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Tactics of Environmental NGOs in Influencing Public Policy in Malaysia

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Keywords: environmental NGOs, political tactics, public policy

ABSTRACT
Environmental non-governmental organizations (NGOs) in Malaysia can influence public policy-making through several political tactics. This study surveyed and compared the tactics used by three selected NGOs, namely, the Sahabat Alam Malaysia (SAM), the Malaysian Nature Society (MNS) and the World Wide Fund for Nature (WWF), Malaysia. The Automobile Association of Malaysia (AAM) was conveniently selected as the control group. Data and information were gathered through face-to-face interview technique with the chief executive officers of the respective organizations or their representative using a structured questionnaire. The findings reveal that the environmental NGOs are different from the AAM in their choice of tactics of influencing public policy. The former prefer to use direct tactics in influencing policy decisions. Tactics such as conducting and presenting research results, presenting personal viewpoints, lobbying and contacting officials, are often used compared to tactics like letter-writing and telegram campaigns, grassroots lobbying, drafting legislation or organizing conferences. Among the NGOs, the MNS has been the most tactical in the sense that it has used more tactics, both direct and indirect, more often than the SAM or the WWF. The MNS also has the most resources of the NGOs and this probably explains its capacity to employ more political tactics. Future studies should use a bigger sample as well as investigate the effectiveness of the various tactics used.

INTRODUCTION
Environmental non-governmental organizations (NGOs) worldwide have been recognized as influential actors in the decision-making arena on policies related to the environment. The manner in which these NGOs influence decision-making vary and depends on the strength of the NGOs themselves as well as the institutions which
they target their activities (Mohd and Laarman 1994). At one extreme, there are NGOs which work closely with the public in harnessing their support to influence policies while at the other extreme there are other NGOs that directly lobby the policy makers themselves. The degree of success of environmental NGOs in influencing policy decisions vary among nations. In some countries, such as the United States of America, environmental NGOs have been responsible for bringing about the institutionalization of environmental concern. In such countries, these NGOs have permanently dotted the political landscape of the nations.

Environmental NGOs have also made their presence felt in the decision-making arena on environmental policies in Malaysia. These NGOs have started to influence decision-making either directly or otherwise. The Sahabat Alam Malaysia (Friends of the Earth, Malaysia), for example, has been organizing conferences on the environment on a regular basis during the past many years which put forward recommendations to be taken up by government departments and ministries. The Malaysian Nature Society (MNS), on the other hand, has played an active role in organizing expeditions to remote forest areas and has made several discoveries of new flora. The outcome of these expeditions help to educate members of the public as well as policy makers on the richness of the country's biological diversity which need to be conserved for future generation. The World Wide Fund for Nature, Malaysia (WWF) has been frequently commissioned by the government to undertake studies that would form the base for policy decisions.

Although the general tactics used by some environmental NGOs are known, there has been no systematic study to account for the similarities and differences in the specific tactics used by the different organizations in influencing policy decisions. By analyzing these specific tactics the public in general, and the members of the organizations, in particular, would be able to gauge the effectiveness of these NGOs in influencing policy decisions.

Environmental NGOs and Tactics of Influence

Environmental NGOs are essentially interest groups whose main goal is, among others, to influence government decisions in favour of the common interest that is shared by the members of the organizations. Members of these voluntary organizations are bonded together by this common interest about the environment and they will pursue it by making claims or demands upon other groups in the society, including the government. The shared interest determines the kind of policies that the organizations will influence and also serve as a yardstick against which these organizations judge the actions or inactions of other members of the society.

In designing tactics to influence policy decisions, environmental NGOs must give overriding attention to the centres of influence. The centres of influence are essentially the points where decisions are made and these generally include the legislative, executive and judicial divisions of the government. Various tactics are open to the NGOs to access the centres of influence and these can be broadly categorized into two, namely "inside" and "outside tactics" (Gais and Walker 1992).

Inside tactics, or conventional lobbying, involve close consultation between the NGOs and policymakers. Through these tactics, the NGOs or their representatives communicate data or opinions to governmental decision makers in an attempt to influence policy decisions. Representatives of the NGOs usually try to convince policymakers that some form of action should be taken to modify an established position or to change it in the midst of competing groups to change it. Hence, popular inside tactics include personal presentation of viewpoints, conducting and presenting research results and legislative and administrative lobbying. (Table 1)

In comparison, outside tactics involve "constituency lobbying", or the use of electoral or constituency connections to exert pressure on policy decisions. Outside tactics serve as indirect efforts to exert influence upon policy processes. However, the main goal is to build support within the general public for a new set of values that may become manifest in the future policies (Gais and Walker 1992). Frequent outside tactics include letter-writing campaign, working with the media, and organizing meetings and conferences.

METHOD

Survey
The focus of the study is on national NGOs concerned with the protection and conservation
Environmental NGOs in Influencing Public Policy in Malaysia

of the environment. The main criterion used in selecting the NGOs is that these NGOs must be known to be active in promoting environmental protection and conservation as evident by their programs and activities reported in the literature or by the media. Using this criterion, three environmental NGOs were selected, namely, the Malaysian Nature Society, the Sahabat Alam Malaysia and the World Wide Fund for Nature, Malaysia. The Automobile Association of Malaysia was selected as the control group because it is quite a prominent non-governmental organization focusing mainly on non-environmental issues.

Data and information required for this study include the history, financial sources, membership, organizational set-up, and the tactics usually employed in attempting to influence policy decisions. Such data and information were gathered through direct interview with the presidents of the organizations or their representatives using a prepared questionnaire. The questionnaire was mailed in advance of the interviews. Telephone calls were also made to inform the organizations representatives of the study and to request for their cooperation. Interviews were conducted between 15th August 1998 to 5th January 1999. All groups participated in the survey.

In order to gather data on the tactics of influence, the representatives were presented with a list of tactics deemed to have been used by the NGOs. The respondents were also allowed to indicate other tactics that were not listed. For each of the tactics, the respondents were asked to indicate its frequency of use on a four-point scale; namely, 1 = used most of the time; 2 = used sometimes; 3 = used rarely; and 4 = never use. The measure of central tendency used in the analysis was the median score.

RESULTS

Background Information of the NGOs

Information on date of establishment, membership size, number of full-time staff members, and sources of funds of the NGOs are given in Table 2.

<table>
<thead>
<tr>
<th>Name of NGO</th>
<th>Year established</th>
<th>Number of members</th>
<th>Number of full-time staffs</th>
<th>Important sources of funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysian Nature Society</td>
<td>1951</td>
<td>3732 (61 are organizations)</td>
<td>36</td>
<td>Membership, publications, donors, contracts</td>
</tr>
<tr>
<td>Sahabat Alam Malaysia</td>
<td>1974</td>
<td>500 individuals</td>
<td>5</td>
<td>Membership</td>
</tr>
<tr>
<td>World Wide Fund for Nature</td>
<td>1972</td>
<td>Non-membership</td>
<td>60</td>
<td>Donors</td>
</tr>
<tr>
<td>Automobile Association of Malaysia (control group)</td>
<td>1932</td>
<td>100,000 (individuals and organizations)</td>
<td>270</td>
<td>Membership</td>
</tr>
</tbody>
</table>

TABLE 1

Inside and outside tactics of influence

<table>
<thead>
<tr>
<th>Inside tactics</th>
<th>Outside tactics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislative and administrative lobbying</td>
<td>Working with the media</td>
</tr>
<tr>
<td>Litigation</td>
<td>Organizing conferences</td>
</tr>
<tr>
<td>Testifying at hearings</td>
<td>Endorsing political candidates</td>
</tr>
<tr>
<td>Conducting and presenting research results</td>
<td>Protests and demonstration</td>
</tr>
<tr>
<td>Informal contact with officials</td>
<td>Letter-writing and telegram campaigns</td>
</tr>
<tr>
<td>Drafting legislation</td>
<td>Entering into coalitions</td>
</tr>
<tr>
<td>Personal presentation of viewpoints</td>
<td>Grassroots lobbying</td>
</tr>
</tbody>
</table>

Source: Schlozman and Tierney (1986)
Among the environmental NGOs, the MNS is the oldest, has the largest membership and the most resourceful, in the sense that it has indicated to have more "important" sources of funds, compared with the other NGOs. In spite of these facts, the environmental NGOs are relatively smaller than the control group, the AAM. The membership of the AAM is about 30 times more than the MNS and its staff members is about eight times more than the that of the WWF.

The environmental NGOs and the AAM, however, share one common characteristic which is their strong dependence on their members for funds. Except for the WWF, which is a non-membership organization, the other organizations indicated that contribution from membership dominate their budget.

Tactics Influencing Policy Decisions
Table 3 shows the results on the frequencies of use of tactics by the NGOs in trying to influence public policy decisions. Data presented in the table shows that there are more differences than similarities in the use of tactics by the environmental NGOs and the AAM. The only similarities are that both the environmental NGOs and the AAM frequently use the media as well as in providing speakers for purposes of seminar and other meetings. Also, both groups of NGOs sometimes testify at meetings and resort to letter-writing and telegram campaigns in promoting their interests on relevant issues.

The differences in tactics used by the NGOs are many. The environmental NGOs are more likely to use "inside" tactics such as conducting and presenting research results, presenting viewpoints, contacting officials informally, and lobbying. The AAM, on the other hand, are more likely to organize conferences, lobby their supporters, draft legislation as well as getting involved in court cases. The AAM, therefore, frequently resort to "outside" tactics in attempting to influence policy decisions.

Among the environmental NGOs, there are as many similarities as there are differences in the use of various tactics. It appears that conducting research and presenting its result, using the media, grassroots lobbying, entering into coalitions and drafting legislation are common tactics used by the environmental NGOs in trying to influence decisions. These NGOs seem to differ on the use of the other tactics.

The results also show that the MNS is the most tactical of the environmental NGOs in the sense that it has been using more tactics, both inside and outside, more frequently compared with the other two organizations. The MNS seems to target their members, the public as well as the policy makers as an overall strategy to influence policy decisions. Being a non-membership organization, the WWF seldom resorts to using letter-writing and telegram campaigns. A strong asset of the WWF seems to be its research capability and it has made use of this asset in influencing public decisions through

<table>
<thead>
<tr>
<th>Tactics</th>
<th>MNS</th>
<th>WWF</th>
<th>SAM</th>
<th>Median</th>
<th>AAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducting and presenting research results</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Working with the media</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Providing speakers</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Personal presentation of viewpoints</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Lobbying</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Informal contacts with officials</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Letter-writing and telegram campaigns</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Organizing conferences</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Entering into coalitions</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Grassroots lobbying</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drafting legislation</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Litigation</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Testifying at hearings</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Protest and demonstration</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Endorsing political candidates</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Notes: 1. Used most of the time 2. Used sometimes 3. Used rarely 4. Never used

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Environmental NGOs in Influencing Public Policy in Malaysia

various tactics as shown in the table 3. The SAM appears to concentrate on conducting research and using the media, probably in publicising the research results.

Table 4 shows the results on the three priority tactics used by the NGOs, as indicated by their representatives during the interviews. It can be seen that there is a sharp contrast between the environmental NGOs and the AAM. Most of the priority tactics used by environmental NGOs are not on the priority list of the AAM. Research activities dominate the tactic of the environmental NGOs whereas the AAM prefers to resort to campaign as its priority tactic.

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>Priority tactics of influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rankings</td>
<td>MNS</td>
</tr>
<tr>
<td>1</td>
<td>Research</td>
</tr>
<tr>
<td>2</td>
<td>Presenting viewpoints</td>
</tr>
<tr>
<td>3</td>
<td>Campaigns</td>
</tr>
</tbody>
</table>

DISCUSSION

The results presented earlier provide some insights into the questions of whether or not environmental NGOs are really different from other NGOs in terms of tactics in influencing policy decisions and whether or not environmental NGOs are more likely to succeed or otherwise in influencing such decisions.

The findings of this survey reveal that the three environmental NGOs appear to adopt different political tactics than the AAM in influencing public policy decisions. In terms of overall tactics as well as priority tactics used, the environmental NGOs often resort to those tactics that bring their leaders or their representatives into close contact with policy makers. Tactics like conducting and presenting research results, presenting viewpoints, contacting government officials and lobbying are popular with these NGOs. The AAM, on the other hand, prefer to adopt indirect ways to get to the policy makers.

A few factors can be highlighted to explain the differences in the tactics used by the environmental NGOs and the AAM. These factors are the assets that are available to the groups which include financial resources, membership size, and number of staff and their expertise. Generally, the more assets a group has the more tactics are available for them to choose to influence policy decisions. Of the various factors, the two most influential ones are the size of membership and staff expertise.

The size of membership, and their geographical distribution, could explain the choice of indirect tactics by the AAM. The AAM has more than 100,000 members comprising individuals and groups and they are located all over the country. These members present a strategic asset to the association because their time and energy can be harnessed to lobby the public or carry out campaign activities on behalf of the association. The leaders of the association need not have to lobby the policy-makers themselves but can do so through their members. Such tactics are relatively cheaper compared with those like conducting and presenting research results and, therefore, can be employed with little costs to the association. Elsewhere, studies have shown that the presence of association subunits or branches is related to a preference of indirect or "outside" tactics (Gais and Walker, 1992).

Theoretically, many factors affect the choice of tactics used by environmental groups of which staff number and their expertise are two of them (Berry, 1977). The MNS and WWF have a sizeable number of staff and most of them have strong research background. Therefore, it is not surprising that research and presentation of its results is the most popular tactic employed by these two organizations. These organizations are well known to be science-based organizations in the sense that they rely heavily on scientific data and evidence to recommend policies and strategies on relevant environmental issues. The MNS, for example, has been organizing scientific expeditions to remote forest areas, including Belum forests and Endau-Rompin forests. These expeditions led to many scientific discoveries as well as created greater awareness of the public on the importance of conserving these areas. As a result of these expeditions, the state governments of Johore and Pahang agreed to set aside 98,000 ha of the Endau-Rompin forest as a national park.

The WWF, on the other hand, is often commissioned by government departments and other interested parties to carry out studies on
various topics related to environmental policies. Two examples of such studies are the formulation of National Ecotourism Plan and Assessment of Biological Diversity in Malaysia. From these examples, it can be seen that the expertise of the staffs of the WWF is sought after by government departments in recommending environmental policies and strategies. The award of such studies to the WWF acknowledges the research capability and strength of the organization.

One of the philosophies of the SAM is that it believes in presenting true and reliable facts in promoting new policies and improving the current ones. Therefore, the organization is committed to research in whichever way possible. It is felt, however, that the involvement of SAM in research activities is not on the same extent as the MNS or the WWF. SAM has very few staff members for it to get involved in significant research activities. It is believed that SAM works together with the Consumer Association of Penang or other sister organizations in conducting research on environmental issues.

Having discussed the tactics used, the next question would be are the environmental NGOs effective in influencing policy decisions? The results of the survey only provide some general answers to the question because in reality a lot of other factors influence government policy decisions.

Theoretically, inside tactics are more effective than outside tactics in influencing policy decisions. Outside tactics are usually used to exert extra pressure on policy decisions, particularly when the inside tactics fail to do so. The rationale for inside tactics is that policymakers are overloaded with daily demands and pressures. NGOs take the opportunity to assist these policy-makers, and in return have their legislative interests represented (Ornstein and Elder, 1978). In all cases, NGOs or their representatives communicate data or opinions to governmental decision-makers in an effort to influence policy decisions. NGOs try to convince policymakers that some form of action should be taken to modify an established position or preserve it in the midst of competing interests to change it.

The findings presented earlier show that the three environmental NGOs are more likely to use inside tactics than the outside ones in influencing policy decisions. Tactics like conducting and presenting research results, presenting viewpoints and lobbying policy-makers are popular with these NGOs. Theoretically, therefore, the environmental NGOs have been using effective tactics in influencing policy decisions. However, further research needs to be done to measure the impacts of these tactics on policy decision-making.

CONCLUSION

Many environmental NGOs in this country are involved in the struggle to influence government policy decisions on the environment by employing various political tactics. This study gives a picture on the tactics used by three selected NGOs. The selected environmental NGOs, however, can be considered as the representatives of the big and popular ones. The tactics that these NGOs use may not represent the tactics used by the smaller and less popular environmental NGOs. The smaller NGOs, presumably being less endowed with financial and human resources, are less likely to use costly tactics such as conducting and presenting results and lobbying policy-makers as what being done by the three NGOs studied. The picture painted for the environmental NGOs give the impression that they are quite different from other NGOs, like the Automobile Association of Malaysia, in terms of the tactics used in influencing policy decisions. It seems like environmental NGOs prefer to use direct tactics while non-environmental NGOs prefer the indirect ones.

Future studies should focus on a bigger sample of NGOs, preferably involving a cross section of the entire environmental NGO population. The findings of such studies will give a better picture on how the community of environmental NGOs attempt to influence policy decisions in this country. Detail studies should also be conducted to measure the impact of the NGO strategies and tactics on policy decisions.

REFERENCES


Environmental NGOs in Influencing Public Policy in Malaysia


(Received: 16 May 2000)
Perubahan Produktiviti dan Kecekapan Teknikal Industri Perkilangan Elektrikal dan Elektronik di Malaysia

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*** Pusat Pengajian Siswaazah Pengurusan Malaysia (MGSM), Universiti Putra Malaysia, 43400 UPM Serdang, Selangor

Kata kunci: produktiviti, pertubuhan ekonomi, teknik-teknik dan komposisi produktiviti, indeks malmquist, DEA

ABSTRAK

ABSTRACT
The interest on the study of productivity has continued to draw considerable passion among researchers due to the significant contribution of productivity to economic growth. The studies on productivity have not only focused on the techniques of measurement, but also the composition of productivity. Understanding the components of productivity offers important insights for policy makers into the sources of inefficiency among industries. By employing the DEA technique and Malmquist index, this study attempts to measure the productivity of the electrical and electronic industry. Through this technique, productivity can be decomposed into two, namely the technical change and efficiency change. The E&E sector has experienced an encouraging productivity growth through technical and efficiency changes.

PENDAHULUAN

Industri E&E menyumbang 61.4 peratus jumlah ekspor pengilangan atau 45.5 peratus daripada jumlah ekspor Malaysia, berjumlah RM55.1 bilion dalam tahun 1993. Sektor ini mencatatkan 39.4 peratus pertumbuhan antara...
Alias Radam, Sazali Abu Mansor dan Sarah Salwa Adnan

Industri E&E diramalkan akan terus menjadi pemangkin utama di dalam strategi pembangunan industri di Malaysia. Sebagaimana yang dicadangkan oleh (UNIDO, 1992), sektor E&E akan menjadi tunjang kepada usaha-usaha pembangunan perindustrian ke arah mencapai matlamat status negara perindustrian.

Walauupun sektor E&E telah memberikan sumbangan yang signifikan kepada pembangunan negara, terdapat beberapa isu dan masalah yang berkaitan dengan industri berkenaan. Ini termasuklah isu persekitaran bahan buangan bertoksid, dominasi pelaburan luar, keperluan guna tenaga mahir dan hubungan dengan industri kecil dan sederhana, kebolehan penyeledikan dan pembangunan (P&P) tempatan dan masalah kekurangan tenaga pekerja.

Industri E&E amat bergantung kepada komponen-komponen yang diimport untuk keluaran. Ini menyumbang kepada kos yang tinggi bagi kerugian negara. Kos yang tinggi bagi penghantaran, dan peningkatan upah telah menyebabkan kos input perindustrian meningkatkan. Selain itu, komplosi bahan baku yang besar, keperluan guna tenaga mahir, dan hubungannya dengan industri kecil dan sederhana juga memerlukan perhatian serius.

METODOLOGI DAN SUMBER DATA
Sejak kertas kerja yang dibentangkan oleh Solow (1956), pengukuran produktiviti telah memainkan peranan yang penting dalam ekonomi gunaan. Para penyelidik telah memperbaiki kefahaman mereka terhadap perubahan antara produktiviti dan lain-lain angkubah ekonomi. Pelbagai kaedah telah dibangunkan bersesuaian dengan kemajuan yang terdapat dalam teknik pemperosesan data. Antara kaedah yang telah diperkenalkan ialah indeks produktiviti di sektor E&E.

Industri E&E menganggap indeks kecekapan teknikal dan indek perubahan teknikal.

Antara kelebihan yang terdapat dalam indeks Malmquist ialah, ahli penyelidik hanya perlu memeroleh data yang mempunyai kuantiti yang tidak bergantung pada harga, apabila penyelidik kerap kali berhadapan dengan masalah harga yang tidak menggambarkan harga pasaran. Indeks Malmquist juga tidak perlu berperikatan pada andainya firma beroperasi pada tahap yang memberikan kos minimum dan hasil maksimum. Kelebihan ini tidak terdapat pada indeks produktiviti yang lain seperti indeks Tornqvist dan Fisher. Dengan menggunakan data panel indeks Malmquist, sumber perubahan produktiviti dapat dipecahkan kepada dua komponen iaitu indeks kecekapan relatif dan teknikal dan indek perubahan teknikal.

Perubahan produktiviti yang wujud dari perubahan kecekapan teknikal adalah kadar dua fungsi jarak pada dua tempoh masa yang berbeza, atau sebagai:

\[ E(y^0, y^1, x^0, x^1) = \frac{D^1(y^1, x^1)}{D^0(y^0, x^0)} \]

dimana superskrip merujuk kepada tempoh masa 0 dan tempoh masa 1 dan fungsi E(.) mewakili indeks kecekapan teknikal. Apabila diletakkan di sebelah atas data, seperti merujuk kepada tempoh masa data tersebut. Apabila diletakkan disebelah bawah, superskrip merujuk kepada tempoh masa teknologi.
Indeks produktiviti Malmquist menggunakan fungsi jarak. Fungsi jarak menjadi bermakna apabila teknologi pengeluaran diterangkan oleh set keperluan input. Fare et al. (1992) pula mengira komponen perubahan teknikal produktiviti sebagai satu indeks campuran yang mengukur data tempoh masa 0 berbanding teknologi tempoh masa 1 \((D^1(x^0, y^0))\) dan indeks campuran yang lain yang mengukur data tempoh masa 1 berbanding teknologi tempoh masa 0 \((D^0(x^1, y^1))\) dinyatakan sebagai:

\[
T(y^0, y^1, x^0, x^1) = \left[ \frac{D^0(y^1, x^1) \cdot D^0(y^0, x^0)}{D^1(y^1, x^1) \cdot D^1(y^0, x^0)} \right]^{\frac{1}{2}}
\]

(2)

di mana fungsi \(T(.)\) mewakili indeks kecekapan teknikal, \(x\) adalah vektor input bukan negatif, \(x = (x_j, x_g, \ldots, x_n)\) dan \(y\) merupakan vektor output bukan negatif, \(y = (y_1, y_2, \ldots, y_n)\).

Perubahan di dalam jumlah faktor produktiviti sebagai indeks Malmquist, yang didefinisikan sebagai:

\[
M(y^0, y^1, x^0, x^1) = T(y^0, y^1, x^0, x^1)
\]

(3)

Indeks produktiviti Malmquist di dalam persamaan (3) mempunyai dua komponen: indeks kecekapan relatif dan indeks perubahan teknikal. Indeks kecekapan relatif menggurau kadar kecekapan teknikal pada tempoh masa 0 dan tempoh masa 1. Ini mengukur "catching up" firma i kepada sempadan mewakili amalan teknologi terbaik. Indeks teknologi menggurau pergerakan di dalam sempadan. Indeks Malmquist menggurau perubahan jumlah faktor produktiviti bagi pemerhatian i, menggabungkan kedua-dua "catching up" pemerhatian i terhadap sempadan amalan terbaik dan pergerakan di dalam sempadan itu sendiri.

Penganggaran bagi model kajian ini menggunakan perisian komputer Warwick – DEA. DEA yang pertama kali diperkenalkan oleh Charnes et al. (1978), merupakan cara untuk mendapatkan sempadan mewakili amalan teknologi terbaik. Indeks teknologi menggurau pergerakan di dalam sempadan. Indeks Malmquist menggurau perubahan jumlah faktor produktiviti bagi pemerhatian i, menggabungkan kedua-dua "catching up" pemerhatian i terhadap sempadan amalan terbaik dan pergerakan di dalam sempadan itu sendiri.

PEPUTUSAN DAN PERBINCANGAN

Sektor E&E (MIC 383) mengandungi lebih dari 600 pertubuhan meliputi pengilangan semikonduktor and komponen, keluaran yang berkaitan dengan teknologi maklumat mengandungi komputer, perisian, perkakasan, rangkaian dan peralatan telekomunikasi, barang elektronik pengguna, dan peralatan dan perkakasan elektrikal.


Dalam beberapa tahun, sektor E&E mengalami pertumbuhan yang tinggi di dalam produktiviti. Nilai ditambah setiap buruh bagi sektor E&E telah berkembang dari RM18,562 dalam tahun 1983 kepada RM34,042 pada tahun 1993, dengan pertumbuhan tahunan sebanyak 5.04 peratus. Bagi subsektor industri elektronik kadar pertumbuhan tahunannya adalah 5.11 peratus untuk tempoh masa yang sama dari RM18,000 pada tahun 1983 kepada RM34,401 pada tahun 1993, sementara sub-sektor industri elektronik kadar pertumbuhan tahunannya adalah 5.11 peratus untuk tempoh masa yang sama dari RM18,000 pada tahun 1983 kepada RM34,401 pada tahun 1993, sementara sub-sektor industri elektronik kadar pertumbuhan setahun untuk tempoh masa yang sama (Jadual 1). Nilai ditambah setiap unit buruh ini juga

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### JADUAL 1
Produktiviti buruh industri perkilangan elektronik dan elektrikal Malaysia, 1983-1993

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Industri Elektronik</th>
<th>Industri Elektrikal</th>
<th>Semua Industri</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nilai ditambah per unit buruh (RM'000)</td>
<td>Output buruh (RM'000)</td>
<td>Nilai ditambah per unit buruh (RM'000)</td>
</tr>
<tr>
<td>1983</td>
<td>18,006</td>
<td>65,511</td>
<td>22,292</td>
</tr>
<tr>
<td>1984</td>
<td>21,914</td>
<td>74,134</td>
<td>20,231</td>
</tr>
<tr>
<td>1985</td>
<td>21,642</td>
<td>69,023</td>
<td>28,116</td>
</tr>
<tr>
<td>1986</td>
<td>21,480</td>
<td>78,908</td>
<td>22,108</td>
</tr>
<tr>
<td>1987</td>
<td>21,296</td>
<td>95,541</td>
<td>22,408</td>
</tr>
<tr>
<td>1988</td>
<td>19,999</td>
<td>98,272</td>
<td>25,766</td>
</tr>
<tr>
<td>1989</td>
<td>23,319</td>
<td>112,788</td>
<td>25,981</td>
</tr>
<tr>
<td>1990</td>
<td>23,469</td>
<td>113,438</td>
<td>27,521</td>
</tr>
<tr>
<td>1991</td>
<td>27,765</td>
<td>133,438</td>
<td>27,521</td>
</tr>
<tr>
<td>1992</td>
<td>32,092</td>
<td>147,919</td>
<td>31,700</td>
</tr>
<tr>
<td>1993</td>
<td>33,401</td>
<td>159,970</td>
<td>37,889</td>
</tr>
</tbody>
</table>

Pertumbuhan (%)  5.11  9.17  4.60  4.73  5.04  8.59

### JADUAL 2
Produktiviti modal, intensiti modal dan kandungan nilai ditambah industri perkilangan elektronik dan elektrikal Malaysia, 1983-1993

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Industri Elektronik</th>
<th>Industri Elektrikal</th>
<th>Semua Industri</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Produktiviti modal</td>
<td>Intensiti modal</td>
<td>Kandungan nilai ditambah</td>
</tr>
<tr>
<td>1983</td>
<td>1.4881</td>
<td>12.0998</td>
<td>27.49</td>
</tr>
<tr>
<td>1984</td>
<td>1.4377</td>
<td>15.2416</td>
<td>29.56</td>
</tr>
<tr>
<td>1985</td>
<td>1.1724</td>
<td>18.4595</td>
<td>31.36</td>
</tr>
<tr>
<td>1986</td>
<td>1.2881</td>
<td>16.6765</td>
<td>27.22</td>
</tr>
<tr>
<td>1987</td>
<td>1.2882</td>
<td>16.5311</td>
<td>22.29</td>
</tr>
<tr>
<td>1988</td>
<td>1.1308</td>
<td>17.6856</td>
<td>20.35</td>
</tr>
<tr>
<td>1989</td>
<td>1.1139</td>
<td>20.9342</td>
<td>20.67</td>
</tr>
<tr>
<td>1990</td>
<td>0.8853</td>
<td>26.5103</td>
<td>20.77</td>
</tr>
<tr>
<td>1991</td>
<td>0.8884</td>
<td>31.2517</td>
<td>20.81</td>
</tr>
<tr>
<td>1992</td>
<td>0.9422</td>
<td>33.9870</td>
<td>21.65</td>
</tr>
<tr>
<td>1993</td>
<td>0.9052</td>
<td>36.8979</td>
<td>20.88</td>
</tr>
</tbody>
</table>

Pertumbuhan (%) -5.37  10.48  -4.06  5.04  -0.44  -0.13  3.29  8.50  -3.55  

Alias Radam, Sazali Abu Mansor dan Sarah Salwa Adnan
menggambarkan jumlah kekayaan yang dapat dijanakan oleh syarikat, berbanding bilangan pekerjaanya. Ianya mempengaruhi kecekapan pengurusan, sikap pekerja, kesan harga dan permintaan terhadap barangan. Nisbah yang tinggi menunjukkan kesan keuntungan terhadap faktor buruh di dalam proses menjanaan kekayaan. Nisbah yang rendah menunjukkan prosedur pekerjaan yang tidak menguntungkan seperti pembelian bahan mentah dan perkhidmatan yang tinggi, pembaziran masa dan bahan dan kadar bayaran gaji yang tidak berpatutan.


Arah aliran yang berkurangan di dalam kandungan nilai ditambah bagi sektor E&E adalah disebabkan tingginya bahan-bahan dan komponen yang diimport. Ini berpunca dari keadaan sektor E&E di Malaysia yang dikuasai oleh syarikat-syarikat multinasional (MNC) yang terlibat terutamanya dalam pemasaran dan pembungkusan komponen-komponen elektronik yang diimport untuk dielabur dan dijual. Kadar pemindahan teknologi yang perlahan dan penyertaan pihak swasta yang rendah dalam aktiviti penyelidikan dan pembangunan tempatan merupakan kelemahan dan rendahnya aktiviti nilai ditambah di dalam sektor E&E. (National Productivity Corporation, 1997).

Pertumbuhan dua digit dalam nilai ditambah setiap buruh dan jumlah output setiap buruh dalam tempoh masa 1983-93 adalah disebabkan peranan pro-aktif yang diambil oleh sektor E&E dan permintaan yang tinggi di dalam keluaran E&E di dunia. Ia seterusnya disokong oleh usaha-usaha kerajaan untuk mempromosi dan membina persekitaran yang menggalakan bagi pembangunan sektor E&E. Dasar fiskal yang diperkenalkan ialah bagi menggalakkan pelaburan, perasingan, eksport, penyelidikan dan pembangunan (P&P), pembangunan sumber manusia dan memperluas kemudahan infrastruktur dan daya saing.

Pertumbuhan nilai ditambah setiap buruh di dalam sektor E&E juga disebabkan peningkatan di dalam kadar aset tetap setiap buruh atau intensiti modal. Intensiti modal adalah kadar yang digunakan untuk mengukur aset tetap yang dipakai untuk setiap buruh atau modal terhadap buruh. Kadar ini digunakan untuk mengukur sama ada industri berintensifkan-modal atau berintensifkan buruh. Kadar intensiti modal yang rendah menunjukkan sesuatu industri itu bergantung kepada kaedah yang berintensifkan buruh dan menggunakan input yang berteknologi rendah. Dalam tempoh masa kajian, intensiti modal sektor E&E berkembang sebanyak 8.50 peratus setahun dari RM14,332 di dalam tahun 1983 kepada RM37,852 pada tahun 1993. Hal ini selaras dengan usaha-


**INDEKS PRODUKTIVITI MALQUIST**

Dua isu utama yang ditekankan dalam pengiraan indeks produktiviti Malmquist untuk industri E&E di Malaysia. Pertama, bagaimana untuk mengukur produktiviti dan kecekapan teknikal dalam jangka masa tertentu. Isu kedua ialah bagaimana produktiviti berubah, dan jika wujud perubahan, ia dapat dipecahkan kepada kesan ‘catching-up’ dan kesan pergerakan sempadan.

Jadual 4, menunjukkan purata nilai sempadan indeks kecekapan Farrell untuk setiap industri. Set kemungkinan pengeluaran mengandungi sejumlah 88 pemerhatian tetapi hanya 53.41 peratus sahaja yang berada di sempadan. Purata kecekapan teknikal untuk industri E&E di Malaysia adalah tinggi iaitu 97.22 peratus. Hanya 37.5 peratus daripada industri mempunyai kecekapan teknikal yang kurang dari purata. Industri yang mempunyai tahap kecekapan teknikal yang tinggi termasuk industri mengilang sel-sel kering dan bateri-bateri penyimpanan (38392), industri mengilang lampu dan tiub elektrik (38393), industri radio dan peti televisyen dan alat-alat pengeluar suara dan merakam (38321/22), industri mengilang kabel dan wayar (38391) dan industri semikonduktor dan lain komponen elektronik serta alat-alat perkakas perhubungan (38329).

Industri yang berada di sempadan pengeluaran dipanggil 'best-practice' dan memperlihatkan kecekapan maksimum dalam penggunaan sumber-sumber. Nilai indeks pada 1.000 menunjukkan sesuatu industri terletak pada sempadan yang terbaik ('best-practice'). Nilai indeks yang kurang dari 1.000 pula menunjukkan ketidakcekapan dalam penggunaan sumber-sumber dibandingkan dengan industri yang berada di sempadan yang terbaik.

Keputusan kecekapan teknikal tahunan diringkaskan dalam Jadual 5. Ia menunjukkan industri E&E mencapai purata antara 95.58 dan 98.63 peratus output oleh industri yang mengikut amalan terbaik sepanjang tahun 1983 hingga 1993. Peningkatan yang sedikit sepanjang tempoh masa tersebut mencadangkan jurang yang sempit antara industri piawai dan industri yang mengikut amalan terbaik.

Jadual 6 menunjukkan penganggaran pengiraan indeks produktiviti Malmquist, indeks perubahan relatif kecekapan teknikal dan indeks perubahan teknikal kecekapan produktiviti bagi industri E&E di Malaysia. Indeks-indeks ini menunjukkan pertumbuhan produktiviti
### JADUAL 3
Daya saing buruh sektor elektronik dan elektrikal Malaysia 1983-1993

<table>
<thead>
<tr>
<th></th>
<th>Industri elektronik</th>
<th>Industri elektrikal</th>
<th>Semua Industri</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nilai ditambah per upah</td>
<td>Upah per buruh (RM)</td>
<td>Kos buruh per unit output</td>
</tr>
<tr>
<td>1983</td>
<td>2.9428</td>
<td>6,119</td>
<td>0.093</td>
</tr>
<tr>
<td>1984</td>
<td>3.2947</td>
<td>6,651</td>
<td>0.090</td>
</tr>
<tr>
<td>1985</td>
<td>2.7810</td>
<td>7,782</td>
<td>0.113</td>
</tr>
<tr>
<td>1986</td>
<td>2.8085</td>
<td>7,648</td>
<td>0.097</td>
</tr>
<tr>
<td>1987</td>
<td>2.8578</td>
<td>7,452</td>
<td>0.078</td>
</tr>
<tr>
<td>1988</td>
<td>2.9004</td>
<td>6,895</td>
<td>0.070</td>
</tr>
<tr>
<td>1989</td>
<td>3.1387</td>
<td>7,430</td>
<td>0.066</td>
</tr>
<tr>
<td>1990</td>
<td>3.1297</td>
<td>7,499</td>
<td>0.066</td>
</tr>
<tr>
<td>1991</td>
<td>3.2316</td>
<td>8,592</td>
<td>0.064</td>
</tr>
<tr>
<td>1992</td>
<td>3.0600</td>
<td>10,495</td>
<td>0.071</td>
</tr>
<tr>
<td>1993</td>
<td>3.2713</td>
<td>10,210</td>
<td>0.064</td>
</tr>
</tbody>
</table>

Pertumbuhan (%) 0.90 4.21 -4.97 4.45 0.15 -4.58 1.39 3.66 -4.93

### JADUAL 4
Min indeks kecekapan teknikal subsektor industri perkilangan elektronik dan elektrikal Malaysia 1983 - 1993

<table>
<thead>
<tr>
<th>Kod MIC</th>
<th>Industri</th>
<th>Purata</th>
</tr>
</thead>
<tbody>
<tr>
<td>38310</td>
<td>Mengilang mesin dan alat-alat industri</td>
<td>93.88</td>
</tr>
<tr>
<td>38321/22</td>
<td>Radio dan peti televisyen dan alat-alat pengeluar suara dan merekod</td>
<td>99.16</td>
</tr>
<tr>
<td>38329</td>
<td>'Semi-conductors' dan lain komponen elektronik dan alat-alat perkakas perhubungan</td>
<td>97.56</td>
</tr>
<tr>
<td>38330</td>
<td>Mengilang alat-alat dan barang-barang perumahan elektrik</td>
<td>95.65</td>
</tr>
<tr>
<td>38391</td>
<td>Mengilang kabel dan wayar</td>
<td>98.93</td>
</tr>
<tr>
<td>38392</td>
<td>Mengilang sel-sel kering dan bateri-bateri penyimpan</td>
<td>99.79</td>
</tr>
<tr>
<td>38393</td>
<td>Mengilang lampu dan tiub elektrik</td>
<td>99.74</td>
</tr>
<tr>
<td>38399</td>
<td>Mengilang pelbagai alat dan bekalan elektrik</td>
<td>98.04</td>
</tr>
</tbody>
</table>

Purata 97.22
Alias Radam, Sazali Abu Mansor dan Sarah Salwa Adnan

**JADUAL 5**

Min indeks kecekapan teknikal industri perkilangan elektronik dan elektrikal di Malaysia 1983 - 1993

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Purata</th>
<th>Maksimum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>97.81</td>
<td>100.00</td>
<td>(3/8)</td>
</tr>
<tr>
<td>1984</td>
<td>95.58</td>
<td>100.00</td>
<td>(4/8)</td>
</tr>
<tr>
<td>1985</td>
<td>97.07</td>
<td>100.00</td>
<td>(5/8)</td>
</tr>
<tr>
<td>1986</td>
<td>96.82</td>
<td>100.00</td>
<td>(5/8)</td>
</tr>
<tr>
<td>1987</td>
<td>96.53</td>
<td>100.00</td>
<td>(6/8)</td>
</tr>
<tr>
<td>1988</td>
<td>98.10</td>
<td>100.00</td>
<td>(4/8)</td>
</tr>
<tr>
<td>1989</td>
<td>96.51</td>
<td>100.00</td>
<td>(3/8)</td>
</tr>
<tr>
<td>1990</td>
<td>97.71</td>
<td>100.00</td>
<td>(4/8)</td>
</tr>
<tr>
<td>1991</td>
<td>98.49</td>
<td>100.00</td>
<td>(4/8)</td>
</tr>
<tr>
<td>1992</td>
<td>98.63</td>
<td>100.00</td>
<td>(4/8)</td>
</tr>
</tbody>
</table>

Purata 97.22

disebabkan oleh perubahan teknikal yang dikira dengan menganggarkan kecekapan teknikal dari tahun 1983 hingga 1993. Kajian ini menunjukkan hubungan songsang dalam indeks teknologi yang diterangkan dalam persamaan (1), apabila nilai lebih daripada 1.0 menunjukkan peningkatan dalam produktiviti disebabkan oleh perubahan teknikal. Indeks ini menetapkan tahun 1983 sebagai tahun asas dengan indeks bersamaan dengan 1.000.


Industri elektronik menunjukkan pertumbuhan sebanyak 13.36 peratus dalam indeks perubahan relatif kecekapan teknikal dan industri elektrikal sebanyak 6.22 peratus. Manakala secara keseluruhan sektor E&E mengalami pertumbuhan 8.01 peratus iaitu pertumbuhan yang amat menggalakkan. Sementara itu dalam indeks perubahan teknikal kecekapan produktiviti, industri elektronik mencatatkan pertumbuhan sebanyak 1.08 peratus, elektrikal 4.04 peratus dan E&E secara keseluruhan 3.29 peratus.

Jadual 7 menunjukkan produktiviti dan komponen indeks untuk subsektor E&E berdasarkan kepada kod MIC. Purata produktiviti setahun yang dikira menggunakan indeks Malmquist untuk semua subsektor dalam industri E&E menunjukkan peningkatan. Peningkatan indeks sebanyak 1.74 menunjukkan proses pengeluaran dalam industri E&E telah meningkat sebanyak 74 peratus jika dibandingkan dengan tahun asas. Dengan melihat kepada setiap subsektor, industri mengilang pelbagai alat dan bekalan elektrik (38399) menunjukkan produktiviti tertinggi dengan indeks 2.0089. Selepas itu, industri mengilang mesin dan alat-alat industri (38310) dengan indeks 1.96, industri mengilang lampu dan tiub elektrik (38393) dengan 1.85 dan industri mengilang sel-sel kering dan bateri-bateri penyimpanan (38392) dengan indeks 1.83. Subsektor lain terletak pada purata produktif dengan indeks 1.6 sementara industri mengilang kabel dan wayar (38391) dengan indeks 1.37.

**KESIMPULAN**

Kajian ini menggunakan Indeks Malmquist untuk mengukur pertumbuhan produktiviti. Pendekatan DEA telah digunakan untuk mengira komponen fungsi jarak bagi indeks Malmquist dan membentuk sempadan amalan terbaik bagi sektor E&E di Malaysia. Indeks perubahan teknikal dan indeks perubahan kecekapan diperoleh dengan membandingkan setiap subsektor terhadap sempadan amalan terbaik dengan teknologi pengeluaran yang sama. Indeks produktiviti Malmquist kemudiannya dikira sebagai hasil dari dua indeks ini.

### JADUAL 6
Indeks perubahan relatif kecekapan teknikal. Perubahan teknikal kecekapan produktiviti dan indeks produktiviti Malmquist industri Perkilangan elektronik dan elektrikal Malaysia
1983 - 1993

<table>
<thead>
<tr>
<th>Indeks perubahan relatif kecekapan teknikal</th>
<th>Perubahan teknikal kecekapan produktiviti</th>
<th>Indeks produktiviti Malmquist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industri elektronik</td>
<td>Industri elektrikal</td>
<td>Semua industri</td>
</tr>
<tr>
<td>1983</td>
<td>1.0000</td>
<td>1.0000</td>
</tr>
<tr>
<td>1984</td>
<td>0.9959</td>
<td>1.0539</td>
</tr>
<tr>
<td>1985</td>
<td>1.2376</td>
<td>1.1123</td>
</tr>
<tr>
<td>1986</td>
<td>1.4671</td>
<td>1.2292</td>
</tr>
<tr>
<td>1987</td>
<td>1.2161</td>
<td>1.3237</td>
</tr>
<tr>
<td>1988</td>
<td>1.7243</td>
<td>1.4830</td>
</tr>
<tr>
<td>1989</td>
<td>2.7530</td>
<td>1.5458</td>
</tr>
<tr>
<td>1990</td>
<td>2.9020</td>
<td>1.5467</td>
</tr>
<tr>
<td>1991</td>
<td>3.1388</td>
<td>1.7401</td>
</tr>
<tr>
<td>1992</td>
<td>3.4150</td>
<td>1.5667</td>
</tr>
<tr>
<td>1993</td>
<td>2.8860</td>
<td>1.7893</td>
</tr>
</tbody>
</table>


### JADUAL 7
Indeks produktiviti Malmquist, indeks perubahan relatif kecekapan tenikal dan indeks perubahan tenikal kecekapan produktiviti untuk subsektor industri perkilangan elektronik dan elektrikal Malaysia
1983 - 1993

<table>
<thead>
<tr>
<th>Kod MIC</th>
<th>Industri</th>
<th>Indeks perubahan relatif kecekapan teknikal</th>
<th>Indeks perubahan teknikal kecekapan produktiviti</th>
<th>Indeks produktiviti Malmquist</th>
</tr>
</thead>
<tbody>
<tr>
<td>38310</td>
<td>Mengilang mesin dan alat-alat industri</td>
<td>1.9797</td>
<td>1.1186</td>
<td>1.9620</td>
</tr>
<tr>
<td>38321/22</td>
<td>Radio dan peti televisyen dan alat-alat pengeluar suara dan merekod</td>
<td>2.9947</td>
<td>0.6574</td>
<td>1.6323</td>
</tr>
<tr>
<td>38329</td>
<td>'Semi-conductors' dan lain komponen elektronik dan alat-alat perakas perhubungan</td>
<td>1.1391</td>
<td>1.4227</td>
<td>1.6570</td>
</tr>
<tr>
<td>38330</td>
<td>Mengilang alat-alat dan barang-barang perumahan elektrik</td>
<td>1.3158</td>
<td>1.2733</td>
<td>1.6062</td>
</tr>
<tr>
<td>38391</td>
<td>Mengilang kabel dan wayar</td>
<td>1.0851</td>
<td>1.2610</td>
<td>1.3705</td>
</tr>
<tr>
<td>38392</td>
<td>Mengilang sel-sel kering dan bateri-bateri penyimpan</td>
<td>1.0228</td>
<td>1.8087</td>
<td>1.8340</td>
</tr>
<tr>
<td>38393</td>
<td>Mengilang lampu dan tiub elektrik</td>
<td>1.1741</td>
<td>1.6987</td>
<td>1.8468</td>
</tr>
<tr>
<td>38399</td>
<td>Mengilang pelbagai alat dan bekalan elektrik</td>
<td>2.3952</td>
<td>0.9143</td>
<td>2.0089</td>
</tr>
</tbody>
</table>

Purata 1.6383 1.2693 1.7397


**BIBLIOGRAFI**


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Factors Influencing the Occurrence of Forest Offenses in a Peninsular Malaysia State

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Keywords: forest law enforcement, forest offenses, illegal logging, economics of crime

ABSTRACT
A study was conducted in one of the states of Peninsular Malaysia to observe the trends and identify factors associated with the occurrence of forest offenses during the period from 1981 to 1992. Data and information on forest offenses, price of logs, size of forest areas, and number of enforcement officers were collected from various sources including the records and annual reports of the State Forestry Department, and MASKAYU bulletin published by the Malaysian Timber Industry Board. Correlation and regression analyses were carried out to determine the relationships between forest offenses and price of logs, size of forest area and number of enforcement officers. The number of forest offenses in the state shows a decreasing trend. Illegal logging which is a form of forest offense constitutes the highest percentage in all the years during the study period. Of the three factors investigated, only the price of logs correlated significantly with forest offenses. The price of logs is inversely correlated with forest offenses. The regression models developed show the relationships between the number of offenses and the price of logs as follows:

For number of forest offenses $p = 0.02$ and
For number of illegal logging cases $p = 0.03$

Further studies should be conducted to better understand other factors like penalties that influence forest offenses.
INTRODUCTION

The government of Malaysia, like many other producers of tropical wood products, has pledged its commitment to manage the forests in a sustainable manner, in line with the International Tropical Timber Organization (ITTO) year 2000 objective which states that all wood products traded in international market must be produced from sustainably managed forests. A number of strategies and programmes have been implemented by the government, including the establishment of National Timber Certification Council as well as the formulation and testing of Malaysia's criteria and indicators (MC&I) for sustainable forest management. Recently, funds collected through timber export cess amounting to more than RM 350 million have been allocated by the government to finance forest development and research projects in an effort to speed up the attainment of the sustainable forest management objective.

While commendable efforts are ongoing in some aspects, the government should also examine other important aspects of forest policy to make sure that they complement one another. One of these aspects is related to forest law enforcement. Forest law enforcement is a critical aspect of forest management because it regulates the relationship between many parties, particularly timber companies, with the forest resource. Illegal and uncontrolled harvesting activities, for example, may cause irreparable damage to the forest which subsequently influences its long-term productivity and sustainability. Generally, forest authority should try to keep forest offenses to a minimum level, particularly those that cause great harm to the forest and the environment.

In spite of the fact that forest offenses pose obstacles to sustainable forest management, little has been studied about them. Little, if any, has been published on the extent of the problem as well as factors influencing their occurrence. This paper highlights the trends in the occurrence of forest offenses in one state of Peninsular Malaysia and identifies factors associated with their occurrence. These offenses are only those provided for in the National Forestry Act, 1984. No attempt is made to look at the nature of these offenses under the general law of crime, namely the Penal Code.

Factors Influencing Forest Offences

Forest offenses can be defined as the conduct of any activity, or its omission, which is illegal under the existing forest law of the country. The main piece of legislation governing the conduct of such activities in Peninsular Malaysia is the National Forestry Act, 1984 and its amendments of 1993. Forest offenses are criminal acts because they violate the law of the state and the person committing them are liable to legal punishment. According to Curzon (1979), crime is "an unlawful act or default which is an offense against the public and renders the person guilty of the act liable to legal punishment." Forest offenses have impact on the State which, in turn, has the responsibility to bring the guilty person to justice. Theories on the economics of crime, therefore should shed light on factors which influence the occurrence of forest offenses.

The body of literature on the economics of crime focuses on two main issues. The first issue is on individual's decision about criminal activity while the second is on criminal justice policy (Hirsch 1979). The concern of the first issue is on the factors that influence an individual's decision whether or not he or she commits a crime. Studies done on this first issue try to develop the supply function for crimes or also known as the deterrence function. The object of studies on the second issue, on the other hand, is to determine the optimal probability of punishment and the optimal type and severity of punishment. Such studies entail, among other things, the determination of the loss to society as a result of crimes.

Economists argue that criminals are rational individuals who respond in a natural way to the incentives provided by the environment in which they operate. Rational individuals balance the costs and benefits of their possible actions and allocate their time to legal and illegal activities accordingly. These individuals will take an action if the benefits obtained outweigh the costs. Following such argument, rational individuals would commit crimes if the expected benefits gained outweigh the expected costs incurred.

What are the benefits and costs associated with committing a crime? The benefit that the individual stands to gain as a result of crime can be measured by establishing the amount that
Factors Influencing Forest Offenses in a Malaysian State

the offender, in a market-like setting, would have to be offered in order to persuade him against committing the crime. Inferences about these benefits can be made by measuring the extent of change in the volume of crimes that result from a given change in costs.

The expected costs (or expected punishment) to the individual comprise of several parts. These are the size of punishment, probability of arrest and probability of conviction. Expected punishment is given by the following formula (Reynolds 1996):

\[
\text{Expected} = \text{Punishment} \times \frac{\text{Probability of Arrest}}{\text{Probability of Conviction}}
\]

where:

- punishment = jail sentence
- probability of arrest = number of arrests/total number of offenses
- probability of conviction = number of convictions/number of arrests

The discussions on benefits and costs of committing crimes presented above can suggest factors that influence forest offenses. The benefits that an offender stands to gain from committing forest offenses should be related to the revenue that he expects to obtain from the sale or processing of stolen logs. Therefore, the sale price of logs should influence the occurrence of forest offenses. It is expected that the higher the price of logs the higher will be the occurrence of forest offenses, if other factors remain constant.

Costs associated with forest offenses are related to the chances that an offender will be apprehended and later convicted and the penalty that he pays if he is convicted. The number of enforcement officers and the size of forest areas should influence the chances of arrest and, hence, the occurrence of forest offenses. The more the enforcement officers, the greater the likelihood for inspection activities to be carried out, and therefore, the higher probability of arrest. Consequently, the more the enforcement officers, the lesser the chances of forest offenses occurring. Therefore, it is expected that the number of enforcement officers is inversely related with forest offenses.

The size of forest area should also influence the probability of arrest. The bigger the forest area, the more time needed for inspection and patrol, and the lower will be the chances for detection of forest offenses. Therefore, the size of forest area should be inversely related with the occurrence of forest offenses. In this study, the number of forest offenses will be correlated with the sale price of logs, the size of forest area and number of enforcement officers in the state forestry department.

METHOD

This study was conducted in one of the states in Peninsular Malaysia and it was chosen for reason of convenience. The total forest area of the state is about 260,000 ha. and this represents about 23 percent of the total land area of the state. Income from forestry activities, particularly logging, contributes significantly to the state's economy. For the purpose of administration, the state is divided into three forest districts.

Two categories of data were collected for the study. The first category is related to the occurrence of forest offenses in the state while the second is on factors that are predicted to influence these offenses. For the first category, data on the number and types of forest offenses for each year during the 1981 to 1992 period were gathered from the records kept by the State Forestry Department. Data on log prices delivered at mill gate, number of enforcement officers in the state and size of productive forests belong to the second category and these were collected from various sources including the records kept by the Malaysian Timber Industry Board and the State Forestry Department itself.

For purposes of analysis, forest offenses were divided into six categories based on the provisions of the National Forestry Act, 1984. These categories were: a) illegal cutting and removing of forest produce from a permanent reserve forest or state land, b) illegal searching, collecting, removing, or manufacturing of any non-wood forest produce, c) illegal clearing for purpose of cultivation, d) trespassing, e) illegal possession of forest produce for conversion, and f) violating license conditions. Graphical analysis will be done in order to observe the trends in the occurrence of the various offenses over the study period.

Models will be developed to relate the occurrence of forest offenses with log prices, number of enforcement officers and size of forest area by means of linear regression which can be mathematically expressed as:
Offenses = \alpha + \beta_1 P_L + \beta_2 F + \beta_3 A

Where:
\begin{align*}
P_L & = \text{price of logs} \\
F & = \text{number of officers} \\
A & = \text{size of forest area}
\end{align*}

RESULTS

Occurrence of Forest Offenses

Table 1.0 provides information on the occurrence of forest offenses in the State during the study period. It gives the actual number of offenses, the number of offenses per 1000 cu.m of wood production and the percentage of category A offenses.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total number of offenses</th>
<th>No. of offenses/1000 cu.m of log production (i.e. illegal logging)</th>
<th>% of category A offenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>150</td>
<td>0.44</td>
<td>75</td>
</tr>
<tr>
<td>1982</td>
<td>129</td>
<td>0.39</td>
<td>71</td>
</tr>
<tr>
<td>1983</td>
<td>91</td>
<td>0.15</td>
<td>88</td>
</tr>
<tr>
<td>1984</td>
<td>84</td>
<td>0.28</td>
<td>73</td>
</tr>
<tr>
<td>1985</td>
<td>80</td>
<td>0.28</td>
<td>73</td>
</tr>
<tr>
<td>1986</td>
<td>68</td>
<td>0.23</td>
<td>70</td>
</tr>
<tr>
<td>1987</td>
<td>47</td>
<td>0.18</td>
<td>48</td>
</tr>
<tr>
<td>1988</td>
<td>47</td>
<td>0.10</td>
<td>89</td>
</tr>
<tr>
<td>1989</td>
<td>70</td>
<td>0.16</td>
<td>67</td>
</tr>
<tr>
<td>1990</td>
<td>31</td>
<td>0.06</td>
<td>90</td>
</tr>
<tr>
<td>1991</td>
<td>31</td>
<td>0.09</td>
<td>80</td>
</tr>
<tr>
<td>1992</td>
<td>45</td>
<td>0.17</td>
<td>73</td>
</tr>
</tbody>
</table>

Data in the table show that forest offenses in the State are on a declining trend. The number of offenses was highest in 1981, gradually decreases from then on until 1988, increases slightly in 1989 before leveling off in early 1990’s. The median number of offenses per year is 69 which means that one offense in every four to five days. Information contained in column three of the table indicate that, on the average, almost two offenses occurred for every 10,000 cu.m of logs harvested or one offense per 5000 cu.m of log produced.

It is also shown that in almost every year, offenses that can be classified as “illegal logging” constitute the biggest proportion of all the categories of offenses. On the average, nearly 74 percent of all the offenses that occurred every year are illegal logging cases. This confirms claims often made that illegal logging occurs widely in the states, including in the State being studied.

Factors Correlated with Occurrence of Forest Offense

Results of correlation analysis between the number of offenses and type A offenses with the independent variables are shown in Table 2.0.

<table>
<thead>
<tr>
<th>Offense</th>
<th>Independent variables</th>
<th>Log price (RM/cu.um)</th>
<th>Number of officers</th>
<th>Total area of production forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>( r = -0.6456 )</td>
<td>( r = 0.2345 )</td>
<td>( r = 0.0571 )</td>
<td></td>
</tr>
<tr>
<td>Offences</td>
<td>( p = 0.02^* )</td>
<td>( p = 0.46 )</td>
<td>( p = 0.86 )</td>
<td></td>
</tr>
<tr>
<td>Type A</td>
<td>( r = -0.6209 )</td>
<td>( r = 0.1909 )</td>
<td>( r = 0.1492 )</td>
<td></td>
</tr>
<tr>
<td>Offences</td>
<td>( p = 0.03^* )</td>
<td>( p = 0.552 )</td>
<td>( p = 0.644 )</td>
<td></td>
</tr>
</tbody>
</table>

\* significant at 5 percent level

As can be seen from the table, only log price correlated significantly with the number of offenses. Both the total number of offenses and type A offenses are inversely correlated with log price which means that there will be fewer of these offenses in times when the price for logs is high than when the price is low.

Subsequent analysis results in the following simple regression models relating forest offenses with log price:

Number of offenses = 393.94 - 0.53 log price

Number of type A offenses = 264.69 - 0.37 log price

The models developed show that for every unit increase in log price, there is a corresponding decrease in about half unit of all types of offenses. Similarly, when the price of logs increases by a unit, the number of type A offenses decreases by about 0.4 unit.

DISCUSSION AND CONCLUSION

Forest offenses, particularly illegal logging, will hinder the attainment of sustainable forest management in this country. Widespread
Factors Influencing Forest Offenses in a Malaysian State

The occurrence of these offenses means that the effective size of productive forest areas is decreased and this can upset the planning for sustainable harvest. In addition, a large sum of money in the form of premium is not collected by the government when the forest areas are illegally logged. Such money could have been invested in development projects that would enhance the productivity and, subsequently, the sustainability of the forest. Due to these reasons, the authority concerned should regularly inspect logging activities to ensure that the loggers abide by the rules and regulations stipulated for them.

The results presented in the earlier part of this paper should be much awaited by the authority. In terms of number of offenses, at least, the trend is declining. However, number of offenses alone do not truly reflect the seriousness of the problem. There can be few incidence of illegal logging activities but the amount of logs removed or the areas cut in each of the incidence can be huge. The state forest authority, therefore, should not be complacent in its enforcement activities once they found out that the number of offenses is declining over the years. It should be a cause for concern in the state being studied as it was shown that illegal logging cases constitute a big proportion of the total number of offenses in the state.

The results of regression analysis do not support the hypotheses made earlier on the relationships between number of offenses and log price, size of forest area and number of enforcement officers. It was expected that forest offenses would increase with increase in log price, and that it would decrease with decrease in forest area and increase in enforcement officers. However, only log price was correlated significantly with number of offenses. It was found that the higher the log price the lower will be the number of offenses. This result shows that loggers will not be motivated to steal more logs when the price of logs increases. It can be argued that an increase in log price already provides enough incentives for the loggers to cut their own forest concession areas. There is no necessity to log other areas in order to obtain a comparable margin of profit.

As far as inspection activities are concerned, the findings indicate that these should be carried more often in times when the prices of logs are low than in times when the prices of logs are high. Inspection activities should be planned taking into consideration the projections made for log prices. The authority should monitor the development in log prices and plan inspection activities accordingly.

The above findings, however, should be treated as very preliminary and more studies should be carried out in other states to confirm them. Future studies may want to use a more disaggregated data for log price, for example, price for different groups of commercial species. Such studies should also try to determine the probability of arrests and probability of conviction for forest offenses and, consequently, analyse their influence on these offenses. More detail data will have to be collected for such studies. The ultimate aim of such studies is to find out whether or not increasing penalties deter the occurrence of forest offenses.

In conclusion, achieving sustainable forest management requires congruent and balanced efforts in many facets of forest policy. The government should not only focus on certain programmes or projects to enhance the productivity and sustainability of the forests but ignore other aspects which may be equally important in achieving sustainable forest management. One important facet of forest policy is its enforcement. Lack of enforcement can lead to widespread occurrence of illegal activities. The occurrence of forest offenses, such as illegal logging and encroachment, can significantly hinder the attainment of sustainable forest management. As little is known on the occurrence of forest offenses in this country, more research should be carried out in the future. Comprehensive research programmes can lead to the formulation of improved strategies to control the occurrence of forest offenses.

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Cadangan Model Teoritikal bagi Menilai Kecekapan Pelaburan dalam Pembangunan Tanah Rizab Melayu

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Kata Kunci: Tanah Rizab Melayu, oportunisme, pelaburan optimal, kos transaksi

ABSTRAK
Tanah Rizab Melayu (TRM) meliputi 33.55% tanah di Malaysia yang boleh diusahakan secara produktif. Malangnya banyak kajian yang telah diuat menunjukkan sumber pengeluaran yang sebenarnya besar tidak berjaya digembleng oleh pemilik untuk mencapai potensi ekonominya yang sebenar. Penyelesaian kepada masalah ketidakcekapan penggunaan sumber ini memerlukan teori yang boleh menerangkan mengapa keadaan ini wujud. Walaupun ada beberapa idea yang telah dilontarkan untuk menjelaskan fenomena ini, idea-idea tersebut tidak berdasarkan teori ekonomi yang tegar. Kertas ini mengusulkan satu teori ekonomi yang mudah tetapi tegar, untuk menerangkan (dari segi ekonomi) mengapa pemilik-pemilik TRM membuat pelaburan yang lebih rendah dari tahap yang cekap, sekali gus menerangkan mengapa TRM kurang dibangunkan potensi ekonominya. Kertas ini menyarankan bahawa kos transaksi dan oportunisme akibat dari pemilikan bertindih boleh mengakibatkan kurang berlakunya pembangunan TRM.

PENGENALAN
Di Malaysia, Tanah Rizab Melayu (TRM) meliputi 33.55% tanah yang boleh diusahakan secara produktif. Malangnya banyak kajian yang telah dibuat (Nik Mohd Zain Nik Yusof 1996; Shaik Mohd Nor Alam 1996; Nik Hashim Nik Mustapha, et al., 1996) menunjukkan sumber yang sebenarnya besar itu tidak diperoleh digembleng untuk mencapai potensi ekonominya yang sebenar. Implikasi ketidakcekapan penggunaan faktor pengeluaran ini kepada pertumbuhan negara di masa akan datang sepertinya mendapat...
perhatian penggubal dasar. Tambahan pula, ketidakcekapan ini juga mempunyai kesan kepada pengagihan pendapatan antara kaum dan antara kelas kerana pemilikan TRM adalah jelas tidak merata.

Isu dan masalah pembangunan TRM memang sering dibahaskan dan terdapat beberapa faktor yang telah dilontarkan oleh penyelidik lepas (Nik Mohd Zain Nik Yusof 1996; Shaik Mohd Nor Alam 1996; Nik Hashim Nik Mustapha, et al., 1996) sebagai penghalang kepada pembangunan TRM. Antara faktor-faktor penghalang ini adalah mekanisma perwarisan tanah yang selalu mengakibatkan pemilikan bertindih dan pembahagian kepada lot-lot yang kecil yang tidak ekonomik untuk diusahakan. Faktor-faktor lain adalah lokasi TRM yang tidak strategik dan kurangnya pengetahuan pemilik tentang cara-cara membangunkan tanah.

Satu kekurangan yang ketara di dalam lontaran-lontaran ide di atas adalah ketiadaan usaha untuk mempertahankannya dengan menggunakan kerangka teori dan prinsip asas ekonomi yang tegar (rigorous). Daripada perspektif teori, kegagalan membangunkan TRM membawa implikasi bahawa terdapat lebihan yang masih belum dieksplotasi. Persoalan yang masih belum terjawab adalah mengapa keadaan ini wujud di Tanah Melayu sebelum merdeka lagi melalui enakmen-enakmen yang telah digubal oleh pentadbiran kolonial British.


**LATABELAKANG TANAH RIZAB MELAYU**

Tanah Rizab Melayu (TRM) boleh ditakrifkan sebagai tanah-tanah yang dimiliki oleh orang Melayu dalam sempadan suatu negeri di Malaysia yang mana hak miliknya hanya boleh dipegang atau dipindah kepada orang Melayu sahaja. Ia telah wujud di Tanah Melayu sebelum merdeka lagi melalui enakmen-enakmen yang telah digubal oleh pentadbiran kolonial British.

TRM diwujudkan semasa pemerintahan penjajah (1890-1956) kerana pemilikan tanah oleh orang Melayu mula terancam akibat kemasukan orang asing yang semakin meningkat. Selain itu, pengaruh perkembangan pertanian perladangan oleh orang bukan Melayu seperti getah menggalakkan orang Melayu menjual tanah mereka kepada orang bukan Melayu. Pada masa yang sama juga, di sesetengah negeri peningkatan industri bijih timah yang lebih lumayan telah menggalakkan orang Melayu menukar haluan kerja dan akibatnya, banyak tanah orang Melayu yang tidak diusahakan dan ditunggalkan oleh orang-orang Melayu. Oleh itu, peruntukan pemilikan tanah kepada orang Melayu melalui Enamken 1913 adalah bertujuan untuk memastikan tanah-tanah yang dimiliki oleh orang Melayu tidak dipindah kepada orang bukan Melayu demi menjaga kawasan-kawasan padi terus diusahakan oleh orang-orang Melayu sebagai sumber makanan kepada penduduk Melayu yang kian meningkat.

Status TRM terus dikekalkan selepas zaman penjajah dan jadual 1 menunjukkan keluasan TRM mengikut negeri di Semenanjung Melayu pada tahun 1995. Secara agregatnya jumlah keluasan telah berkurangan pada Januari 1995, tetapi kekurangannya adalah kecil iaitu tidak sampai 3%. Namun begitu, perlu juga diingat bahawa pengekalan keluasan TRM ini tidak...
Cadangan Model Teoritikal bagi Menilai Kecekapan Pelaburan dalam Pembangunan Tanab Rizab Melayu

semestinya bermakna bahawa pengambilan atau pembatalan TRM disusuli dengan penggantian tanah yang setanding dari segi cirri-cirinya.

**MODEL TEORETIKAL**


Andaikan terdapat dua tempoh masa, \( t=1 \) (ex-ante) dan \( t=2 \) (ex-post). Andaikan lagi bahawa seramai \( n \) orang adik beradik telah mewarisi sebidang tanah dari seorang bapa yang telah meninggal dunia. Walaupun peratusan pemilikan untuk setiap adik-beradik adalah jelas, hak pemunyaan masih tidak jelas. Apa yang dimaksudkan di sini adalah tidak ada seorang pun daripada mereka dapat menunjukkan bahagian tanah mana yang menjadi miliknya. Akibatnya, tanah tersebut menjadi harta kuasi awam (quasi common property). Kita juga mengandaikan di peringkat awal bahawa oleh kerana faktor sosial dan kebudayaan yang eksogen, adik beradik sekeluarga tidak merelakan penjualan tanah kepada pihak lain.

Perlu dinyatakan bahawa senario di atas sudah cukup untuk melahirkan dua implikasi penting. Pertama, hak individu bernilai cuma bagi ursu niaga di kalangan ahli keluarga sahaja. Kedua, akan timbul masalah pelaburan yang tidak cekap dari perspektif sosial ke atas tanah milik bersama ini seperti yang akan diterangkan di bawah.

**Ketidakecapan Pelaburan**

Katakan salah seorang pemilik boleh melabur, ex-ante, sejumlah \( e \) ke atas tanah untuk menghasilkan lebihan \( v(e) \) yang mana \( v'(e) \geq 0 \) dan \( v''(e)<0 \). Andaikan juga di peringkat ini bahawa, tiada persetujuan secara kontrak yang boleh ditentukan dan dikuatkuasakan berkenaan dengan pelaburan dan pembahagian lebihan antara pemilik-pemilik tanah. Pembahagian lebihan bersih \( v(e) - e \) akan ditentukan ex post, menerusi proses perundingan dan tawar-menawar dan lebihan yang hanya dapat direalisasikan dengan persetujuan semua ahli keluarga. Apabila pemilik-pemilik tanah mengagihkan lebihan melalui proses tawar-

**JADUAL 1**

Tanah Rizab Melayu, Semenanjung Malaysia
(Keluasan dalam hektar pada 1.1.1995)

<table>
<thead>
<tr>
<th>Bil</th>
<th>Negeri</th>
<th>Asal¹</th>
<th>Batal²</th>
<th>Ganti³</th>
<th>Ambil⁴</th>
<th>Sekarang²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perlis</td>
<td>37,348.53</td>
<td>167.26</td>
<td>301.66</td>
<td>379.84</td>
<td>37,482.93</td>
</tr>
<tr>
<td>2</td>
<td>Kedah</td>
<td>964,911.43</td>
<td>96,126.05</td>
<td>27,296</td>
<td>20,677.89</td>
<td>830,692.77</td>
</tr>
<tr>
<td>3</td>
<td>W. Persekutuan</td>
<td>1,067.56</td>
<td>280.45</td>
<td>TM</td>
<td>TM</td>
<td>787.11</td>
</tr>
<tr>
<td>4</td>
<td>N. Sembilan</td>
<td>207,738.60</td>
<td>2,240.53</td>
<td>4,177.07</td>
<td>2,240.53</td>
<td>209,881.43</td>
</tr>
<tr>
<td>5</td>
<td>Johor</td>
<td>275,562.70</td>
<td>286.07</td>
<td>2,893.09</td>
<td>TM</td>
<td>278,169.72</td>
</tr>
<tr>
<td>6</td>
<td>Pahang</td>
<td>500,507.50</td>
<td>110,759.00</td>
<td>124,411.73</td>
<td>TM</td>
<td>518,021.53</td>
</tr>
<tr>
<td>7</td>
<td>Terengganu</td>
<td>91.459</td>
<td>TM</td>
<td>TM</td>
<td>17.956</td>
<td>91.46</td>
</tr>
<tr>
<td>8</td>
<td>Kelantan</td>
<td>1,493,130.40</td>
<td>TM</td>
<td>TM</td>
<td>8,726.36</td>
<td>1,493,130.40</td>
</tr>
<tr>
<td>9</td>
<td>Perak</td>
<td>884,120.58</td>
<td>10,424.80</td>
<td>3,558.45</td>
<td>4,076.08</td>
<td>877,254.23</td>
</tr>
<tr>
<td>10</td>
<td>Selangor</td>
<td>181,658.63</td>
<td>8,059.46</td>
<td>TM</td>
<td>TM</td>
<td>173,599.17</td>
</tr>
<tr>
<td></td>
<td>Jumlah</td>
<td>4,545,937.40</td>
<td>228,343.63</td>
<td>135,369.79</td>
<td>36,118.65</td>
<td>4,419,110.75</td>
</tr>
</tbody>
</table>

**Nota**

Asal = Tanah yang diwujudkan sebagai tanah Rizab Melayu mengikut enakmen-enakmen Rizab Melayu

Batal = Tanah yang dibatalkan statusnya mengikut enakmen-enakmen Rizab Melayu

Ganti = Tanah yang diganti menurut Perkara 90, Perlembagaan Persekutuan

Ambil = Tanah yang diambil melalui undang-undang pengambilan tanah

Sekarang = (Asal + Ganti) - Batal = Keluasan Tanah Rizab sekarang.

TM = Tiada maklumat

Sumber: Diubah suai daripada Kementerian Tanah dan Pembangunan Koperasi

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menawar ini maka diandaikan keseimbangan Nash akan tercapai (dan kuasa tawar-menawar antara ahli keluarga adalah serupa5) sehingga:

\[ v(e) - (s + e) = (n - 1)s \]

atau

\[ s = \frac{v(e) - e}{n} \]

dengan \( s \) = jumlah lebihan yang diterima oleh setiap pemilik

Untuk memaksimumkan lebihan bersihnya, individu yang membuat pelaburan akan menyelesaikan masalah berikut:

\[
\text{Max} \left( \frac{v(e) - e}{n} \right) - e
\]

Adalah mudah untuk menunjukkan bahawa pilihan pelaburan, \( e \), yang optimal berlaku dalam keadaan di mana:

\[
\left( \frac{v'(e) - 1}{n} \right) - 1 = 0
\]

oleh itu,

\[ v'(e) = n + 1 \]

Walau bagaimanapun, tingkat pelaburan yang cekap memerlukan e dipilih supaya \( v(e) \) n e dimaksimumkan. Ini hanyalah benar apabila:

\[ v'(e) = 1 \]

Persamaan (5) dan (6) adalah syarat biasa untuk tingkat optimum pelaburan apabila pulangan adalah sama dengan kos sut pelaburan. Dengan membandingkan persamaan (5) dan (6) jelas didapati bahawa tingkat pelaburan individu lebih rendah daripada tingkat pelaburan yang cekap. Kesimpulan ini dibuat dengan menyedari bahawa \( v(e) \) adalah cembung (concave).

Perhatikan juga apabila nilai \( n \) meningkat (iaitu apabila bilangan pemilik bertindih meningkat), jangkauan perbezaan tingkat pelaburan individu dan tingkat pelaburan optimum menjadi semakin besar. Ini kerana semakin tinggi nilai \( n \), semakin rendah tingkat pelaburan individu.

Secara intuitif, kekurangan pelaburan (dan dengan itu pembangunan) berlaku kerana seseorang pelabur tidak dapat meraih kesemua lebihan yang dihasilkan oleh pelaburannya. Sikap oportunistik ahli keluarga menyebabkan mereka "menumpang dengan percuma" sebahagian dari hasil pelaburan yang dilakukan oleh ahli keluarga lain. Oleh kerana pengagihan lebihan dilakukan ex post melalui proses tawar-menawar dan lebihan hanya boleh direalisasikan dengan persetujuan semua, maka model di atas menjangkakan kurangnya pembangunan TRM. Bahkan keadaan ini akan menjadi lebih buruk jika bilangan pemilik bertindih, \( n \), meningkat.

**Kontrak Pelaburan Optimal**

Dalam model yang telah dibincangkan, ketiadaan kontrak yang boleh ditentusahkan dan dikuatkuasakan telah menyebabkan wujudnya oportunisme yang membawa kepada tahap pelaburan dan pembangunan yang rendah. Oleh itu masalah ini boleh diatasi secara prinsipnya melalui pemeteraan kontrak yang sesuai untuk menghasilkan pelaburan yang optimal. Bahagian ini akan membincangkan dua bentuk kontrak yang sebegini; iaitu kontrak pelaburan dan kontrak jualan. Di samping itu bahagian ini juga akan menerangkan mengapa pemeteraan kontrak seperti ini dijangkakan sukar dilaksanakan di kalangan pemilik-pemilik TRM.

**Kontrak Pelaburan**

Masalah ketidakcekapan pelaburan boleh diatasi jika kontrak ditulis, ex-ante, untuk menyatakan pelaburan yang perlu dibuat dan pengagihan sebarang lebihan yang terhasil. Suatu contoh kontrak pelaburan yang mudah tetapi optimal adalah dimana hak pemilikan lebihan yang dihasilkan dari pelaburan semata-mata diberikan kepada individu yang melabur. Disebabkan hanya individu pelabur sahaja yang mendapat lebihan pelaburan dan pementeraiannya kontrak menghalang oportunisme, maka ketidakcekapan pelaburan tidak akan berlaku. Didalam kes ini fungsi objektif pelabur adalah sama dengan perancang masyarakat (social planner) iaitu memaksimumkan \( v(e) - e \). Oleh itu tahap pelaburan yang dipilih, \( e \), adalah optimal dan lebih tinggi.

Satu lagi kontrak pelaburan yang boleh membawa kepada pelaburan optimal ialah dengan pementeraiannya satu perjanjian, ex ante, yang menyatakan bahawa semua pemilik, selain...
Cadangan Model Teoritikal bagi Menilai Kecekapan Pelaburan dalam Pembangunan Tanah Rizab Melayu

pelabur, akan menerima sejumlah lebihan yang
nilainya (katakan k) tidak berubah dengan
jumlah pelaburan. Oleh kerana oportunisme
terhalang dengan kontrak ini, pelaburan yang
akan dibuat adalah optimal. Ini dapat dilihat
sekalai lagi dengan menyedari bahawa fungsi
objektif pelabur adalah memaksimumkan
\[ v(e) - e - k \]
di mana k ialah pemalar. Agak mudah
untuk menunjukkan bahawa pilihan tahap
pelaburan, e, adalah optimal dalam kes ini.

Malangnya, adalah dijangkakan ke dua-dua
jenis kontrak tersebut di atas (dalam kes TRM),
sangat sukar untuk direalisasikan oleh pemilik
pemilik kerana dua sebab utama. Pertama oleh
kerana faktor budaya dan keadaan hidup sosial
berkeluarga, para pemilik (adik-beradik) akan
mendapati sukar untuk menulis satu kontrak
untuk menyatakan hak dan tanggungjawab
eruma kontrak yang boleh ditentusahkan dan dikuatkuasakan oleh
mahkamah menimbulkan kos sosial yang tinggi.
Ahli keluarga sukar bahkan enggan menulis
kontrak kerana bahkan enggan menulis kontrak kerana ia mewujudkan suasana yang
berbentuk atau mirip perniagaan (businesslike
environment) dan mengancam lebihan yang
dikecapi hasil dari hubungan kekeluargaan yang
berkeluargaan. Misalnya, pemodal akan menentukan
tahap pelaburan dengan memaksimumkan
\[ v(e) - e \]
di mana v ialah fungsi objektif pemodal. Ini dapat dilihat
dengan menyedari bahawa pemodal akan menentukan
tahap pelaburan dengan memaksimumkan
\[ v(e) - e \]
di mana v ialah fungsi objektif pemodal.

Walau bagaimanapun, peruntukan ini
terdedah kepada masalah "penunggang percuma". Setiap pihak mengetahui bahawa
tawaran untuk membayar lebihan yang
beranak dari pelaburan akan mengakibatkan lebihan yang
berhasil dan menentukan tahap pelaburan dilakukan.
Setiap pemodal akan memberi tawaran yang
lair untuk menjual hak mereka dengan harapan
ahli keluarga akan mendapat lebihan yang lebih besar.
Bagaimanapun, jika ini benar untuk seseorang
ahli keluarga maka ia juga mesti benar untuk
sebaiknya, oleh kerana semua ahli ingin "menunggang dengan
percuma", tiada seorangpun yang akan menjual
ahli keluarga mereka dan kontrak jualan tidak akan
menjadi kenyataan. Keadaan ini ada
kesamaannya dengan hujah Grossman dan Hart
(1980) di dalam isu "penunggang percuma"
dalam kegagalan pengambilalihan firma yang
diurus oleh pengurus yang tidak cekap.

**IMPLIKASI EMPIRIK**

Model yang ditunjukkan di atas memberi
sekurang-kurangnya dua implikasi yang boleh
dinyatakan secara empirik.

**Kontrak Jualan**

Walaupun kemungkinan penjualan tanah kepada
pihak luar telah digugurkan dalam model di atas, pemilik yang ingin membuat pelaburan
masih boleh membuat tawaran untuk membeli
esemua tanah daripada pemilik lain. Melalui
kontrak yang sebening, sebarang lebihan yang
dijana dari pelaburan akan diperolehi
sepenuhnya oleh pelabur. Oleh itu pelaburan
yang optimal akan berlaku kerana kesempurnaan
kontrak jualan ini kepada tahap pelaburan adalah sama
sebagainama kontrak pembahagian lebihan
ex ante secara tetap seperti yang telah
dibincangkan. Ini dapat dilihat dengan
menyedari bahawa pemilik akan menentukan
tahap pelaburan dengan memaksimumkan
\[ v(e) - e \]
di mana v ialah fungsi objektif pemodal.

Pertama, jika model ini benar dan dengan
mengawal semua faktor lain yang mempengaruhi
nilai TRM, maka kita akan dapat bahawa
pembangunan (nilai) TRM adalah berkadar
langsung dengan kekayaan pemilik bertindih. Ini
dapat dilihat dengan membandingkan tingkat
pelaburan dalam persamaan (5) dan (6) apabila
nilai n diubah. Sebagai huraihan, tanah yang
dimiliki oleh hanya seorang pemilik lebih
cenderung untuk dibangunkan (melalui
pelaburan) ke tahap yang lebih tinggi


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sehingga nilai pasarannya lebih besar berbanding dengan tanah yang sama tetapi dimiliki secara bertindih oleh ramai pemilik.

Kedua, model ini juga membawa implikasi bahawa TRM yang dimiliki secara bertindih lebih tinggi nilainya jika pemilik-pemiliknya telah berjaya menulis kontrak yang boleh dikuatkuasakan berbanding dengan tanah milik keluarga yang gagal berbuat demikian. Kejayaan mewujudkan kontrak ex ante akan menghalang oportunisme dan menggalakkan peningkatan nilai pelaburan.

Tentu sekali ujian empirik ini perlu dirangka sebegitu rupa sehingga ia berupaya untuk mengawal semua faktor lain yang dijangka mempengaruhi nilai TRM untuk mengelak dari kesilapan inferens.

KESIMPULAN

Kertas ini telah membincangkan latar belakang TRM dan membentangkan model teoritikal untuk menerangkan mengapa pemilikan bertindih merupakan salah satu daripada punca masalah pembangunan TRM. Model ini menunjukkan bahawa akibat dari kekangan yang tertentu, pemilik-pemilik yang rasional memilih untuk membuat pelaburan tambah nilai yang tidak optimal terhadap tanah milik mereka. Isu-isu seperti tawar-menawar ex post, opportunisme dan kos transaksi telah dikaikan dengan permasalahan pelaburan yang tidak optimal ini. Akhir sekali kertas ini menyatakan dua implikasi yang boleh digunakan untuk menguji secara empirik model yang telah dibentuk.

RUJUKAN


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Technical Efficiency Estimates for Sarawak Pepper Farming: A Comparative Analysis

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Keywords: technical efficiency, Sarawak pepper farming, comparative analysis

ABSTRACT
Estimating technical efficiency of production technology is important for policy purposes. Four production frontiers consisting of parametric and nonparametric functions were analysed to estimate technical efficiency ratios on a sample of pepper farms in Sarawak. The methodologies employed produced different estimates, distributions, and rankings of efficiency ratios. The nonparametric estimates were greater than parametric estimates except under stochastic parametric method. Due to the large differences in technical efficiency results, recommendation for policy purpose should not be made without prior detailed analysis of each method.

INTRODUCTION
The modeling of production activities has long occupied a central role in applied economic research, both as an area in which existing statistical estimators may be applied and in providing a stimulus for the development of new methods. In standard microeconomic theory, production technology is represented by transformation (production) function that defines the maximum attainable outputs from different combinations of inputs. Hence, the transformation function describes a boundary or a frontier. Given that the production function to be estimated had constant returns to scale, Farrell (1957) assumed that observed input per unit of output values for firms would be above the so-called unit isoquant. The unit isoquant defines the input per unit output ratios associated with the most efficient use of inputs to produce the output involved. The deviation of observed input per unit output ratios from the unit isoquant is considered to be associated with technical efficiency. On the other hand, technical inefficiency is defined as a firm’s failure to produce maximum output from a given set of inputs (Forsund et al., 1980).

A more general presentation of Farrells’ concept of production (or frontier) is depicted in Fig. 1 involving the original input and output values. The observed input-output values are below the production frontier, given that firms do not attain the maximum output possible for the inputs involved, for a given technology. A measure of technical efficiency of the firm which produce output, $y$, with input, $x$, denoted by point A, is given by $y/y^*$, where $y^*$ is frontier...
output associated with the level of input, x, (point B). Thus, the ratio of observed output and frontier output is a measure of technical efficiency for the input involved.

In recent years, many empirical studies using frontier function methodologies have been undertaken with the purpose of measuring farm efficiency. Recent differences in farm efficiency measurements may have been the result of numerous factors, including the time period analysed, the degree of sample homogeneity, output aggregation and the method employed (Neff et al., 1991). For example, Bravo-Ureta and Rieger (1990) examine New England and New York farm efficiency using four production frontier methods. The result of their analysis indicates that, while large differences exist between estimated average firm efficiency ratios, all four sets of efficiency ratios are highly correlated within two time periods.

Kalaitzandonakes et al. (1992) examined the relationship between firm size and technical efficiency on a sample of Missouri grain farms using three production frontiers. There are strong differences between estimated average efficiency ratios from the three methods. Byrnes et al. (1987), using a nonparametric radial output efficiency measure, find that south-central Illinois grain farms are producing only four percent below their efficient levels. However, Aly et al. (1987) and Neff et al. and Hornbaker (1991) using a deterministic parametric frontier, find that farms are producing at approximately 60-65 percent of their efficiency level. Finally, Grabowski et al. (1990) employing a stochastic parametric frontier, find that a sample of Illinois grain farms are producing at 82 percent of their efficient levels.

Given the result of previous studies, the purpose of this paper is to provide a comparison of the most commonly used frontier methods utilizing four production frontier methods, namely:

a. Deterministic Parametric Frontier (COLS)
b. Linear Programming Parametric Frontier (LP)
c. Nonparametric Frontier (NPAR), and
d. Stochastic Parametric Frontier (SPF)

This paper proceeds as follows. The next section focuses on the methodology that are used in this study. Section three presents the data and estimation followed by the empirical results. The last section concludes the study with the implications of the findings.

**METHODOLOGY**

**Deterministic Parametric Frontier**

Let y represent the output of a firm and let x denotes a vector of input utilized in the
production of \( y \). The deterministic parametric frontier is estimated assuming a conventional Cobb-Douglas production technology:

\[
Y = \alpha \Pi X^\beta e^u
\]  

(1)

where

\( \alpha = \) a constant and

\( \beta = \) a vector of slope coefficients.

From the output relationship estimated by Ordinary Least Squares (OLS), the frontier production function is derived by a method called Corrected Ordinary Least Squares (COLS). It has been shown that the COLS estimates give coefficients which are unbiased and consistent (Green, 1980). The procedure involves estimating the individual specific error terms from the production function, and revising the intercept by the magnitude of the largest error term. The results in output magnification not only at that point but over the entire production surface. Thus, the frontier function is given by

\[
Y^* = \alpha^* \Pi X^\beta e^u
\]  

(2)

The technical efficiency measure of an individual firm is the ratio of actual output \( Y \), to potential output, \( Y^* \):

\[
TE = \frac{Y}{Y^*} \leq 1
\]  

(3)

Linear Programming Parametric Frontier

A further measure of technical efficiency can be estimated using linear programming methods (Aigner and Chu, 1968; Timmer, 1970, 1971). This approach differs from the Deterministic Parametric Frontiers in that the assumption of linear homogeneity is relaxed at a cost of specifying a functional form for the production function. Again, the Cobb-Douglas specification is used. Using Eq. (1), assume that the disturbance terms are constrained to be one sided, that is, \( u_i \leq 0 \) so that the function is a frontier one. For an efficient frontier, this should be estimated so that:

\[
\sum_{g=0}^{G} \alpha_g X_{i,g} = Y_{i}^* \geq Y_i \quad i=1, 2, ..., n
\]  

(4)

where

\( Y_{i} = Y_{i}^* + u_i \)

\( Y_{i}^* = \) the frontier estimate of \( Y \), and

\( u_i = \) the residual of farm \( i \)

Only efficient farms satisfy the strict equality. In order to determine the unique vector \( \alpha_g \) which satisfy (4), Timmer (1970) suggests minimizing the linear sum of residuals rather than minimized the linear sum of square residuals since the latter accentuates the impact of extreme observation. Thus the problem is to find \( \alpha_g \) in order to:

\[
\text{Min } \sum_{i=1}^{n} u_i
\]

\[
\text{st } \sum_{g=0}^{G} \alpha_g X_{i,g} \geq Y_i
\]

(5)

\[
\alpha_g \geq 0
\]

To solve this using LP method, \( \Sigma u_i \) is expressed as a linear function of \( \alpha_g \) and \( X_{i,g} \). The production function in (1) is then summed over \( i \) and \( \Sigma u_i \) is solved, that is

\[
- \sum_{i=1}^{n} u_i = \sum_{i=1}^{n} \sum_{g=0}^{G} \alpha_g X_{i,g} - \sum_{i=1}^{n} Y_i
\]  

(6)

However, for any data set, the last term on the RHS of (6) is a constant, so it can be removed. What remains becomes the objective function. Timmer (1970) suggests that the problem is computationally simpler when the objective function is divided by the number of observations. Thus, the LP problem is to find \( \alpha_g \) in order to:

\[
\text{Min } a_0 + a_1 X_{11} + a_2 X_{21} + ......... + a_G X_{G1}
\]

\[
\text{st } \alpha_0 + \alpha_1 X_{11} + \alpha_2 X_{21} + ......... + \alpha_G X_{G1} \geq Y_i
\]

\[
\alpha_0 + \alpha_1 X_{1n} + \alpha_2 X_{2n} + ......... + \alpha_G X_{Gn} \geq Y_n
\]

(7)

\[
\alpha_g \geq 0
\]

Having estimated the production frontier, the efficiency ratings are calculated for each farm in each year as \( Y_i/Y_{i}^* \). Thus, that LP measure of technical efficiency for farm \( i \) is given by exponential of these ratio, that is

\[
TE = \exp \left( \frac{Y_i}{Y_{i}^*} \right) \leq 1
\]  

(8)
Nonparametric Frontier

Nonparametric frontiers were originally proposed by Farrell (1957). The radial output measure of technical efficiency is estimated by assuming a nonparametric production technology (T) with strong disposable output and inputs, and non-constant return to scale:

$$T = \{(x,y): zY \geq y, zX \leq x, \sum z_i = 1, z \in R^+\}$$

where

- $x$ is a $(n \times 1)$ vector of inputs
- $y$ is a $(m \times 1)$ vector of outputs
- $k$ is the number of farms
- $X$ is the $(n \times m)$ matrix of inputs
- $Y$ is the corresponding $(n \times k)$ matrix of outputs, and
- $z$ is the intensity with which any activity $(x,y)$ is utilized.

Technical efficiency is estimated by solving the following linear programming for each farm $i$:

$$\text{Max } \Theta_i$$
$$\text{st } zY \geq \Theta_i y_i$$
$$zX \leq x_i$$
$$\sum z_i = 1$$

For the single-output nonparametric efficiency measure used here, there is one output constraint in (10). There are six input constraint for the measures. The solution to each programming, $\Theta_i$, represent the ratio of each farm frontier output to observed output. The efficiency ratio, $\text{TE} = \frac{1}{\Theta_i}$, indicates the percentage ($\text{TE} \times 100$) of output achieved by each firm. A primary difference between nonparametric and parametric production frontiers is that the former does not assume any parametric form. Hence, instead of attempting to fit a regression surface through the center of the data, nonparametric procedures lay a piecewise linear surface on top of the observation (Kalaitzandonakes et al. 1992).

Stochastic Parametric Frontier

Aigner et al., (1977) and Meeusen and Van den Broeck (1977) have specified and estimated a stochastic production frontier which can be written as:

$$Y_i = F(X_i, \beta_i) e^\varepsilon$$

The stochastic frontier is also called composed error model, because it postulates that the error terms ($i$ is composed of two independent error component:

$$\varepsilon_i = \nu_i - u_i$$

The error component $\nu_i$ is assumed to be distributed normally with mean zero and variance $\sigma^2_\nu$ ($\nu_i \sim N(0, \sigma^2_\nu)$) and account for variability in the frontier due to random shocks or noise. The error component $u_i$ is assumed to be distributed half-normally ($u_i \sim \frac{1}{\sigma_u} |N(0, \sigma_u^2)|$) and assumed to capture firm inefficiency, that is deviation from the stochastic frontier. Equation (4) is estimated using maximum likelihood. The technical efficiency related to the stochastic production frontier is capture by the one sided error component $u_i \geq 0$ (Jondrow et al., 1992).

DATA AND ESTIMATION

A cross section of 159 sample Sarawak pepper farms was used to estimate the production frontier models discussed in the previous section. Our empirical model consists of a single equation production function, which is justified by invoking expected profit maximization. The Cobb-Douglas functional form was chosen, as has been the practice in most published efficiency studies, because of its well-known advantages. The specific model estimated is:

$$\ln Q = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2$$
$$+ \beta_3 \ln X_3 + \beta_4 \ln X_4$$
$$+ \beta_5 \ln X_5 + \epsilon$$

where

- $Q$ is pepper production (kg/year)
- $X_1$ is the fertilizer used (kg/year)
- $X_2$ is the weedicide used (lt/year)
- $X_3$ is the chemical used (lt/year)
Technical Efficiency Estimates for Sarawak Pepper Farming

\[
X_4 = \text{labour (manday/year)} \\
X_5 = \text{number of vines cultivated} \\
\beta_0 = \text{parameter to be estimated, } i = 1,2,5 \\
\varepsilon = \text{disturbance terms}
\]

As the first step, Ordinary Least Square (OLS) is applied for estimation, yielding best linear-unbiased estimates of production coefficients. The scale parameter estimates is then corrected by shifting the function until no residuals is positive and one is zero. In the application of the LP deterministic parametric frontier, equations (7) are used to estimate the parameters.

The nonparametric model derived the efficiency of each farm by comparing its observed use of inputs and produced output relative to all other farms. In the application to the Sarawak pepper farms, 159 farms observations of five inputs and single output are assembled. Therefore, there are five equations for input constraints and one additional constraint that the element of the intensity vector sum to one (\(\Sigma z = 1\)). Since 159 farms are present, a series of 159 such linear programming must be solved to determine the technical efficiency of each farm.

Estimation of parameters of stochastic frontier as well as the consequential diagnostics and statistical test was accomplished by using the maximum likelihood method (Greene, 1992).

**RESULTS AND DISCUSSION**

Table 1 presents COLS, LP and stochastic estimates of the production function parameters. The adjusted \(R^2\) indicates that the fitted regression explain 53.75 percent of the variation in pepper production for COLS model. It is interesting to note that farmers were operating at almost constant return to scale as indicated by the sum of the estimated coefficient. The regression coefficients for all the variables are positive and significant at 1 percent level. However, in the case of LP model, no standard error and \(R^2\) can be calculated, but the intercept estimate is higher than the COLS method.

The corresponding stochastic and COLS estimates are quite similar in term of signs. The levels of significant for the corresponding coefficients are largely the same with the exception of the case for chemical. The COLS estimate of the intercept is smaller than the stochastic estimate. This confirms that the average production function (traced by the COLS estimates) lies below the stochastic production function reached by maximum likelihood estimates. The variance ratio parameter

| TABLE 1 | Estimates of production function |
|-----------------|-----------------|-----------------|
|                | Deterministic Parametric (COLS) | LP-Deterministic Parametric | Stochastic Parametric (SPF) |
| Fertilizer     | 0.2364 (7.415)* | 0.1619          | 0.31160 (6.234)* |
| Weedicide      | 0.1151 (4.680)* | 0.1489          | 0.0881 (2.138)*  |
| Chemical       | 0.2508 (2.827)* | 0.2391          | 0.2232 (1.458)   |
| Labor          | 0.2048 (2.995)* | 0.2774          | 0.24941 (1.984)b |
| No. of Vine    | 0.1666 (5.527)* | 0.1993          | 0.25180 (4.981)* |
| Constant       | 1.1195 (0.2603) | 1.4066          | 2.0513 (1.661)b  |
| \(R^2\)-ADJ    | 0.5375          |                 |                 |

\(\sigma^2\) = 0.1068 \\
\(\sigma^2_u\) = 0.0671 \\
Log-Likelihood = -63.7464

Note: Figures in parentheses are t-statistics
a Significant at 1% level 
\(b\) Significant at 10% level
\( \lambda = \frac{\sigma_u}{\sigma_v} \), a measure to indicate the extent of total variation that is due to differences in production efficiency, is found to be 0.78. This suggests that a high portion of the differences between farmers' realized production and the maximum possible productions are due to farming practices rather than random behaviour.

Table 2 presents the results of the efficiency analyses for four frontier models. At first glance, the results show considerable variability in the value of mean technical efficiency across methods. On average, the mean efficiency ratios of the sample farms are high, over 80 percent for SPF measures. The NPAR measure indicates that the pepper farms are almost 80 percent efficient, which is about 1 - 2 percent lower than average measures for the SPF model. The COLS frontier method has the lowest average efficiency ratio for the pepper farms. The COLS measure indicates that farms are approximately 62 percent efficient on average, about 3 - 4 percent lower than the average measures for the LP method. Both measures are about 20 - 22 percent lower than the average measure for the NPAR and SPF models. Efficiency ratios from the SPF model are higher than the COLS model because modeling the error term in SPF as a composite of random error and inefficiency, rather than solely as inefficiency (Neff et al., 1993).

The nonparametric model tends to result in higher average efficiency measures than the parametric model (except for the SPF model). A significant reason for this is that the NPAR model analyses construct a different frontier for every sample farm. This result is consistent with Neff et al. (1993) where the NPAR model is a piecewise-linear, not a smooth function as in the COLS and SPF models.

The standard deviation for SPF model is the smallest compared to other three models. Consequently, the SPF model provides farm efficiency estimates with much lower variability than any of the other methods. For the SPF model, the technical inefficiency of each farm is a point estimate, that is, the mean of the conditional distributions of each farm's inefficiency error component \( u \) given its total error term \( e \). The mean for the conditional distributions \( \mathbb{E}(u|e) \) of the sample farms are very similar resulting in low variability in the efficiency ratios.

Table 2 and Fig. 2 represent distributions of farm efficiency ratios. The COLS and LP models is almost normally distributed. Approximately only 8 percent of the farms are very efficient (ER ≥ 90 percent) and 28 percent are inefficient (ER ≤ 50 percent) for COLS model. For LP models, approximately 13 percent of the farms are very efficient and 24 percent are inefficient. The COLS model, which is parametric, results in only one farm being on the frontier (ER = 1) and two farms for LP models.

The distribution of the NPAR model is skewed to the left. This is primarily due to a large number of efficient, or very efficient (ER ≥ 90%), farms associated with the nonparametric frontiers. The results indicate that a large number

<table>
<thead>
<tr>
<th>Frequency of efficiency ratio of pepper farming in Sarawak</th>
<th>Deterministic</th>
<th>Deterministic</th>
<th>Deterministic</th>
<th>Deterministic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COLS (Parametric)</td>
<td>LP (Parametric)</td>
<td>NPAR (Non-Parametric)</td>
<td>SPF (Stochastic)</td>
</tr>
<tr>
<td>31 - 40</td>
<td>12 (7.5)</td>
<td>11 (6.9)</td>
<td>13 (8.2)</td>
<td>1 (0.6)</td>
</tr>
<tr>
<td>41 - 50</td>
<td>33 (20.8)</td>
<td>28 (17.6)</td>
<td>17 (10.7)</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>51 - 60</td>
<td>45 (28.3)</td>
<td>40 (25.2)</td>
<td>25 (15.7)</td>
<td>50 (31.4)</td>
</tr>
<tr>
<td>61 - 70</td>
<td>23 (14.5)</td>
<td>26 (16.4)</td>
<td>20 (12.6)</td>
<td>104 (65.4)</td>
</tr>
<tr>
<td>71 - 80</td>
<td>13 (8.2)</td>
<td>17 (10.7)</td>
<td>17 (10.7)</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>81 - 90</td>
<td>20 (12.6)</td>
<td>16 (10.1)</td>
<td>20 (12.6)</td>
<td>104 (65.4)</td>
</tr>
<tr>
<td>91 - 100</td>
<td>13 (8.2)</td>
<td>21 (13.2)</td>
<td>67 (42.1)</td>
<td>2 (1.3)</td>
</tr>
</tbody>
</table>

Minimum: 0.3398, Maximum: 1.0000, Average: 0.6162, Standard Deviation: 0.1712

Note: Figures in parenthesis represent percentage of total sample

TABLE 2
of farms being on the frontier. For the NPAR model, there are 55 farms with ER = 1. In part, this is a result of piecewise-linear manner in which the nonparametric frontiers are constructed where each farm observation has its own frontier.

The distribution of the efficiency ratio for the SPF model is in contrast to the other three measures. Over 65 percent of the sample farms are concentrated in the 80 - 90 percent efficiency region. On average, it appears that none of the sample farms in the SPF model have efficiency level less than 50 percent and also none are perfectly efficient. This is because the frontier is stochastic, and a portion of the total error is attributable to random behaviour (Neff et al., 1993).

Table 3 presents summary statistics of the differences (DER) between the efficiency ratios estimated by the four frontier methods. A large number positive differences indicate that, in general, the efficiency ratio of four models are ranked as SPF > NPAR > LP > COLS. There are large differences between the efficiency ratios of the COLS, LP and NPAR models. NPAR efficiency ratios are 16 percent and 19 percent higher on average, respectively, than those of COLS and LP methods.

**CONCLUSION**

The purpose of this paper is to compare the results derived from alternative production frontier estimation methods. The Cobb-Douglas functional form was used to evaluate the four methods that have been frequently employed in the literature, on a sample of 159 pepper farms in Sarawak.

In general, all the four models indicate that Sarawak pepper farms are producing at 60 - 80 percent efficiency ratio. However, the study

**TABLE 3**

Summary statistics of difference in efficiency ratio (DER) between four frontier models

<table>
<thead>
<tr>
<th></th>
<th>COLS-</th>
<th>COLS-</th>
<th>COLS-</th>
<th>LP-</th>
<th>LP-</th>
<th>NPAR-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LP</td>
<td>NPAR</td>
<td>SPF</td>
<td>NPAR</td>
<td>SPF</td>
<td>SPF</td>
</tr>
<tr>
<td>Der &gt; 0</td>
<td>37</td>
<td>1</td>
<td>20</td>
<td>0</td>
<td>30</td>
<td>74</td>
</tr>
<tr>
<td>Der ≥ 0</td>
<td>122</td>
<td>158</td>
<td>139</td>
<td>159</td>
<td>129</td>
<td>85</td>
</tr>
<tr>
<td>Difference in Efficiency Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>-0.03</td>
<td>-0.18</td>
<td>-0.20</td>
<td>-0.16</td>
<td>-0.18</td>
<td>-0.02</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.15</td>
<td>-0.59</td>
<td>-0.42</td>
<td>-0.61</td>
<td>-0.45</td>
<td>-0.36</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.11</td>
<td>0.01</td>
<td>0.14</td>
<td>0.00</td>
<td>0.14</td>
<td>0.41</td>
</tr>
</tbody>
</table>
revealed that systematic differences in the efficiency measures are attributable to the method used. Differences also exist in the distribution of efficiency measures and the relative rankings of the farms by various models. The distributions of the COLS and LP measures are widely dispersed and more normally distributed. In contrast, the distribution of efficiency ratios from the stochastic parametric method is highly concentrated around 70 - 90 percent efficiency rate. This is in part due to the need to estimate inefficiency using the Jondrow et al. (1992) decomposition. However, in the case of nonparametric frontier, the results indicate that 35 percent of the sample farms are perfectly efficient (ER = 1). This is because the frontier is more flexible; that is, it is a piecewise-linear instead of continuous, functional form; and it constructs a different frontier for each observation.

In summary, the results indicate that frontier production functions proved significant in computing efficiency level in pepper production. The results can assist those involved in the industry's decision making to formulate strategy in abating inefficiency in order to enhance productivity. For example, a low level of technical efficiency indicates that increasing production would require new innovations or high-tech farming system. However, the absolute level, the distribution and the relative ranking of farm efficiency as shown in this study are influenced by the method employed. Thus, before any remedies can be suggested, the precision of predictors for individual technical efficiency should be carefully considered.

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Demand for Fish and its Substitutes in Malaysia: Evidence of Habit Formation and Structural Change

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Keywords: demand, fish, habit formation, structural change

ABSTRACT

This paper addresses the issue of changes in consumers' tastes in the demand for fish and meat products in Malaysia. Both, habit persistent effect and structural change in consumers' preferences towards fish and its substitutes are empirically examined using data from 1960 to 1990 with an Almost Ideal Demand System (AIDS) approach. In the dynamic AIDS model, it was found that there was a pervasiveness of habit formation in the demand for fish, chicken and pork but the amount of beef and mutton purchased during the last period tends to lower current budget allocation on these meat products. The structural change in consumers' preferences were tested using CUSUMSQ procedure and it was found that there was no structural break in the fish equation. This indicates that consumers' tastes do not change with respect to fish, consistent with a priori expectation, but the more health-conscious population are changing their preferences away from the red meats and currently demanding a bigger amount of white meat, which includes fish.

INTRODUCTION

Malaysia is a comparatively small, multi-racial and multi-religious country in Southeast Asia. For the past several years, the Malaysian economy has been growing at the rate of eight per cent per annum. Slightly less than half of its population are Malays, followed by Chinese, Indians and other minority races. The Malays being Moslems cannot eat pork while the Indians being predominantly Hindus are prohibited from consuming beef. Whilst meat-based protein consumption is dependent on the racial and religious fabrics of the population fish is basically acceptable to all irrespective of income levels. Thus, it is only natural to expect that fish tends to dominate over other meat consumption in this country.

Around mid-seventies and early eighties there was a sudden increase in the demand for seafood worldwide. This shift in the consumption pattern was partly attributed to a very important discovery in the medical field on the relationship...
between saturated fats and nutrition and health. Seafood was found to be particularly healthy because of its Omega-3 fatty acids which was often associated with reduced heart disease and neurological disorders (Lees, 1988). The discovery has affected the pattern of meat consumption worldwide including many of the developing economies.

The importance of fish products (white meat) in the consumer's diet and budget share is not entirely new in Malaysia. Being a relatively poor country then and maritime in nature, fish has naturally been a life line for the majority of its population. In 1990 per capita fish consumption was estimated at 37.5 kg per annum while per capita consumption for beef, poultry, mutton and pork were relatively lower at 3.49kg, 20.40kg, 0.50kg and 10.29kg, respectively (DVS, 1992). The high per capita consumption of fish relative to other meat products is not only a manifestation of the health concerns but most importantly fish is the cheapest form of protein meat available and acceptable to all races and religions in Malaysia.

Figs. 1 and 2 illustrate the per capita consumption trends for fish and other meats in Malaysia from 1960 to 1990. The summary statistics of these trends are given in Table 1. The most striking feature in these diagrams is the steady increase in the per capita consumption of fish and chicken, both of which are categorized as white meat, while the consumption of other red meats remains steady or even declining. The per capita fish consumption in particular has increased almost threefold since 1960 while chicken consumption has doubled during the same period. One possible explanation for this phenomena is that the relative prices of chicken to beef, and fish to beef have declined over the sampled period. In terms of average budget share, fish captures 57.09% of the consumers' total meat expenditures, pork 32.9%, chicken 13.45% while beef and mutton account for 4.36% and 2.09%, respectively. Coincidentally this consumption pattern is similar compared to those in other countries of the Pacific rim region where the principal product is unequivocally fishery products (Capps et al., 1994).

Since the introduction of the almost ideal demand system (AIDS) by Deaton and Muellbauer (1980), many applications of this model have been made to analyze consumer demand for food. These have included studies by Blanciforti and Green (1983), Eales and Unnevehr (1988), Fulponi (1989), Moschini and Meilke (1989), and Chalfant et al. (1989). Several studies have also been carried out in this region using the same model. Examples are studies by Ahmad Zubaidi and Zainal Abidin Mohamed (1993) and Nik Mustapha et al. (1994). Except for Blanciforti and Green (1983), all these studies have applied the linear approximation of AIDS model (LA/AIDS) by using the Stone's index to obtain price and income elasticity estimates.

Most of these applications however utilized static demand model (static AIDS) in which consumers are assumed to fully and instantaneously adjust their optimal purchase of commodities to current changes in prices and income. One problem of the static AIDS model is that it ignores the features of persistence in habits and the possibility of dynamic behavior in consumer demand. It has been suggested that inappropriate specification of the dynamic behavior may account for the rejection of theoretically based demand conditions (Deaton and Muellbauer, 1980). Several studies that have successfully incorporated this habit formation problem were Blanciforti and Green (1983), Burton and Young (1992) and Molina (1994), among others.

Another important aspect of demand studies is the issue of structural change in demand for fish and meat products. Statistical instability is often interpreted to mean that some underlying parameters in the utility function have changed. For example, changes in own-price elasticity (taste) or income elasticity affect the stability of the demand equations. Structural instability may result in model that may be correct in one sample period but not in another period. Structural change in Malaysian fish and meat

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Average per capita consumption (kg)</th>
<th>Average budget share of meat products (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>37.35</td>
<td>57.09</td>
</tr>
<tr>
<td>Chicken</td>
<td>9.84</td>
<td>13.45</td>
</tr>
<tr>
<td>Pork</td>
<td>15.88</td>
<td>32.9</td>
</tr>
<tr>
<td>Beef</td>
<td>1.67</td>
<td>4.36</td>
</tr>
<tr>
<td>Mutton</td>
<td>0.65</td>
<td>2.09</td>
</tr>
</tbody>
</table>

TABLE 1 Average per capita consumption and budget shares for fish and meat products in Malaysia, 1960-1990

Demand for Fish and its Substitutes in Malaysia: Evidence of Habit Formation and Structural Change

Demand is an important concern because such changes may necessitate corresponding changes in the fish and meat industry. The industry's responses however should be based on sound economic modeling and economic forecast. Models that do not explicitly account for the changing nature of fish and meat demand may be inappropriate, and thus may suggest industry changes that are inconsistent with economic reality. Previous studies that dealt with this issue using different statistical approaches include Martin and Porter (1985), Chalfant and Alston (1988), Moschini and Meilke (1989), Chen and Veeman (1991), Burton and Young (1992) and Edwards (1992). However, the results reported in these earlier studies were mixed.

No previous studies have so far been carried out to investigate these issues in this part of the world. This study is believed to be the first attempt in this country to address such research which undoubtedly can be very useful towards understanding consumers' behavior in many developing countries concerning demand for protein-based meats. The objective of this paper is therefore two folds: The dynamic form of AIDS that incorporates a habit effect in the consumer expenditure function will first be estimated empirically. The purpose is to examine whether this specification yields empirical results that are consistent with the economic theory of consumer behavior. The other objective is to demonstrate evidence of structural change in the demand for fish and meat products, to assess whether or not consumers' preferences (tastes) towards fish and other meat products have changed over the past three decades.

This paper is organized as follows. Section two discusses the specification of dynamic AIDS model. This is followed by the description of the data used in the study and the estimation
procedure. A brief note on the testing for structural change is given in section four. Section five presents the empirical results and discussion while the last section provides the concluding comments.

**MODEL SPECIFICATION**

The Almost Ideal Demand System developed by Deaton and Muellbauer (1980) as expressed in expenditure share form is:

\[ S_i = \alpha_i + \sum_j \gamma_{ij} \ln P_j + \beta_i (\ln E - \ln P) \]  

(1)

where

- \( i, j = 1, ..., n \) refers to meat groups
- \( S_i \) = the expenditure share of the \( i \)th meat group
- \( P_j \) = prices
- \( E \) = total expenditure on all commodities in the system,
- \( \alpha_i, \beta_j, \beta_i \) = demand parameters to be estimated.

In equation (1), \( P \) is a price index defined by

\[
\ln P = \alpha_0 + \sum_k \alpha_k \ln P_k + \frac{1}{2} \sum_j \gamma_{jk} \ln P_k \ln P_j
\]

(2)

To be consistent with the fundamental postulates of demand theory, the following conditions must hold in terms of parameter restrictions:

- \( \Sigma \alpha_i = 1, \Sigma \gamma_{ij} = 0, \Sigma \beta_i = 0 \) (adding-up) (2a)
- \( \sum_j \gamma_{ij} = 0 \) (homogeneity) (2b)
- \( \gamma_{ij} = \gamma_{ji} \) (symmetry) (2c)

The standard AIDS specification in (1) is often described as static AIDS.

To incorporate consumption habit variables into the AIDS model, the “dynamic translating” procedure proposed by Pollak (1970) and Pollak and Wales (1981) is adopted here. Following this procedure, the original demand function is replaced by a new system that contains translating parameters, and it is assumed that only the \( i \) parameters depend on the habit persistence variables. Applying this procedure to the AIDS model and specifying the linear dynamic translating parameter as

\[ \alpha_i = \alpha_i^* + d_i q_{i,t-1} \]

where \( d_i \) is the coefficient that measures the impact of previous consumption on the current expenditure share of meat type \( i \), the habit persistence version of the AIDS model becomes:

\[
S_i = \alpha_i^* + d_i q_{i,t-1} + \sum_j \gamma_{ij} \ln P_j + \beta_i (\ln E - \ln P), \quad i, j = 1, ..., 5
\]

(3)


\[
\ln P = \alpha_0 + \sum_j (\alpha_j^* + d_j q_{j,t-1}) \ln P_j + \frac{1}{2} \sum_k \sum_j \gamma_{jk} \ln P_k \ln P_j
\]

(4)

Equation (3) is popularly known as the dynamic AIDS.

The adding-up condition in the modified system applies if:

\[
\Sigma \alpha_i^* = 1, \Sigma \gamma_{ij} = \Sigma \beta_i = \Sigma d_i q_{i,t-1} = 0
\]

(5)

As in the case of the original AIDS model, the adding up restrictions hold only locally. The restriction \( \Sigma d_i q_{i,t-1} = 0 \) requires that at least one of the \( d_i \) is negative. While a positive sign indicates habit persistence, a negative sign implies inventory depletion effects. The condition of homogeneity and symmetry remain as \( \Sigma \gamma_{ij} = 0 \) and \( \gamma_{ij} = \gamma_{ji} \), respectively. The habit persistence extension adds \( n \) parameters to the static AIDS model.

**THE DATA AND ESTIMATION PROCEDURES**

The dynamic AIDS model will be estimated in this paper. The annual time series data from 1960-1990 on prices for fish and four other meat groups namely chicken, pork, beef and mutton, and income were used in this study. Consumption figures were obtained from the Department of the Veterinary Services (DVS), while data on prices were obtained from various Federal Agricultural Marketing Authority (FAMA) bulletins. Population, income and consumer price index (CPI) were collected from various Malaysia Plans and Economic Reports. All retail prices and income data were deflated by CPI \((1980=100)\). The per capita consumption figures were derived by dividing the total consumption for fish and each of the other meat groups with total consuming population.

The AIDS system summarized in equation (3) is non-linear in parameters. In order to permit this equation to be expressed in linear form equation (4) is often replaced by an index developed by Stone (1983). The index is:

\[
\ln P^* = \sum_k \tilde{w}_k \log P_k
\]

(6)

where \( \tilde{w}_k \) is the mean of the budget share of the \( k \)th commodity.
In this paper, the dynamic AIDS model with homogeneity and symmetry restriction imposed was estimated using the Zellner's Seemingly Unrelated Regression (SUR) method. This permits cross equation restrictions to be imposed and with iterative solutions, estimates are Maximum Likelihood. The mutton equation was deleted due to the adding-up restrictions.

**TEST OF STRUCTURAL CHANGE**

There have been many developments which could have resulted in a systematic change in the demand for fish and meat. For example, the attitude of some consumers towards red meat appears to have changed following the discovery of the relationship between saturated fats and health. The health concerns may have produced a shift in fish and meat preferences. In addition, recent developments in the fast-food industry, for example, have introduced new forms of products available to consumers and this may have directly affected the demand for fish and meat.

In this study we examined the stability (or constancy of parameters) of the meat demand equations using tests based on recursive residuals introduced by Brown, Durbin and Evan (1975). The testing was undertaken using single equation method to avoid the spillover of any misspecification from one equation to another. The approach has the advantage over the others (for example, Chow tests) since it does not require prior knowledge of the shifts but tests for the presence of such occurrence over the sample period.

Briefly, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) are based on the one-step-ahead forecast errors derived using recursive updated parameter estimates. Accordingly, a change in the structure overtime will result in the recursive residuals to have non-zero mean. The CUSUM and CUSUMSQ of these residuals are used to test for structural change. If the plot of the CUSUM or CUSUMSQ sample path moves outside critical region, and in this case 5% significant level, the null hypothesis of stability overtime of the intercept and slope parameters is rejected (assuming the model is correctly specified). In this study we only report the CUSUMSQ since it is known to be more powerful than the CUSUM test.

**RESULTS AND DISCUSSION**

Estimates of the structural parameters for the dynamic AIDS model are given in Table 2. Some very interesting results can be summarized from this table. Nineteen of the thirty coefficients estimated are significantly different from zero and the minimum budget shares, α, are all between zero and one for each meat type, indicating satisfactory fit. The coefficient β, are all negative and highly significant for each meat type except mutton. This implies that with the exception of mutton, fish and all other meat products are necessities.

The Durbin-Watson (D.W.) statistics in all except the pork equation are quite high, suggesting that serial correlation is not a problem. The low D.W statistic in the pork equation may suggest some sort of misspecification problem. We also compare the results of dynamic AIDS model with the static AIDS model. Based upon likelihood ratio test, it was found that the dynamic specification is preferred over the static model. The R² values for the fish, chicken, pork and beef equations are 0.87, 0.93, 0.86 and 0.86, respectively, indicating that the model performs reasonably well in terms of explanatory power. This suggests that the AIDS model with habit formation variable (i.e. the Dynamic AIDS) is an acceptable specification of the demand model for meats.

It is also interesting to note that the habit persistence variable, δ, are positive and statistically significant for fish, chicken and pork.
but negative and insignificant for beef and mutton. This indicates the pervasiveness of habit formation in fish, chicken and pork but the amount of beef and mutton purchased during the last period tends to lower current budget allocation on these meat products. The significant coefficients on habit persistence variables suggest that this feature has some influence on consumers' budget share allocation for fish, chicken and pork.

The above results concur with some of the previous studies in that the inclusion of consumption habit effect improves the consistency between theory and data. While changes in relative prices, total expenditure and consumers' habit explain some of the variation in fish and meat consumption, a considerable portion of the observed changes in fish and meat expenditure patterns over the past thirty years is also consistent with a structural change in consumer preferences.

The results of the test for structural change in fish and meat demand in Malaysia using the CUSUMSQ procedure are presented in Fig. 3. Using a 5 percent significant level, it is interesting to note that there is no structural breaks in the fish equation. This indicates that there is no structural change in consumer preferences (i.e. no change in taste) as far as fish is concerned. Being the cheapest source of protein, fish used to be and continues to be consumed by the vast majority of the population, either in fresh or processed forms. The favorable medical discovery regarding seafood products has not resulted in the change in tastes or preferences as reported in many other studies.

However, structural breaks are detected, as expected, in chicken, beef and pork consumption. For beef in particular, structural breaks occur in the mid-seventies and the later

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<th>TABLE 2</th>
<th>Maximum likelihood estimates of dynamic AIDS with for homogeneity and symmetry restrictions</th>
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<tbody>
<tr>
<td></td>
<td>Fish</td>
</tr>
<tr>
<td>$\gamma_{11}$</td>
<td>0.0047</td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
</tr>
<tr>
<td>$\gamma_{21}$</td>
<td>-0.0158</td>
</tr>
<tr>
<td></td>
<td>(-3.29)*</td>
</tr>
<tr>
<td>$\gamma_{31}$</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>(-6.9)</td>
</tr>
<tr>
<td>$\gamma_{41}$</td>
<td>0.0096</td>
</tr>
<tr>
<td></td>
<td>(2.57)*</td>
</tr>
<tr>
<td>$\gamma_{51}$</td>
<td>0.2456</td>
</tr>
<tr>
<td></td>
<td>(-12.03)*</td>
</tr>
<tr>
<td>$\beta_i$</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>(-18.79)*</td>
</tr>
<tr>
<td>$d_i$</td>
<td>0.2456</td>
</tr>
<tr>
<td></td>
<td>(8.96)*</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0016</td>
</tr>
<tr>
<td></td>
<td>(7.16)*</td>
</tr>
<tr>
<td>D.W.</td>
<td>1.47</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Log-likelihood value = 510.308

Note: t - values in parenthesis
* - significant at 5%
$\gamma = 1, 2, \ldots, 5$, where 1 = fish, 2 = chicken, 3 = pork, 4 = beef and 5 = mutton.
Fig. 3. CUSUMSQ plot for fish and other meats in Malaysia, 1960-1990 (5% significance level)
part of the eighties. For pork, it was evident in the late seventies while the same phenomenon occurred in the early eighties for chicken. It appears that structural changes may have caused the demand for some red meats to decline. Interestingly enough, these trends are consistent with those findings in Australia (Martin and Porter, 1985), the USA (Edwards, 1992) and the Great Britain (Burton and Young, 1992). For example, Burton and Young (1992) reported that there was a reduction in the budget shares for beef, pork and mutton during the late seventies and eighties, but changes in tastes in recent years tended to be in favor of fish and chicken. These changes in fish and meat expenditures and consumption pattern are usually alleged to be associated with increasing health concerns regarding diets. Other possible causes of these changes include the changing nature of the poultry, beef and pork products and the growth of the fast food outlets.

CONCLUSION

This study has addressed at least two important issues in the demand for fish and meat products in Malaysia. Aspects of consumers’ tastes were incorporated in the analysis of the Almost Ideal Demand System (AIDS) for fish and other meat products through the inclusion of habit formation variable. The structural changes in the consumer preferences were also tested.

The results of the Almost Ideal Demand System with habit formation (dynamic AIDS) performed creditably from the statistical point of view. It was found that there was strong persistence in the consumption for fish, chicken and pork but past purchases tend to lower budget share allocations for beef and mutton during the period from 1960 to 1990. These findings are consistent with the trends observed in the per capita consumption and budget share where fish, chicken and pork tend to dominate over beef and mutton.

In the structural change tests, it was found that there was no structural change in consumer preferences for fish but changes in taste were observed in chicken, beef and pork consumption. This occurrence is consistent with studies carried out elsewhere, where the health conscious populations are now consuming lesser amount of red meat products but an increasing quantity of white meat such as fish.

Both results suggest several point of interest to Malaysian policy makers, planners and fish and meat traders. The consumers are persistently demanding more fish and their tastes and preferences towards fish have not changed over the past three decades. Fish remains as the most popular meat item and has acquired a very important position in the diet. It is therefore imperative that continuous and stable supply of fish at reasonable price be made available to the population. Any short fall in the supply of fish will bound to have a negative impact on the consumer’s diet, nutrition and the health of Malaysians at large.

Several strategies could be adopted by policy makers to ensure a sustainable supply of fish in this country. Increase importation of fish from neighboring countries would probably be the easiest option. However this option will unnecessarily put a pressure on the country’s already strained balance of payment, and will not be politically and economically viable. The other alternative is to increase fish production locally. This proposition however will further create problems on our already overexploited fishery resources. Increasing fish price and the use of more efficient fishing technology will not redress the problem at hand but unnecessarily putting severe pressure on fish resources. In order to ensure sustainable fish supply, this renewable resources must be managed efficiently. Various management regimes are discussed in many fishery economics literatures and some of them especially the fishing effort reduction measures are currently being instituted by fishery administrators. In some areas the results are very encouraging where the fish production improves and in the long run, these fishery resources conservation measures will help mitigate the growing fish demand in this country.

The movement towards an increased importance of white meats has some important implications on the beef and other red meat industries as well. Our results suggest that these industries need to make quality adjustment in production since consumers are concerned with the potential danger of large intake of cholesterol and other saturated fats.

Further research should be carried out in this aspect using other approaches. Consumers’ responses to price and income changes before and after the structural change has occurred should be studied before any effective policies.
regarding fish and meat industries be drawn up and implemented to satisfy the presently more effluent and health-conscious consumers in this country.

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