IMPACT OF AIR AND WATER POLLUTANT EMISSIONS ON PRODUCTIVITY GROWTH OF MALAYSIA'S MANUFACTURING SECTOR

By

ELSADIG MUSA AHMED

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2004

I DEDICATE THIS WORK TO THE SWEET MEMORY OF MY BLOVED WIFE, RABEHA KINUKO OFUSA, (20TH FEBRUARY 1999-22ND OCTOBER 1999).

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy

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Chairman: Professor Khalid Abdul Rahim, PhD

Faculty: Economics and Management

The manufacturing sector has been the engine of growth for the Malaysian economy since the economic structural transformation in 1987. The sustainability of high economic growth depends on the productivity through the enhancement of total factor productivity. Total factor productivity development strategies emphasise on quality of the workforce, raw materials, capital structure and technical progress. The improvement and slowdown of total factor productivity (TFP) contribution to the manufacturing sector industries in terms of average annual growth rates depend on the quality of inputs used in the production of the manufacturing sector industries, that were reported to be of low quality and insufficient.

The results of the study confirm that productivity growth of Malaysia's manufacturing sector is an input driven rather than TFP driven and mainly dependent on Foreign Direct Investment (FDI). The performance of productivity growth after the financial crisis of 1997 was found to be negative during 1998. In addition, it was also found that the

slowdown of labour productivity growth of the manufacturing sector industries in terms of average annual growth rates was due to the quality of labour involved in the manufacturing sector industries.

Meanwhile, the study contributes to the literature available in the area of growth accounting method in terms of calculating the real TFP growth by internalising the pollutant emissions beside the input terms in the production function. By this technique total factor productivity growth becomes an indictor of green productivity, which puts into consideration economic development and environmental protection.

Furthermore, the factors affecting the output growth of the manufacturing sector as identified using Jorgensen et al model are the individual contributors to capital, labour, material, pollutant emissions and the combined contribution of the quality of these inputs expressed as the TFP. In fact, the higher level of pollutant emissions generated by the manufacturing sector slowed the growth rates of TFP by internalised the pollutant emissions beside the traditional input terms in the form of undesirable output produced beside the original products of the sector in the model as shown in the results of model 1.

While the factors identified as influencing the labour productivity of the manufacturing sector (that is indicated as a good measure of standard of living rather than output that measure the output per person) as in Dollar and Sokoloff model are the individual contributors to the capital deepening, material-labour ratio, pollutant emissions intensity

and the simultaneous contribution of the quality of these factors expressed as the TFP per unit of labour. The pollutant emissions per worker were found to be of more impact into slowing down the contribution of TFP per unit of labour (technological progress) of the manufacturing sector compared with that of the first model. This is due to the problems of labour, during the entire period of the study that witnessed the rapid industrial development in the Malaysian economy, which generated higher level of pollutant emissions as a result of the industrial activities. Finally, combining the results of the two models this study found that industrial activities are related to the growth rate of pollutant emissions generated in the production process of the manufacturing sector. This appears in the form of undesirable output that had slowed the productivity growth of the manufacturing sector in general and the contributions of total factor productivity of the manufacturing sector in particular.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

IMPAK PENCEMARAN UDARA DAN AIR KE ATAS PERTUMBUHAN PRODUKTIVITI SEKTOR PENGILANGAN MALAYSIA

Oleh

ELSADIG MUSA AHMED

Disember 2004

Pengerusi: Profesor Khalid Abdul Rahim, PhD

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Sektor pengilangan telah menjadi jentera pertumbuhan ekonomi Malaysia sejak pemindahan struktur ekonomi dalam tahun 1987. Kelestarian pertumbuhan ekonomi yang tinggi bergantung kepada produktiviti melalui peninggian produktiviti faktor total. Strategi pembangunan produktiviti faktor total harus menekankan kepada kualiti daya kerja, bahan mentah, struktur modal dan perkembangan teknikal. Pembaikan dan kelambatan sumbangan produktiviti faktor total kepada industri sektor pengilangan dari segi kadar pertumbuhan purata tahunan bergantung kepada kualiti input yang digunakan dalam pengeluaran industri sektor pengilangan, yang awalnya dilaporkan berkualiti rendah dan tidak mencukupi.

Walau bagaimanapun, keputusan kajian ini mengesahkan pertumbuhan produktiviti sektor pengilangan Malaysia adalah lebih berpandukan input berbanding berpandukan produktiviti faktor total dan kebanyakannya bergantung kepada Pelaburan Langsung

Asing (FDI). Dan prestasi pertumbuhan produktiviti selepas krisis kewangan tahun 1997 adalah negatif pada tahun 1998. Sebagai tambahan, juga didapati kelambatan pertumbuhan produktiviti buruh bagi industi sektor pengilangan dari segi kadar pertumbuhan purata tahunan disebabkan oleh penglibatan kualiti buruh dalam industri sektor pengilangan.

Manakala, kajian ini menyumbang kepada karya kaedah pertumbuhan perakuanan dalam bidang pengiraan pertumbuhan produktiviti faktor total sebenar dengan mendalami penyebaran pencemar disamping terma-terma input dalam fungsi pengeluaran. Dengan teknik ini pertumbuhan produktiviti faktor total menjadi penunjuk kepada produktiviti hijau, yang mengambilkira pembanguna ekonomi dan perlindungan alam sekitar.

Lebih-lebih lagi, faktor yang mengesani pertumbuhan ouput sektor pengilangan dikenalpasti menggunakan model Jorgensen et al adalah sumbangan masing-masing dari modal, buruh, bahan, penyebaran pencemar dan sumbangan gabungan kualiti input ini dinyatakan sebagai produktiviti faktor total. Malah, semakin tinggi aras penyebaran pencemar yang dihasilkan oleh sektor pengilangan melambatkan kadar pertumbuhan produktiviti faktor total dengan mendalami penyebaran pencemar disamping input tradisional dalam bentuk output yang tidak diingini dikeluarkan disamping produk asal sektor ini dalam model yang ditunjukkan dalam keputusan model 1.

Manakala faktor yang dikenalpasti sebagai mempengaruhi produktiviti buruh (yang menunjukkan sebagai ukuran piawai bagi kehidupan yang baik berbanding output kerana ia mengukur output per orang) bagi sektor pengilangan dari model Dollar dan Sokoloff adalah sumbangan individu dengan meningkatkan modal, kadar bahan-buruh, intensiti penyebaran pencemar dan sumbangan serentak kualiti faktor-faktor ini dinyatakan sebagai produktiviti faktor total. Penyebaran pencemar per pekerja telah melambatkan sumbangan TFP (perkembangan teknologi) bagi sektor pengilangan melebihi dari model pertama oleh masalah buruh, dalam tempoh kajian yang menyaksikan pembangunan industri yang pesat dalam ekonomi Malaysia, yang menjana penyebaran pencemar aras tinggi oleh aktiviti industri. Akhirnya, meletakkan keputusan bagi kedua-dua model kajian ini didapati aktiviti industri adalah berkaitan dengan kadar pertumbuhan penyebaran pencemar yang dijana dalam proses pengeluaran bagi sektor pengilangan. Ini ujud dalam bentuk output yang tidak diingini telah melambatkan pertumbuhan produktiviti bagi sektor pengilangan secara amnya dan sumbangan produktiviti faktor total dalam sektor pengilangan khasnya.

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I certify that an Examination Committee met on (10/12/2004) to conduct the final examination of Elsadig Musa Ahmed on his Doctor of Philosophy thesis entitled "Impact of Air and Water Pollutant Emissions on Productivity Growth of Malaysia's Manufacturing Sector" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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ELSADIG MUSA AHMED

Date**:**

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