UNIVERSITI PUTRA MALAYSIA

TOTAL FACTOR PRODUCTIVITY GROWTH, EFFICIENCY AND TECHNOLOGICAL PROGRESS OF THE MALAYSIAN MANUFACTURING SECTOR

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By

ROSLINA MOHD ISA

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

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UPM

Disertai CD-ROM / disket yang boleh diperolehi
di Bahagian Media dan Arkib
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at the Media and Archives Division)

To My Family, Mother, Brother, Sister-in-law,

Aunties and Uncles.....

Especially To My Husband Azizan

And Our Children:

Izzul Amri

Izzul Amsyar

Izzul Amnan

Izza Liyana

With

Ever Lasting Love, Gratitude, Admiration,

High-Spirit, Courage And Treasured Moments.

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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May 2005

Chairman: Professor Maisom Abdullah, PhD

Faculty: Economics and Management

Productivity growth has always been an important aspect of Malaysia's economic policy. This is evident in every stage of Malaysia's economic development plans. Sustainable economic growth need to continuously focus on improvements in productivity. Productivity-driven growth has gained momentum in many countries since the 1970's. The Seventh Malaysia Plan (1995-2000), had placed the importance of productivity with a shift in policy, where productivity-driven strategy was the primary synergy to growth in the future. The productivity-driven strategy is further emphasised in the Eighth Malaysia Plan (2001-2005) and in the Third Outline Perspective Plan (OPP3) (2001-2010). As a result, Malaysia was able to recover from the financial crisis faced in 1997 and experience sustainable economic growth. In view of Malaysia's current full employment situation, total investment is expected to decline. Malaysia's future growth henceforth will depend more on productivity-driven growth strategies.

Enhancing productivity growth is essential to achieve high economic growth substantial improvement in income distribution, relative price stability and poverty eradication. Due to limited resources and capacity in capital accumulation accompanied by stiff competition in attracting foreign investments, it has become more pertinent to move the economic development strategy from input-driven to productivity-driven growth by enhancing the contribution of Total Factor Productivity (TFP).

As Malaysia moves forward to achieve her goals as set in Vision 2020, she is expected increasing her bottlenecks and limitations especially in terms of skill and organisational/technological capabilities. Shortage of labour will also increase the cost of production which would lead to the erosion of competitiveness. Furthermore, she will increase competitiveness due to globalisation and liberalisation. Nonetheless, that there has been relatively low TFP growth both in the manufacturing sector as well as the economy as a whole.

The main objective of this dissertation is to demonstrate the usefulness of recent developments in stochastic frontier analyses in measuring the TFP, efficiency and technological progress in Malaysian manufacturing industries (1985-2001), and the specific objectives are: (i) To provide alternative estimations of technical and cost/allocative efficiency, technological progress and TFP of Malaysian manufacturing sector by using four alternative approaches: Production Function (Cobb Douglas Production Frontier (CDP), Translog Production Frontier (TP)) and Dual Cost Function (Cobb Douglas

Cost Frontier (CDC) and Translog Cost Frontier (TC)); (ii) To review and identify the underlying impact, assumptions, approach, nature and applications of the above models for Malaysia; (iii) To review the results of alternative estimates of efficiency, technological progress and TFP; (iv) To discuss the relationships between technological progress, efficiency and TFP in Malaysian manufacturing industries; (v) To utilise the results of the models in planning for higher TFP growth; and (vi) To provide some policy implications.

According to economists, there are three sources contributing to economic growth of a nation: inflation rate, employment growth and productivity growth. In exploring the later, this study uses 4 alternative models, and the selected final model is the translog cost frontier model. This provides estimations of technical and cost / allocative efficiency, technological progress and TFP of twenty selected Malaysian manufacturing sub-sectors using stochastic frontier panel data of time-variant. This study has been able to provide a detailed trend analysis of TFP growth, technological progress, allocative/cost efficiency and the effects of scale economies at 3 and 5-digits sub-sector level of the Malaysian manufacturing sector. The importance of measuring the two components of TFP growth i.e., technical/cost efficiency change and technological progress is that they may provide insights into the causes of low productivity. In this study, the methodologies of stochastic frontier production and cost are employed using micro/firm level data. Micro/firm level data have the advantage of overcoming some of the measurement problems and aggregation bias associated with aggregated industry data. Furthermore, the

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stochastic frontier production and cost methods will enable us to separate the contributions of technological progress and changes in technical/cost efficiency to TFP growth. The latter can also provide important policy guidelines on the possible factors underlying the productivity issue.

This study has provided TFP growth estimates which show considerable effects by changes in technical/allocative efficiency technological progress and scale of components. The overall manufacturing sector for the period 1986-2001 registers TFP growth of 0.69%. The sub-sectors which register high TFP growth are textiles, wood products, other chemicals products, non-ferrous metal, electrical machinery, beverages and other manufacturing. Sub-sectors with low TFP growth are machinery except electrical, rubber products, transport equipment and fabricated metal. The allocative/cost efficiency is the main contributor to TFP growth as compared to technological progress. The overall manufacturing sector for the period 1985-2001 registers an efficiency contribution of 66.0%, scale components 33.0% and technological progress 1.0% to the TFP. These determinants will give a positive significant effect on productivity growth.

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

PERTUMBUHAN FAKTOR PRODUKTIVITI KESELURUHAN, KECEKAPAN DAN PERUBAHAN TEKNOLOGI UNTUK SEKTOR PEMBUATAN MALAYSIA

Oleh

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Pertumbuhan produktiviti sering menjadi aspek terpenting untuk polisi ekonomi Malaysia. Ini terbukti dalam setiap peringkat perancangan pembangunan ekonomi Malaysia. Daya tahan pertumbuhan ekonomi perlu dititikberatkan melalui penambahbaikan produktiviti yang berterusan. Pertumbuhan yang berasaskan produktiviti sudah menjadi penggerak utama bagi kebanyakan negara sejak tahun tujuh puluhan lagi. Rancangan Malaysia Ketujuh (1995-2000), telah mengubah peranan polisi Malaysia kepada ekonomi berasaskan produktiviti, dan ini telah menjadi dasar utama untuk pertumbuhan ekonomi di masa hadapan. Seterusnya, di dalam Rancangan Malaysia Kelapan (2001-2005) dan Rangka Rancangan Jangka Panjang Ketiga (OPP3) (2001-2010), penekanan strategi yang berasaskan produktivti dititikberatkan lagi. Pendekatan ini telah dapat memulih Malaysia dari kemelut krisis kewangan 1997 dan seterusnya mengalami pertumbuhan ekonomi yang berdaya tahan. Memandangkan Malaysia masa kini sedang mengalami tenaga kerja yang penuh dan jumlah pelaburan dijangkakan menurun,

pertumbuhan Malaysia di masa hadapan akan lebih bergantung kepada strategi yang berasaskan pertumbuhan produktiviti.

Peningkatan pertumbuhan produktiviti adalah penting bagi pencapaian pertumbuhan ekonomi yang tinggi pengagihan pendapatan yang lebih baik, kestabilan harga dan pembasmian kemiskinan. Disebabkan oleh sumber dan pengumpulan kapasiti modal yang terhad disertai dengan daya saing yang sengit dalam menarik pelaburan asing, maka jalan yang terbaik untuk meningkatkan strategi pembangunan ekonomi adalah melalui peralihan dari pertumbuhan berasaskan input kepada pertumbuhan berasaskan produktiviti melalui peningkatan Produktiviti Faktor Menyeluruh (TFP).

Dalam halatuju Malaysia menuju ke arah mencapai Wawasan 2020, akan di jangkakan menghadapi banyak rintangan dan kekangan terutamanya di dalam bidang kemahiran teknologi dan pengurusan organisasi. Kekurangan tenaga mahir akan meningkatkan kos pengeluaran. Ini akan mengakibatkan Malaysia kurang berdaya saing. Selanjutnya, persaingan juga akan meningkat disebabkan era globalisasi dan liberalisasi. Pada masa yang sama juga, pertumbuhan TFP Malaysia adalah masih rendah di dalam sektor pembuatan dan ekonomi keseluruhan.

Objektif utama tesis ini adalah untuk menunujukkan manfaat perkembangan analisa "Stochastic frontier" dalam pengukuran TFP, kecekapan dan kemajuan teknologi dalam industri pembuatan Malaysia (1985-2001). Spesifik objektif adalah (i) menyediakan anggaran alternatif bagi kecekapan kos

/teknikal, kemajuan teknologi dan TFP bagi sektor pembuatan Malaysia dengan menggunakan empat kaedah alternatif: "Production Function (Cobb Douglas Production Frontier (CDP), Translog Production Frontier (TP)) and Dual Cost Function (Cobb Douglas Cost Frontier (CDC) dan Translog Cost Frontier (TC)"; (ii) menunjukkan dan mengenalpasti impak faktor yang tersirat di dalam andaian dan aplikasi untuk model Malaysia; (iii) menunjukkan keputusan dari anggaran alternatif bagi kecekapan, kemajuan teknologi dan TFP; (iii) Memperbincangkan hubungan di antara kemajuan teknologi, kecekapan dan TFP bagi industri pembuatan Malaysia; (iv) menggunakan keputusan dari modal tersebut untuk perancangan pertumbuhan TFP; dan (v) menyediakan beberapa implikasi polisi.

Ahli ekonomi menyatakan bahawa ada tiga faktor utama yang menyumbang kepada pertumbuhan negara seperti pertumbuhan inflasi, guna tenaga dan produktivti. Dalam menjelajahi isu produktiviti dan selepas menjalani penyelidikan menggunakan 4 jenis kaedah alternatif, model terpilih adalah "translog cost frontier". Dengan ini anggaran kecekapan kos, kemajuan teknologi dan pertumbuhan TFP untuk dua puluh sub-sektor pembuatan Malaysia terpilih di perolehi menggunakan 'stochastic frontier' data panel dengan perubahan masa. Kajian ini memberi satu analisis yang mendalam mengenai aliran pertumbuhan TFP, kemajuan teknologi, kecekapan dan tindak balas skala ekonomi bagi tahap 3 dan 5 digit sub-sektor untuk sektor pembuatan Malaysia. Kepentingan dalam mengukur dua komponen pertumbuhan TFP ia-itu kecekapan tehnikal/kos dan kemajuan teknologi akan dapat memberi penilaian yang mendalam dan berbeza mengenai faktor

penyumbang rendahnya pertumbuhan TFP. Ini akan dapat menjadi panduan kepada perancang polisi untuk membuat dasar berkaitan dengan isu produktiviti.

Dalam pengajian ini, kaedah "stochastic frontier" pengeluaran dan kos digunakan untuk analisa data firma/mikro. Data firma/mikro lebih berfaedah di mana ia dapat mengatasi beberapa masaalah pengukuran dan boleh mempengaruhi data terkumpul yang berhubungkait dengan data terkumpul industri. Seterusnya, kaedah "stochastic frontier" pengeluaran dan kos dapat mengasingkan sumbangan yang diperolehi dari kemajuan teknologi dan peruabahan dalam kecekapan teknikal dan kos terhadap pertumbuhan TFP. Kecekapan teknikal atau kos dapat memberi garis panduan penting untuk pembentukan polisi terhadap faktor-faktor berkemungkinan ada berkaitan dengan isu produktivti.

Penyelidikan ini memberi anggaran nilai pertumbuhan TFP yang diakibatkan oleh perubahan kecekapan teknikal /kos, kemajuan teknologi dan komponen skala. Kajian ini mecatatkan nilai pertumbuhan TFP 0.69% untuk keseluruhan sektor pembuatan bagi jangka masa 1986-2001. Sub-sektor yang menunjukkan pertumbuhan TFP yang tinggi adalah tekstil, keluaran kayu, lain-lain keluaran kimia, logam bukan ferus, jentera elektrik, minuman, keluaran getah, dan lain-lain pembuatan. Bagi sub-sektor yang mencatatkan pertumbuhan TFP yang rendah adalah alat-alat pengangkutan, jentera melainkan alat alat elektrik, keluaran getah pasangsiap daripada logam. Dalam kajian ini didapati sumbangan utama pertumbuhan TFP adalah dari

penambahbaikan dalam kecekapan kos/teknikal berbanding dengan kemajuan teknologi. Keseluruhan sektor pembuatan bagi jangka masa 1986-2001 mencatatkan sumbangan dari kecekapan 66.0%, komponen skala 33.0% dan kemajuan teknologi 1.0% terhadap TFP. Sumber-sumber pertumbuhan TFP ini akan dapat memberi kesan yang positif ke atas pertumbuhan produktiviti.

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