



UNIVERSITI PUTRA MALAYSIA

**A SIMULATION STUDY ON COMPETING RISKS WITH CENSORED
DATA USING COX MODEL**

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FSAS 1999 3

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DATA USING COX MODEL**

By

IING LUKMAN

**Thesis Submitted in Fulfilment of the Requirements for the
Degree of Master of Science in the Faculty of
Science and Environmental Studies
Universiti Putra Malaysia**

December 1999



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science.

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December 1999

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A simulation study was performed to compare two regression methods for competing risks with censored data. The first method was the conventional Cox's proportional hazard regression model (Cox model). The second method was based on Cox model using a duplicated data technique of Lunn and McNeil (or the modified Lunn-McNeil). Samples with various sizes and censoring percentages were generated and fitted using both methods. This study was conducted by comparing the inference of both methods, using Root Mean Square Error (RMSE), the power tests, and the Schoenfeld residuals analysis. The power tests used in this study were likelihood ratio test, Rao-score test, and Wald statistics. The Schoenfeld residuals analysis was conducted to check the proportionality of the model through its covariates. The estimated parameters were computed for cause-specific hazards. Results showed the RMSE were

generally smaller for the model of the modified Lunn-McNeil method than that of the ordinary Cox method. The power tests of the likelihood ratio statistics and Rao-score test were only powerful for the unstratified Cox model, so that, it could be concluded that the model had more advantages than the modified Lunn-McNeil one. However, results from the analysis of Schoenfeld residuals indicated that the modified Lunn-McNeil was better than the ordinary Cox in complying with the proportional hazards model assumption with respect to certain covariates.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

**KAJIAN SIMULASI TERHADAP RISIKO BERSAING DENGAN
DATA TERTAPIS MENGGUNAKAN MODEL COX**

Oleh

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Kajian simulasi dijalankan untuk membandingkan dua kaedah regresi bagi risiko bersaing dengan data tertapis. Kaedah pertama ialah model regresi kadaran bahaya Cox biasa (model Cox). Kaedah kedua ialah model Cox yang berlandaskan pada penggunaan teknik data yang sama dari Lunn dan McNeil (atau kaedah Lunn-McNeil terubahsuai). Beberapa sampel dengan saiz berbeza dan peratusan tapisan berbeza dijana dan dianalisis menggunakan kedua-dua kaedah tersebut. Kajian ini dijalankan dengan membandingkan inferens dari kedua-dua kaedah tersebut, menggunakan Punca Kuasadua Min Ralat (PKMR), ujian kuasa, dan analisis reja Schoenfeld. Ujian kuasa yang digunakan ialah ujian nisbah kebolehjadian, ujian skor-Rao, dan statistik Wald. Analisis reja Schoenfeld dijalankan untuk meneliti keseimbangan model menerusi kovariatnya. Anggaran parameter dihitung bagi punca bahaya tertentu.

Keputusan menunjukkan PKMR secara amnya lebih kecil bagi model Lunn-McNeil terubahsuai berbanding dengan kaedah Cox biasa. Ujian kuasa dari statistik nisbah kebolehdjian dan ujian skor-Rao adalah hanya berkuasa bagi model Cox takberstrata, jadi dapat disimpulkan bahawa model ini memiliki kelebihan ke atas kaedah Lunn-McNeil terubahsuai. Bagaimanapun, keputusan daripada analisis reja Schoenfeld menunjukkan bahawa Lunn-McNeil terubahsuai adalah lebih baik berbanding Cox biasa kerana ia mematuhi andaian model kadaran bahaya meskipun untuk beberapa kovariat tertentu sahaja.

ACKNOWLEDGMENTS

Praise be to Alloh Subhanahu Wata'ala who hath given me the permission to write this thesis, and peace be upon His Messenger, Muhammad Sallallahu 'Alaihi Wasallam (SAW) and his followers. Alloh Subhanahu Wata'ala senth Muhammad SAW for the benefit of the entire universe (Holy Koran epistle 21, verse 107) until the ages ending.

My great thanks to Dr. Noor Akma Ibrahim, the chairperson of the supervisory committee, because of her guidance, patience, and critics have given me the understanding of the whole work written in this thesis. My great thanks also goes to Associate Prof. Dr. Isa bin Daud, the committee member, for giving me a better understanding about Schoenfeld residuals. My great thanks is also to Puan Fauziah bt. Maarof, the committee member, for checking on the hypothesis I used in the power tests and her permission to let me used the computer in the computer laboratory.

An another great thanks goes to the authorities of IRPA project with code number 51119 which is led by Associate Prof. Dr. Isa bin Daud for giving me the financial assistance through the Graduate Assistantship scheme.

My thanks also goes to Associate Prof. Dr. Jambari Hj. Ali of Biology Department (UPM), and Associate Prof. Dr. Abdurrauf Rambe, Mst., of Statistics Department, Institut Pertanian Bogor for giving me the letters of recommendation at the time I applied to study at UPM. To the whole staffs of the UPM Graduate School Office, I express my thanks.

To my beloved wife, Maria Viva Rini, and my beloved children, Tanukh, Haifa, Puput, and Aida, I send them this special thanks. Also a special thank you to my parents, brothers and sisters in Bandung for their supports and prayer. A lot of thanks to all of my Indonesian friends, especially Ida Yuhana, Frediantony Nasdean, Lalang Buana, Iman Rahayu, and Syamsuddin Toaha. Also thanks to my Sudanese friends such as Faiz Elfaki, Yusuf, and Anwar. May Alloh Subhanahu Wata'ala give a lot of rewards to those I say thanks.



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