. For a recent study relating trade policy and productivity in the manufacturing sector in Morocco see Haddad (1993).
An important factor affecting overall labor productivity (GDP/employment) has also been the rising percentage of government employees in the total workforce; while in 1971 already 39% of employees worked for the public sector, this share was 49% in 1992. This influences labor productivity in two ways: the first is associated with measurement problems of public services, the second with increased bureaucracy and regulation, which has a negative effect on productivity in the private sector. In periods of high unemployment (particularly since 1986), the Jordanian government felt obligated to increase public employment, contributing to a decline in labor productivity. No official data on military employment is available, but the defense burden undoubtly had a noticeable effect on employment and productivity.

Between 1971 and 1982 the GDP share of agriculture decreased from nearly 13% to around 6%; from 1983 to 1992, a period of low productivity increase, the share fluctuated around the second value. This corresponds to the observation that the reallocation of resources from agriculture to other more productive activities can play a significant role for productivity gains at a country’s early development stage and that, once these reallocation gains are exhausted, fast productivity growth in the industrial sector is needed. The latter did not take place in Jordan.

The effect of changes in skills and education on productivity is examined in a later section.

3.3 Total factor productivity analysis

After obtaining some information on investment efficiency and labor productivity, it is useful to engage in a more detailed analysis concerning the contributions of labor, capital and other influences on GDP growth. The following section on total factor productivity delineates these contributions using a neoclassical growth-accounting approach. It will help to answer the question to what extent past growth has been a result of an increase in inputs, as opposed to improvements in the efficiency of input use, technical advances, etc. and if foreign funds were used wisely. The results also shed some light on the relevance of some abstract concepts and empirical measures used in the modern theoretical and empirical growth literature.

\[19\text{see, for example, Syrquin (1984), Pack (1992) p.283}\]
3.3.1 The standard neoclassical approach

In order to derive the contribution of capital, labor and total factor productivity growth to GDP growth, the concept of an aggregate Cobb-Douglas-production function with constant returns to scale is used.

With

\[ Y_t = A_t K_t^\alpha L_t^\beta \]  \quad (Y=\text{real GDP}, K=\text{Capital}, L=\text{Labor})

\[ \dot{A}_t = \dot{Y}_t - \alpha \dot{K}_t - \beta \dot{L}_t \]  \quad (where hats denote rates of growth)

is the total factor productivity (TFP) growth (Solow residual), i.e. the residual which captures the improvement in the use of the factors labor and capital. This TFP growth can capture technological change, improved quality of labor or other factors. In the neoclassical growth theory, it is assumed to be exogenous; in the modern theory, TFP growth is usually endogenized.

Of course, the measurement of capital is still no less a problem than 36 years ago, when Robert Solow (1957) complained about the difficulties involved. Here, a modified version of the Harberger (1978) technique is used in order to estimate the capital stock for 1970\(^{20}\). The series until 1992 is then derived by using the perpetual inventory method with a depreciation rate of 8\%. In order to account for varying capacity utilization, the convex hull method\(^{21}\) is

---

\(^{20}\) The approach starts from the observation that if the capital-output-ratio is constant in a given period, the rate of growth of capital and output are equal during that period. It follows that \( \dot{K}_t = I_t / (g + \sigma) \), where \( \sigma \) denotes the depreciation rate and \( g \) the growth of output. In order to avoid short-term-variations of \( g \), the growth rate of output is estimated by a regression of log(gdp) on time. Also, for \( I_t \), the fitted value for 1971 from a regression of investment on time is used. The initial capital stock for 1970 is then obtained. Consistent investment and GDP series in constant prices were constructed using World Bank Departmental Data growth rates.

\(^{21}\) Starting with a plot of the time series of actual real GDP against time, the time series of potential real GDP is obtained by the lowest concave curve lying on or over the actual GDP curve. The index of capacity utilization is given by the ratio of potential to actual GDP. (see Lau, Jamison and Louat (1991), p.10) The values for the convex hull and the resulting index are given in the appendix.
employed to construct a capacity utilization index, by which the constructed capital series is then multiplied\(^2\). Data on employment is used as labor input series. The employment figures only include officially recorded employment. Nevertheless, they are more accurate that the incomplete estimates of the population between 15 and 64 years. (Ideally, one would like to measure not only hours worked, but also quality and effort levels.) In the literature, improvements have been made by subdividing capital and labor by type. This could not be done here. Given the doubtful quality of the data in the seventies, the following results are to be interpreted with caution.

Concerning the output elasticities \(\alpha\) and \(\beta\), which under the assumption of constant returns to scale (\(\alpha+\beta=1\)) and perfect competition\(^3\) represent the shares of capital and labor in output, they have been estimated to be about 0.4 and 0.6 respectively for developed countries\(^4\); in developing countries, however, the share of capital is considered to be higher\(^5\). A regression restricting the coefficients to add up to one gave as a result a capital share of 0.52. (See annex for the details of the regressions) The hypothesis of constant returns to scale cannot be rejected.

The shares used in the first analysis below are therefore 0.5 for capital and labor, as a rough approximation. The TFP growth rates were computed year by year, for four-year periods and as total growth rates for 1970-83, 1983-1991 and for 1970-91. The year-by-year comparisons suffer from business-cycle fluctuations (see annex 3). A closer look is nevertheless interesting: for thirteen of the 22 observations, TFP growth was negative. The negative numbers are especially concentrated in the late eighties. Productivity gains were achieved in the second half of the seventies. Graph 9 depicts the evolution of the level of Total Factor Productivity, with the initial value set arbitrarily equal to one.

\(^{22}\)The basic results following are not altered when using the raw capital data.

\(^{23}\)The importance of these assumptions is underlined in a study by Hall (1989)

\(^{24}\)see, for example, Christensen, Cummings and Jorgenson (1980)

\(^{25}\)see, for example, De Gregorio (1992) for Latin America
In the table below, four-year periods are analyzed. From 1970 to 74, output grew only by 1%. Capacity utilization was low, leading to a decrease of capital in use by 18%; employment grew by 22%. This leads to odd contributions of the factors: the recorded GDP growth is mainly attributable to the increase in employment, given that capital decreased. Between 1975 and 1979, the picture looks "healthier": although the increase in capital in use was the major source of growth (73%), 20% of total increase in GDP was attributable to TFP growth. In the period 1979-1983, TFP growth was again negative, accounting for -26% of GDP growth. Productivity improved slightly between 1983 and 1987; its contribution to GDP was still less than the typical 30% estimated for developing countries\textsuperscript{26}. Between 1988 and 1991 a sharp decline in productivity took place. It has to be noted that GDP decreased by 10% in this last period, with the consequence that the remarkable contribution of TFP growth to this negative change was +107%.

\textsuperscript{26}Chenery (1986), p.19
Table 6:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Growth of Output</th>
<th>Capital</th>
<th>Labor</th>
<th>Contribution to GDP Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Capital</td>
</tr>
<tr>
<td>1970-74</td>
<td>0.01</td>
<td>0.18</td>
<td>0.22</td>
<td>-15.57</td>
</tr>
<tr>
<td>1975-79</td>
<td>0.75</td>
<td>1.09</td>
<td>0.16</td>
<td>0.73</td>
</tr>
<tr>
<td>1979-83</td>
<td>0.38</td>
<td>0.83</td>
<td>0.14</td>
<td>1.08</td>
</tr>
<tr>
<td>1983-87</td>
<td>0.20</td>
<td>0.17</td>
<td>0.14</td>
<td>0.44</td>
</tr>
<tr>
<td>1988-91</td>
<td>-0.10</td>
<td>-0.04</td>
<td>0.06</td>
<td>0.20</td>
</tr>
<tr>
<td>1970-81</td>
<td>1.17</td>
<td>1.47</td>
<td>0.62</td>
<td>0.62</td>
</tr>
<tr>
<td>1981-91</td>
<td>0.19</td>
<td>0.45</td>
<td>0.32</td>
<td>1.20</td>
</tr>
<tr>
<td>1970-91</td>
<td>1.58</td>
<td>2.59</td>
<td>1.13</td>
<td>0.81</td>
</tr>
</tbody>
</table>

The long-term results are probably the most revealing: in the period from 1970-1981, total factor productivity growth contribution to GDP growth was only 11%, from 1981-91 it was -1.06%. Overall, TFP growth was slightly negative (-0.3%) between 1970 and 1991 and it contributed negatively to growth, on an average -5.4%. The empirical analysis also shows that the sensitivity of the main qualitative results with respect to variations in assumed capital depreciation rates and factor shares is low.

Assuming a constant trend growth rate of productivity, the factor \( A \) from the production function can be rewritten as \( \mu e^{\delta t} \), with \( \delta \) as the growth rate. Starting from this, two regressions were run in order to estimate the least-square-growth rate of productivity, i.e. the long-run productivity trend: the yearly productivity trend growth rates around \(-0.008\) are negligible. The computed growth rate was higher for the seventies than for the eighties.

The chosen functional Cobb-Douglas form may be too restrictive; therefore, an additional regression using a CES-formulation was run. The elasticity of substitution was estimated using non-linear least squares, assuming neutral technical change and constancy of the

\(^{27}\)This table shows by how much percent capital, labor and TFP contributed to growth, so that each line adds up to one.

\(^{18}\)in use
elasticity of substitution; although it is significantly smaller than one (0.5), the TFP result does not change strongly: the computed growth rate for the whole period is very small, but slightly positive (0.0026) p.a. (See annex)

For an overview, the different calculated growth rates are presented together:

<table>
<thead>
<tr>
<th></th>
<th>Contribution to GDP Growth</th>
<th>Yearly TFP Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Rate from year-by-year-cal (C-D)</td>
<td>-0.054</td>
<td>-0.003</td>
</tr>
<tr>
<td>Cobb-Douglas Regression</td>
<td>-0.145</td>
<td>-0.008</td>
</tr>
<tr>
<td>CES Regression</td>
<td>0.054</td>
<td>0.003</td>
</tr>
</tbody>
</table>

All in all, the findings are surprising, given that the residual typically accounts for a large part of output increases. The analysis makes clear technical progress and improvements in efficiency did not play an important role in the growth of the Jordanian economy from 1970 to 1991. On the contrary, growth was mainly achieved by increasing the input quantities of capital and labor. This qualitatively confirms the results of Fraihat (1992) who used slightly differing data and methods. The result is puzzling at first glance, and it is useful to think about explanations for the extremely low productivity record beyond the simple neoclassical model.

3.3.2 Inclusion of Human Capital

The analysis has so far abstracted from human capital formation and has not adjusted for changing quality of labor; the inclusion of human capital, whose role in economic growth is often pointed out, could give more insights. The educational achievements in Jordan in the last twenty years make this expansion particularly desirable. However, apart from obvious measurement problems, it is not a-priori evident in which way human capital should be included in the model. A neoclassical approach would be to expand the simple Solow-type model by incorporating human capital as an additional factor of production. Mankiw, Romer and Weil (1992) followed this line. The endogenous growth literature, on the other hand, stresses the importance of externalities associated with the accumulation of human capital29.

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29for example, see Romer (1990)
In this view, a mere inclusion as another factor would be a misspecification\(^{30}\). We first start with the Mankiw, Romer and Weil approach and use another specification later.

The aggregate production function is now

\[ Y_t = K_t^{\alpha} H_t^{\beta} (A_t^{1-\alpha} L_t^{1-\beta}) \]

where \( H \) denotes the human capital stock. The human capital series was taken from calculations done by Nehru, Swanson and Dubey (1993) until 1987; further data was not available. The series consists of the average sum of the years of primary, secondary and tertiary education years per worker, multiplied by the labor force. In contrast to other calculations, this data takes actual mortality, drop-outs, and repeater rates into account.

It is interesting to visualize the improvements in average years of schooling; in contrast to the usual situation, where economists try to explain large positive productivity residuals with improved education, in our case the problem is to reconcile negative productivity growth with continuous increases in human capital.

\(^{30}\)see, for example Benhabib and Spiegel (1992)
In an estimation of the factor shares with a restricted regression, the estimated share for human capital was only 0.05, a value much lower than the one estimated by Mankiw, Romer and Weil of 0.23 in cross-country regressions. Also, the t-statistic for human capital is very low, and an estimation with first differences does not change the results. A log-likelihood specification test shows that adding human capital does not make a significant contribution to the explanation of GDP.

According to Benhabib and Spiegel (1992), this result is not surprising. In their findings, human capital growth has an insignificant, and usually negative effect in explaining per-capita income growth. They introduce an alternative model that allows human capital levels to directly affect total factor productivity through two channels: first, following Romer (1990), by determining the capacity of countries to innovate new technologies, and, second, following Nelson and Phelps (1966), by allowing human capital levels to affect the speed of technological catch-up and diffusion. Assuming $H$ as exogenously given, the specification is:
\[ \frac{A_i(t)}{A_i(t)} = g(H_i) + c(H_i) - \frac{A_m(0)e^{gH_m}}{A_i(t)} - A_i(t) \]

where \( A_i \) is the technology level of country \( i \), \( A_m \) is the technology level of the leading country, \( g(H_i) \) is the endogenous growth rate and \( c(H_i) \) is a catch-up coefficient (both non-decreasing functions of \( H_i \)). Benhabib and Spiegel find that human capital levels enter significantly in first difference growth accounting regressions, both for cross-country and U.S. manufacturing data.

However, in a similar regression for Jordan, human capital fails to enter significantly again and has a negative sign. One can interpret this findings as evidence of the inappropriateness of human capital measures using enrollment rates for countries with huge migration flows. These measures do not capture the actual human capital in place. For most countries with a normal development of population, schooling years represent a good measure of human capital. For Jordan, where people often leave the country after completion of their education, this is not the case. An interesting extension would therefore be the construction of a more adequate measure of human capital. One possibility would be to add or subtract from the human capital stock flows related to migration. Unfortunately, the detailed data on schooling concerning immigrants and emigrants required for such a correction is not available in the case of Jordan. Another attempt would be to regularly conduct surveys on the education of the actual workforce. The findings also lead to some doubts concerning the empirical analysis undertaken by Cohen and Hammour (1993) who use the Mankiw/Romer/Weil framework to explain the economic performance of Syria, Jordan, Egypt, Tunisia and Morocco. (Their measure of human capital savings rates are enrollment rates.)

An alternative approach does not attribute importance to formal schooling. Other aspects, as on-the-job-training, are considered to be much more relevant for the accumulation of human capital. An interesting research line in this context has been trying to model the interactions between the introduction of new goods, productivity and an economy’s learning maturity\(^1\). Human capital accumulation may occur at different rates in different activities.

\[^1\text{see, among others Stokey (1988), Young (1991) and Lucas (1993)}\]
How migration may have influenced Jordan's stock of human capital and TFP growth is discussed below.

4. Explanations

Although it is extremely difficult to understand the pattern of productivity, this section tries to offer some explanations for the observed slow trend growth in productivity. Two of the major features of the Jordanian economy are its high inflows of foreign capital and large labor movements. The sections below therefore relate TFP growth to the use of available funds and to migration issues.

4.1 Deteriorating quality of investment

The TFP analysis confirms the results of the previous ICOR-analysis: although investment rates were very high - in the late seventies and early eighties comparable to those of Korea - the results were not very impressive and the quality of investment declined more or less steadily. Consider the growth rates of capital and employment:

<table>
<thead>
<tr>
<th></th>
<th>Capital Growth</th>
<th>Employment Growth(^{32})</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970-82</td>
<td>190%</td>
<td>67%</td>
</tr>
<tr>
<td>1970-82 per year(^{33})</td>
<td>10.2%</td>
<td>4.8%</td>
</tr>
<tr>
<td>1982-91</td>
<td>38%</td>
<td>28%</td>
</tr>
<tr>
<td>1982-91 per year</td>
<td>4.1%</td>
<td>3.1%</td>
</tr>
<tr>
<td>1970-91</td>
<td>300%</td>
<td>113%</td>
</tr>
<tr>
<td>1970-91 per year</td>
<td>7.2%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

\(^{32}\)Employment data from: Amrah, M.S. (1992)

\(^{33}\)Compound rate
While employment rose by 113% percent from 1970 to 1991, the capital stock increased threefold; in most years, capital grew faster than employment, especially in the period 1976-84. Although one has to be careful with interpreting this result, as the measure is somewhat susceptible to changes in assumed depreciation rates, the picture is quite clear. On the one hand, such an increase in capital intensity would be a normal characteristic of a development process. The simple Solow model predicts such an increase in the capital/labor-ratio for a capital-scarce country in the transition period to the steady-state. Although Jordan’s population growth was very high, this growth was overcompensated by high investment rates. On the other hand, what the ICORs and the TFP analysis show, is that this investment, at least after 1979, was not very productive.

A look at the conditions of the labor markets makes increasing capital intensity plausible: after the Oil Boom, wages in the Gulf region increased, attracting a growing number of
Jordanian workers (see table). In order to compete, wages in Jordan also grew at high rates\(^{34}\). In such a situation, with highly mobile labor and a therefore increased ratio of wages to cost of capital, producers will react by employing more capital relative to labor\(^{35}\) in a growing economy. This reaction was facilitated by the access to cheap credit - interest rates were negative during various periods as a result of regulated rates - and relatively low tariffs on capital goods\(^{36}\).

The slow productivity growth despite high investment rates raises doubts concerning those simple endogenous models that emphasize the role of accumulation of capital, without distinguishing between types of investment. Simple versions of endogenous growth models do not differentiate between types of investment, and stress the possibility that the return from physical capital as a whole may be larger than in the neoclassical growth model and may not decrease. Although individual firms perceive diminishing returns, the economy as a whole does not exhibit diminishing returns due to positive investment externalities\(^{37}\). For example, the firm’s production function could be of the form:

\[
Y_{it} = A_{it}K_{it}^\alpha L_{it}^{(1-\alpha)}K_{t}^\theta
\]

where \(K_{it}\) and \(L_{it}\) denote the individual firm’s inputs of capital and labor, \(A_{it}\) is firm-specific TFP and \(K_{t}\) refers to the economy’s total capital stock. Aggregation of the individual firms’ production functions gives:

\[
Y_{t} = A_{t}K_{t}^{\alpha+\beta}L_{t}^{(1-\alpha)}
\]

Romer (1986) considers the case where \(\alpha+\beta\) add up to one and \(\alpha<1\), so that at the individual firm’s level returns are diminishing, but the social returns to investment are constant. This model does not seem to fit the Jordanian data for three reasons. First, it would imply an even

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\(^{34}\) For an analysis of the wage development in Jordan see Al-Akel (1985).

\(^{35}\) See, for example, Bruno and Sachs (1985).

\(^{36}\) Anani (1990), p.46.

\(^{37}\) See, for example, Romer (1986). For a discussion of the model using U.S. data see Adams and Chadha (1992); this section borrows from their analysis.
lower overall productivity growth as the capital share in the previous analysis would have been too low). While it is already difficult to explain a zero TFP growth rate over two decades, a strongly negative rate seems implausible. Second, the model implies that neoclassical-calculated TFP growth should be strongly correlated to capital growth rates, not differentiating between different types of capital. In the Jordanian case, there is hardly any correlation between an aggregate measure of investment and TFP growth:

Graph 10

Third, the model predicts that regressions of the GDP growth rate on investment rates should show a positive coefficient, and, with a growth contribution of capital equal to one, it should be equal to the inverse of the average capital-output ratio (for Jordan this ratio is around 2). On the other hand, the simple neoclassical model implies a coefficient on investment growth rates of zero in the steady state. Although it is difficult to test this implication as one never actually observes the long-run, and one may be confusing level and growth effects, a regression does not support the simple endogenous growth model (see annex).

—specifically, the TFP growth rate for $\alpha=1, \beta=0.5$ would be -5% per year
No complete sectoral information on investment is available, but a look at the allocation of investment over the period from 1978-1991 may reveal some trends:

**Table 9: Gross Fixed Capital Formation by Type of Assets**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Residential building</td>
<td>21%</td>
<td>20%</td>
<td>30%</td>
<td>26%</td>
<td>26%</td>
<td>32%</td>
<td>34%</td>
<td>29%</td>
<td>24%</td>
<td>27%</td>
<td>44%</td>
<td>42%</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>Non-residential building and other construction</td>
<td>35%</td>
<td>34%</td>
<td>32%</td>
<td>25%</td>
<td>28%</td>
<td>29%</td>
<td>28%</td>
<td>49%</td>
<td>46%</td>
<td>43%</td>
<td>29%</td>
<td>27%</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>20%</td>
<td>19%</td>
<td>16%</td>
<td>24%</td>
<td>13%</td>
<td>21%</td>
<td>6%</td>
<td>15%</td>
<td>10%</td>
<td>8%</td>
<td>16%</td>
<td>26%</td>
<td>26%</td>
<td>10%</td>
</tr>
<tr>
<td>Machinery equipment and others</td>
<td>24%</td>
<td>27%</td>
<td>21%</td>
<td>17%</td>
<td>22%</td>
<td>26%</td>
<td>17%</td>
<td>15%</td>
<td>14%</td>
<td>19%</td>
<td>15%</td>
<td>12%</td>
<td>12%</td>
<td>9%</td>
</tr>
</tbody>
</table>


From 1978 to 1991, the share of investment in residential buildings in total gross fixed investment has clearly increased, whereas the share devoted to machinery equipment has been sharply reduced. This fact is interesting in the light of the findings of De Long and Summers (1991), who discover a causal nexus between equipment investment and economic growth. In this view, which is in line with the modern growth theory that stresses the role of externalities associated with the accumulation of physical and human capital, the social return to machinery investment exceeds the private return. Indeed, a regression relating total factor productivity growth in Jordan to the ratio of machinery and transport equipment imports (as a proxy for machinery investment) to total gross fixed investment, lagged one year, reveals a significant degree of correlation (see annex).

This finding alone obviously does not allow us to derive conclusions concerning causality, but it corresponds to the cross-country regression results by De Long and Summers (1993). The Jordanian government has tried to promote machinery investment in the past, by exempting capital goods from import duties. Probably there is scope for further policy action in this field.

One can view the Jordanian experience as supportive of De Long's and Summer's hypothesis that stresses the quality of investment, and argue that, like some other countries with high

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39 The lag accounts for the time between import and installment of machinery.
savings rates (e.g. India), Jordan did not make good use of its (foreign) savings. After some improvements in productivity, the quality of investment declined. The result is consistent with findings from cross-country growth regressions that indicate that the efficiency of investment is as important as its level in determining growth\textsuperscript{40} and with Young's (1992) case-study findings. In the case of Jordan, regulated rates of interest, due to which the role of interest as a means of rationing credit among competing users and risk premia for riskier projects were eliminated. An underdeveloped financial sector, in which credit is only available against fixed collateral, contributed to an inefficient allocation of capital\textsuperscript{41}. Tax incentives for expensive residential construction were not very productivity-enhancing, either, nor were the high levels of military spending (estimates lie around 20% of GNP in the late eighties\textsuperscript{42}). Large public investments had low returns to capital.

From a theoretical perspective, it is therefore desirable to develop more sophisticated models to differentiate between various types of investment. The "AK-model" is obviously inadequate to explain Jordan's growth performance.

\textbf{4.2 The labor flows}

When seeking for the reasons underlying Jordan's growth and productivity pattern, it is natural to try to understand the effects of the large labor flows. While it is impossible to determine their ultimate impact, some aspects which are important in this context can at least be highlighted.

On one hand, the positive aspects of the migration in terms of long-run growth are the high levels of remittances which facilitated large investments, investments that would not have been otherwise possible due to Jordan's limited access to international capital. Also, one has to bear in mind the fact that returning Jordanians add valuable experience to the country, after having worked with technicians and professionals from all over the world, compensating

\textsuperscript{40}see Easterly and Wetzel (1989)

\textsuperscript{41}see for example King and Levine (1993) and Greenwald and Stiglitz (1989) for a theoretical explanation of these links and El-Naggar (1990) for a discussion of financial intermediation in Jordan

\textsuperscript{42}the usual ratio for developing countries is 4-5%; see Lavy and Sheffer (1991)
somewhat for the country’s previous loss in human capital. On the other hand, one is tempted to explain part of the Jordanian low-productivity experience by a brain-drain-syndrome. This explanation would help to understand the disparity between measured increases in human capital and declining rates of growth and productivity. Especially after the Oil Crisis, wages in the Gulf states rose, attracting the best people. As can be seen from table 3, the migrant labor clearly pertains to the segment of higher-skilled people, whereas education of the non-Jordanian workforce is certainly below average.

Table 10: Educational Level 1987 in Percent

<table>
<thead>
<tr>
<th></th>
<th>Jordanian labor abroad</th>
<th>Non-Jordanian workers</th>
<th>Jordanian labor force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below secondary</td>
<td>26.1%</td>
<td>73.1%</td>
<td>67.0%</td>
</tr>
<tr>
<td>Secondary level</td>
<td>49.8%</td>
<td>4.6%</td>
<td>13.1%</td>
</tr>
<tr>
<td>Intermediate institute</td>
<td>9.0%</td>
<td>17.6%</td>
<td>11.7%</td>
</tr>
<tr>
<td>First university degree</td>
<td>12.7%</td>
<td>4.3%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>2.4%</td>
<td>0.3%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>


Training new workers often had as a consequence the departure of these people from the country after acquiring marketable skills. According to the Ministry of Planning, in 1985 41.4% of the higher-educated workforce was abroad. As already noted, the usual measures of human capital disregard these important aspects and do not represent a good measure of the abilities of the employed workforce.

Jordan’s inability to compete in wages for high-skilled-labor is likely to have had short and long-run consequences: it led to the replacement of leavers by less qualified employees, according to Wilson (1991), p.4, this effect is negligible, as most of returnees retire from active employment and live on their savings as quoted in Roy and Irelan (1992), see Anani (1990).
increased wages and it may have reduced Jordan's abilities of expanding its productive sector.

This kind of phenomenon has been modelled in the modern trade and endogenous growth theory literature. Consider a simple model of an economy with one sector. Unskilled workers $U$ and skilled people $S$ are substitutionable to a certain extent, but productivity growth depends on the number of skilled people involved in production. Let the production function for example be:

$$Y = A \cdot K^{\alpha_S} \cdot S^{1-\alpha}$$

Endogenous growth takes place through external learning-by-doing:

$$\dot{A}/A = \mu S$$

An outflow of skilled labor and an inflow of unskilled workers increases the ratio $U/S$ and induces a slowdown in productivity growth, leading to a lower growth path for the economy. The wage ratio for skilled and unskilled workers is determined by the ratio of the endowments:

$$w_s/w_u = (B/(1-\alpha-\beta))(U/S)$$

In fact, findings indicate that wage differentials between technicians and skilled workers (which became rare in Jordan) and limited skilled workers (which were abundant due to foreign inflows) widened.

The presence of externalities has the effect that the loss for the country is higher than the private marginal product of the skilled people leaving. This also means that high levels of remittances probably cannot compensate for the loss of human capital.

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46 I am using the same notation as Cartiglia (1992), who develops a much more sophisticated model

47 Cartiglia (1992) develops a sophisticated Two-Sector-Model, in which he analyzes similar issues. There, productivity growth is determined by the level of output in the High-Tech-Sector.

48 see Al-Akel (1985), p.255
The model leads to the presumption that Jordan's economy would have grown on a higher growth path if its high educational achievements had been allowed to have a significant impact on technology and productivity. On the contrary, Jordan got more or less stuck in the production of low-tech goods. In fact, after some industrialization progress in the seventies, the manufacturing sector stagnated and its contribution to GDP was lower in 1992 than in 1982. The beneficial circumstances from 1974 to 1984 did not have the strong long-term structural impact that a country with a highly developed educational system like Jordan could have experienced. The government undertook some measures to avoid the outflow of skilled labor; for example, during 1978-84, the Ministry of Labor had to approve every job advertisement from abroad in order to ensure that it did not ask for "rare skills". These regulations were easy to circumvent.

As the data on migration is very incomplete, it is difficult to support this hypothesis with strong evidence. An interesting test would be, for example, to check whether accurate estimates of skilled migrants and unskilled immigrants can help to explain the behavior of the Solow-residual. Also, the story is not as simple and static as the model above suggests. For example, the division between skilled and unskilled labor is obviously an oversimplification, and the dynamics of the whole process are hard to specify.

The Gulf Crisis and the resulting "exogenous" return of emigrants may constitute a "natural experiment" for the hypothesis presented here; accordingly, one should observe a rise in productivity in the next years.

An alternative explanation, in line with the view of Lucas (1993) would be that Jordan suffered from continuous losses in firm-specific human capital; the problem would not have been the differences in average schooling years of immigrants and migrants, but the lack of acquisition of training on-the-job. If it turns out that a corrected measure of average years of schooling still does not help explaining GDP growth, that would be an important hint for thinking about human capital in a different way, possibly as proposed by Lucas. Right now, neither correct human capital measures in the traditional sense nor sufficient sectoral data is available in the case of Jordan to investigate these issues empirically.

49see Anani (1990) p.40
5. Policy Implications

This paper did not attempt to pursue a thorough analysis of institutional and policy aspects and their impacts on productivity. Nevertheless, some general conclusions can be drawn. From the previous analysis it is apparent that the allocation of resources was inefficient in the past; for the formulation of future policies, it is important to bear these results in mind.

Undoubtedly, the peace process will bring about many chances for economic development: economic relations with Israel, a reduction in military spending, a more secure investment environment, increased tourism and regional cooperation in water management are among the most obvious possible peace dividends. However, in order to benefit extensively from these opportunities, Jordan has to reduce internal inefficiencies that led to the poor productivity performance in the past. Concerning the issue of deteriorating investment quality, policies designed to enhance the working of the financial system, to improve the business environment and to reduce the role of the state in the economy are particularly important. The brain-drain issue represents a difficult problem to tackle from a policy point of view; however, it is likely to diminish in importance if Jordan manages to adapt successfully to the new conditions.

5.1 Improving the efficiency of the financial sector

An improved working of the financial sector would foster productivity through a better allocation of scarce funds. Presently, the Jordanian financial sector is heavily biased towards the real estate sector; access to credit for the productive sectors is insufficient. The current financial system is too rigid, with privilege-granted institutions designed to provide credit to specific sectors. These institutions enjoy monopoly power and have no incentives to increase efficiency. Allowing for competition and eliminating privileges could constitute an important step towards a higher level of financial intermediation. This does not mean that the state should not help to overcome credit market imperfections, but competition in the financial sector is essential. Private financial intermediaries could not only improve the evaluation and monitoring of businesses, but also help to mobilize domestic savings in order to overcome the dependency on foreign funds. The integration of Jordan’s capital market with the international markets has to be deepened in order to improve access to foreign capital, to allow entrepreneurs to secure themselves against risks and to exploit profitable linkages with foreign businesses. All these measures could help to redirect resources to their most productive uses.
5. 2 Reducing the role of the Public Sector and enhancing the business environment

In order to allow Jordan to take greatest advantage of the economic opportunities ahead, the imbalance between the public and the private sector should be reduced. Public enterprises and parastatals have absorbed large amounts of domestic credit in the past; their role in the Jordanian economy is too dominant, given the many advantages they enjoy over private businesses and the distortions resulting from these unequal positions. Government interference in form of bureaucratic barriers have been reduced in the past, but red tape (e.g. in form of licensing procedures) is still abundant. The chance given by the peace process to lower the military burden has to be taken advantage of; freed resources should be diverted to more productive investments.

Several other policy fields will have to receive similar attention, such as the trade policy and the goods and labor market regulatory policies. Competition from foreign firms would reduce monopoly power and improve efficiency; a more open economy can benefit more from foreign R&D. Reducing labor market rigidities and price controls in the goods markets would contribute to a productivity-enhancing reallocation of factors.

Concerning the specific point made about machinery investment, this issue requires more careful attention and it would be too quick to derive the need for subsidization measures without a more careful analysis of the issues. Even if it is true that the social returns to certain types of investment exceed the private returns, the risks associated with the interference of the state in investment decisions are large and should be evaluated against potential benefits.

6. Summary

The analysis has revealed some stylized facts about Jordan’s growth and productivity record. Growth in Jordan has been mostly a result of higher levels of the inputs labor and capital, not of productivity gains; the high educational achievements did little to improve productivity, as skilled Jordanians tended to leave the country. The hypothesis presented here implies that the return of skilled emigrants during the Gulf Crisis will presumably lead to an improvement in productivity. The quality and allocation of investment was not optimal and deteriorated.
Foreign flows were not used efficiently; the poor productivity record indicates that they may even have aggravated existing inefficiencies, by alleviating the pressure for reform\textsuperscript{50}.

The implications of simple endogenous growth models that emphasize the role of capital accumulation without disaggregating ("AK-models") cannot be supported. There is some support for the view that quality of investment matters, and that particularly machinery investments do have spillovers.

It is apparent that human capital measures as total number of school years or enrollment years that do not correct for the effects of migration are inadequate for countries that experience large migration flows. In the construction of corrected measures of human capital lies a tedious, but important piece of work for further research.

The analysis reveals the need for policies targeted at the improvement of the allocation of resources; a reform of the financial sector could constitute an important step in that direction.

\textsuperscript{50}see Lavy and Sheffer (1991)
References


Richards, Alan and John Waterbury (1990): "A Political Economy of the Middle East", Boulder 1990


SIPRI, Yearbook, 1989


Annex 1 Composition of GDP 1971, 1982, 1992

Jordan - Composition of GDP

1971

Agriculture (18.5%)

Mining (1.5%)

Manufacturing (7.5%)

Construction (4.5%)

Services (28.5%)

1982

Agriculture (5.5%)

Mining (1.5%)

Manufacturing (19.5%)

Construction (3.5%)

Services (39.5%)
Annex 2

Regressions

List of variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGGDP</td>
<td>Log of real GDP (1989 JD)</td>
</tr>
<tr>
<td>LOGUCAP</td>
<td>Log of capital</td>
</tr>
<tr>
<td>LOGLAB</td>
<td>Log of employment</td>
</tr>
<tr>
<td>YEAR</td>
<td>Time variable</td>
</tr>
<tr>
<td>LOGGDPLA</td>
<td>Log of GDP per worker</td>
</tr>
<tr>
<td>LOGUCAPL</td>
<td>Log of capital per worker</td>
</tr>
<tr>
<td>LOGHUMAN</td>
<td>Log of human capital</td>
</tr>
<tr>
<td>LOGHLAB</td>
<td>Log of human capital per employment</td>
</tr>
<tr>
<td>UCAPLAB</td>
<td>Capital per employment</td>
</tr>
<tr>
<td>C</td>
<td>Constant</td>
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<tr>
<td>AHAT</td>
<td>Total factor productivity growth</td>
</tr>
<tr>
<td>RATIO</td>
<td>(Machinery imports)/gross fixed investment</td>
</tr>
<tr>
<td>Q</td>
<td>LOGGDP-0.5<em>LOGUCAP-0.5</em>LOGLAB</td>
</tr>
<tr>
<td>RA</td>
<td>LOGGDP-LOGUCAP-0.5*LOGLAB</td>
</tr>
</tbody>
</table>

Regression 1: \( \log Y = c + \sigma \cdot \text{time} \) 
Estimation of trend growth rate

Regression 2: \( \log I = c + \sigma \cdot \text{time} \) 
Obtention of fitted inv. for 1970

Regression 3: \( \log \frac{Y}{L} = 0.417 + 0.522 \log \frac{K}{L} \) 
Estimation of \( \alpha, \beta \), restricting \( \alpha + \beta = 1 \)

Regression 4: \( \log \frac{Y}{L} = 15.246 - 0.008 \cdot \text{time} + 0.629 \cdot \ln \frac{K}{L} \) 
Estimation of \( \delta \) (TFP growth)

Regression 5: \( \log Y - 0.5 \log K - 0.5 \log L = 15.418 - 0.008 \cdot \text{time} \)
Estim. of \( \delta \) with fixed coeff.

Regression 6: \( \log \frac{Y}{L} = -0.300 + 0.0026 \cdot \text{time} - 1.000 \cdot \log [0.9986(\frac{K}{L})^{1.000} + (1 - 0.9986)] \) CES

Regression 7: \( \log \frac{Y}{L} = 0.328 + 0.541 \cdot \log \frac{K}{L} + 0.053 \cdot \log \frac{H}{L} \) 
Restricted estimation of \( \alpha, \beta \)

Regression 8: \( (\log \frac{Y}{L})_{t} - (\log \frac{Y}{L})_{t-1} ) = 0.644 \cdot (\log \frac{K}{L})_{t} - (\log \frac{K}{L})_{t-1} + 0.132 \cdot (\log \frac{H}{L})_{t} - (\log \frac{H}{L})_{t-1} \)
First difference estimation
Regression 9: \[ \log gdp - \log gdp(-1) = 0.260 - 0.03 \cdot \log H + 0.662 \cdot (\log K - \log K(-1)) \]
\[ + 0.108 \cdot (\log L - \log L(-1)) \text{ Including levels of human capital} \]
\[ (1.465) (-1.498) (8.247) \]
\[ 0.188 \]

Regression 10: \[ \frac{(\text{TFP}_t - \text{TFP}_{t-1})}{\text{TFP}_t} = -0.0967 + 0.173 \cdot (\text{mach}\cdot\text{import/gfi})_t \]
\[ (-2.873) (2.819) \]

Regression 11: \[ \frac{(\text{TFP}_t - \text{TFP}_{t-1})}{\text{TFP}_t} = -0.007 + 0.062 \cdot (K_t - K_{t-1})/K_t \text{ Test of investment spillovers} \]
\[ (-0.507) (0.380) \]

Regression 12: \[ \frac{(Y_t - Y_{t-1})}{Y_t} = 0.033 - 0.001 \cdot (L_t - L_{t-1})/L_{t-1} + 0.175 \cdot (I_t - I_{t-1})/I_{t-1} \text{ Growth vs. investm.} \]
\[ (0.803) (-0.001) (1.528) \]
### Annex 3 Data

<table>
<thead>
<tr>
<th>Year</th>
<th>ln GDP</th>
<th>GDP&lt;sup&gt;51&lt;/sup&gt;</th>
<th>Convex Hull</th>
<th>Capacity util.</th>
<th>GDP Hull</th>
<th>Capital</th>
<th>Capital in use</th>
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<tr>
<td>1970</td>
<td>6.839</td>
<td>933.556</td>
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<td>1004.487</td>
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<td>0.98053</td>
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<td>7.7025</td>
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