Appendix A:

To proof, let the demand function be the conditional demand function $x(p, m_x)$, and the expenditure function for the subutility maximization problem be $e(p, v)$. We can write the overall maximization problem of the consumer as

$$\max_{v,z} U(v, z) \qquad \text{such that } e(p, v) + qz = m$$

In order to have the budget constraint that is linear in quantity index, we need to assume that subutility function has a special structure, such as it is a homothetic function. Then we can rewrite the expenditure function as $e(p)v$. Hence, we can choose the quantity and price index to be

$$X = v(x)$$
$$P = e(p)$$

and $U(X, z)$ be the utility function. We get the same Z if we solve

$$\max_{v,z} U(v, z) \qquad \text{such that } PX + qz = m$$

as when we solve

$$\max_{x,z} u(v(x), z) \qquad \text{such that } px + qz = m, \text{ and then aggregate using } X = v(x)$$

Aggregating across consumers

Suppose the individual consumers' indirect utility functions take the **Gorman form:**

$$v_i p(p, m_i) = a_i(p) + b(p) m_i$$

Note that the $a_i(p)$ term can differ from consumer to consumer, but this $b(p)$ term is assumed to be identical for all consumers. By Roy's identity the demand function for good *j* of consumer *i* will then take the form

$$x_i^j(p, m_i) = \alpha_i^j(p) + \beta^j(p) m_i$$

Where,

$$\alpha_i^j(p) = -\frac{\frac{\partial a_i(p)}{\partial p_j}}{b(p)}$$

$$\beta^j(p) = -\frac{\frac{\partial b(p)}{\partial p_j}}{b(p)}$$

Note that the marginal propensity to consume good *j*, $\partial x_i^j(p, m_i / \partial m^i)$ is independent of the level of income of any consumer and also constant across consumers since $b(p)$ is constant across consumers. Thus, the aggregate demand for good *j* will then take the form

$$X^j\left(p,m^1,\ldots,m^n\right)=-\left[\sum_{i=1}^{n}\frac{\frac{\partial a_i}{\partial p_j}}{b(p)}+\frac{\frac{\partial b(p)}{\partial p_j}}{b(p)}\sum_{i=1}^{n}m_i\right]$$

this demand function can in fact be generated by a representative consumer. His representative indirect utility function is given by

$$V(p,M)=\sum_{i=1}^{n}a_i(p)+b(p)M = A(p)+B(p)M$$

where $M=\sum_{i=1}^{n}m_i$

To proof this, we simply apply Roy's identity to this indirect utility function. In fact it can be shown that the Gorman form is not only sufficient for the representative consumer model to hold, but it is also necessary since it is the most general form of the indirect utility function that allow for aggregation in the sense of the representative consumer model.

Suppose, for the sake of simplicity, that there are only two consumers. Then by hypothesis the aggregate demand for good j can be written as

$$X^j(p,m_1+m_2)\equiv x_1^j(p,m_1)+x_2^j(p,m_2)$$

If we first differentiate with respect to m_1 and then with respect to m_2, we find the following identities

$$\frac{\partial X^j(p,M)}{\partial M}\equiv\frac{\partial x_j(p,m_1)}{\partial m_1}\equiv\frac{\partial x_2^j(p,m_2)}{\partial m_2}$$

Hence, the marginal propensity to consume good j must be the same for all consumers. If we differentiate this expression once more with respect to m_1, we find that

$$\frac{\partial^2 X^j(p,M)}{\partial M^2}\equiv\frac{\partial^2 x_j^i(p,m_1)}{\partial m_1^2}\equiv 0$$

Hence, the demand functions for good j take the form

$$x_i^j(p,m)=\alpha_i^j(p)+\beta^j(p)m_i$$

If this true for all goods, the indirect utility function for each consumer must have the Gorman form.

One special case of a utility function having the Gorman form is a utility function that is homothetic. In this case the indirect utility function has the form $v(p,m)=v(p)m$, which is clearly of the Gorman form. Another special case is that of a quasilinear utility function. In this case $v(p,m)=v(p)+m$, which obviously has the Gorman form. Many of the properties possessed by homothetic and/or quasilinear utility functions are also possessed by the Gorman form.

Appendix B[10]

The relationship between mode-choice and ordinary demand elasticities can be summarized by the following formula:

$$F_{ij} = M_{ij} + \delta_j \qquad \text{for all } i \text{ and } j$$

where F_{ij} is the price elasticity of the ordinary demand for mode *i* with respect to price of mode *j*, M_{ij} is the mode-choice elasticity of choosing mode *i* with respect to the price of mode j, and δ_j is the elasticity of demand for the aggregate traffic, denoted Q, with respect to the price of mode j. Because information on δ_j is not usually available, the following formula may be useful in computing them.

$$\begin{aligned}\delta_j &= (\partial Q / \partial P_j)(P_j / Q) \\ &= F(\partial P / \partial P_j)(P_j / P) < 0\end{aligned}$$

where F is the price elasticity of aggregate market demand for transport (that is, $(\partial Q / \partial P)(P / Q)$, and $(\partial P / \partial P_j)(P_j / P)$ is the elasticity of aggregate price P with respect to the price of mode j. therefore, an explicit conversion of a mode-choice elasticity to an ordinary demand elasticity for a particular mode requires information about either the elasticity of aggregate transport demand with respect to price of each mode (δj) or the price elasticity of aggregate transport demand (F) and the second term in (2). Unfortunately, this information is not available in the studies reviewed here. Consequently, it is virtually impossible to draw on the extensive mode-choice literature to help establish values of the ordinary demand elasticities. However, a special case of (1) for the expression of own-price elasticity, $F_{ij} = M_{ij} + \delta_j$, indicates that, in terms of absolute value, the own-price mode-choice elasticity (M_{ii}) understates the ordinary own-price elasticity (F_{ii}) because δ_i is negative. The size of the difference, $\delta_j = F_{ii} - M_{ii}$, cannot be determined without further information. However, it shows that the own-price elasticities of mode-choice may serve as lower bounds for ordinary elasticities in terms of absolute value. Taplin (1982) suggest that estimates of ordinary elasticities could be constructed from mode-choice elasticity using equation (2) in conjunction with an assumed value for one ordinary demand elasticity, and various constraints on elasticity values based on theoretical considerations. Of course, as noted by Oum T.H et al (1990), the accuracy of the elasticities computed depends heavily upon the validity of the assumed value of the elasticity chosen to initiate the computation.

[10] Refer to Oum T.H (1992:144) and Taplin (1982).

Appendix C: Estimation Outputs

C.1: Elasticity estimates for private transportation demand.

Dependent Variable: LEVEL
Method: Least Squares
Date: 05/17/05 Time: 12:43
Sample(adjusted): 1 813
Included observations: 813 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FUEL	-0.075020	0.023718	-3.163019	0.0016
INVT	-0.181527	0.026728	-6.791701	0.0000
PARK	-0.033792	0.024652	-1.370770	0.1708
C	8.288290	0.528599	15.67973	0.0000

R-squared	0.155292	Mean dependent var	2.000000
Adjusted R-squared	0.152159	S.D. dependent var	0.816999
S.E. of regression	0.752279	Akaike info criterion	2.273488
Sum squared resid	457.8319	Schwarz criterion	2.296616
Log likelihood	-920.1729	F-statistic	49.57569
Durbin-Watson stat	0.269329	Prob(F-statistic)	0.000000

C.2: Elasticity estimates for public transportation demand.

Dependent Variable: LEVEL
Method: Least Squares
Date: 05/17/05 Time: 12:46
Sample(adjusted): 1 813
Included observations: 797
Excluded observations: 16 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FARE	0.152426	0.024156	6.310166	0.0000
INVTP	0.067244	0.028596	2.351492	0.0189
OUTVT	0.101760	0.023954	4.248166	0.0000
CROWD2	-0.294058	0.016969	-17.32868	0.0000
C	1.885407	0.082546	22.84061	0.0000

R-squared	0.372870	Mean dependent var	2.020075
Adjusted R-squared	0.369703	S.D. dependent var	0.812650
S.E. of regression	0.645173	Akaike info criterion	1.967658
Sum squared resid	329.6688	Schwarz criterion	1.997023
Log likelihood	-779.1116	F-statistic	117.7242
Durbin-Watson stat	0.670433	Prob(F-statistic)	0.000000

APPENDIX D

THE QUESTIONNAIRE

NO:

SOAL SELIDIK PENGGUNAAN PENGANGKUTAN PERSENDIRIAN DAN AWAM LEMBAH KLANG

BAHAGIAN A: LATARBELAKANG RESPONDEN

1. Umur:

- ☐ 25 tahun dan ke bawah
- ☐ 26-30 tahun
- ☐ 31-35 tahun
- ☐ 36-40 tahun
- ☐ 41 tahun dan ke atas

2. Gender:

- ☐ Lelaki
- ☐ Perempuan

3. Pendapatan bulanan:

- ☐ RM529 dan ke bawah
- ☐ RM530-RM1059
- ☐ RM1060-RM1589
- ☐ RM1590-RM2119
- ☐ RM2120-RM2649
- ☐ RM2650-RM3179
- ☐ RM3180-RM3709
- ☐ RM3710-RM4239
- ☐ RM4240-RM4769
- ☐ RM4770 dan ke atas

4. Status perkahwinan:

- ☐ Bujang
- ☐ Berkahwin
- ☐ Lain-lain

5. Bilangan anak yang tinggal bersama: ☐

6. Bilangan anak yang bersekolah: ☐

7. Tempat tinggal: ____________________

8. Tempat kerja: ____________________

BAHAGIAN B: MAKLUMAT PERJALANAN

9. Jarak perjalanan anda dari rumah ke tempat kerja

- ☐ 10KM dan ke bawah
- ☐ 11KM hingga 20KM
- ☐ 21KM hingga 30KM
- ☐ 31KM hingga 40KM
- ☐ lebih daripada 40KM

11. Masa perjalanan daripada rumah ke tempat kerja (jika tanpa kesesakan):

- ☐ 30 minit dan ke bawah
- ☐ 31 hingga 40 minit
- ☐ 40 minit hingga 1 jam
- ☐ 1 hingga 1 1/2 jam
- ☐ lebih 1 1/2 jam

10. Kos perjalanan bulanan (Petrol, tol dan parking):

- ☐ RM100 dan ke bawah
- ☐ RM101 - RM200
- ☐ RM201 - RM300
- ☐ RM301 - RM400
- ☐ Lebih daripada RM400

12. Adakah terdapat pengangkutan awam di tempat tinggal anda?

- ☐ Ada
- ☐ Tiada (Terus ke soalan 14)

Sila nyatakan tahap persetujuan anda untuk setiap pernyataan berikut (Mengikut skala *5 -SANGAT SETUJU, 4 -SETUJU, 3 -SEDERHANA SETUJU, 2 -KURANG SETUJU, 1 -TIDAK SETUJU)*

	1	2	3	4	5
13. Perkhidmatan pengangkutan awam mudah diperolehi di tempat tinggal saya	☐	☐	☐	☐	☐
14. Faktor-faktor berikut mempengaruhi penggunaan *pengangkutan persendirian* saya					
14.1 Harga petrol	☐	☐	☐	☐	☐
14.2 Masa perjalanan	☐	☐	☐	☐	☐
14.3 Kos meletak kenderaan	☐	☐	☐	☐	☐
14.4 Bayaran tol	☐	☐	☐	☐	☐
14.5 Kesesakan jalanraya	☐	☐	☐	☐	☐
15. Faktor-faktor berikut mempengaruhi penggunaan *pengangkutan awam* saya.					
14.1 Tambang pengangkutan awam	☐	☐	☐	☐	☐
14.2 Masa perjalanan (In-vehicle time)	☐	☐	☐	☐	☐
14.3 Masa menunggu di stesen	☐	☐	☐	☐	☐
14.4 Keselesaan	☐	☐	☐	☐	☐
14.5 Kesesakan jalanraya	☐	☐	☐	☐	☐

BAHAGIAN C: PILIHAN JENIS PENGANGKUTAN

BAHAGIAN C.1 : NYATAKAN SEJAUHMANAKAH ANDA AKAN MENGURANGKAN PENGGUNAAN PENGANGKUTAN PERSENDIRIAN AKIBAT DARIPADA PERUBAHAN HARGA PETROL, MASA PERJALANAN, DAN KOS MELETAK KENDERAAN. SILA NYATAKAN TAHAP PERUBAHAN TERSEBUT SAMA ADA SANGAT SEDIKIT, SEDIKIT, SEDERHANA, BANYAK, ATAU SANGAT BANYAK.

BIL	FAKTOR PERUBAHAN	PENGURANGAN PENGGUNAAN PENGANGKUTAN PERSENDIRIAN				
a)	***PENINGKATAN HARGA PETROL***	***SANGAT SEDIKIT (≤5%)***	***SEDIKIT (6 - 10%)***	***SEDERHANA (11 - 15%)***	***BANYAK (16 - 20%)***	***SANGAT BANYAK (>20%)***
1.0	Harga meningkat **7 sen hingga 13 sen seliter**	☐	☐	☐	☐	☐
1.1	Harga meningkat **14 sen hingga 20 sen seliter**	☐	☐	☐	☐	☐
1.2	Harga meningkat **21 sen hingga 27 sen seliter**	☐	☐	☐	☐	☐
1.3	Harga meningkat **28 sen hingga 34 sen seliter**	☐	☐	☐	☐	☐
b)	***PENINGKATAN MASA PERJALANAN***					
1.4	Masa perjalanan meningkat **15 hingga 30 minit**	☐	☐	☐	☐	☐
1.5	Masa perjalanan meningkat **31 hingga 45 minit**	☐	☐	☐	☐	☐
1.6	Masa perjalanan meningkat **46 hingga 60 minit**	☐	☐	☐	☐	☐
c)	***PENINGKATAN KOS MELETAK KENDERAAN***					
1.7	Kos meletak kenderaan meningkat **RM1.00 sehari**	☐	☐	☐	☐	☐
1.8	Kos meletak kenderaan meningkat **RM2.00 sehari**	☐	☐	☐	☐	☐
1.9	Kos meletak kenderaan meningkat **RM3.00 sehari**	☐	☐	☐	☐	☐
1.10	Kos meletak kenderaan meningkat **RM4.00 sehari**	☐	☐	☐	☐	☐

BAHAGIAN C.2: NYATAKAN SEJAUHMANA ANDA SANGGUP MENINGKATKAN PENGGUNAAN PENGANGKUTAN AWAM AKIBAT DARIPADA PERUBAHAN TAMBANG, MASA PERJALANAN, MASA MENUNGGU, DAN KESELESAAN. SILA NYATAKAN TAHAP PERUBAHAN TERSEBUT SAMA ADA SANGAT SEDIKIT, SEDIKIT, SEDERHANA, BANYAK, ATAU SANGAT BANYAK.

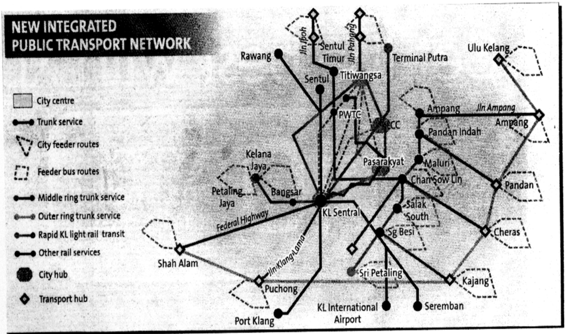
BIL	FAKTOR PERUBAHAN	PENINGKATAN PENGGUNAAN PENGANGKUTAN AWAM				
a)	***PENURUNAN TAMBANG***	***SANGAT SEDIKIT (≤5%)***	***SEDIKIT (6 - 10%)***	***SEDERHANA (11 - 15%)***	***BANYAK (16 - 20%)***	***SANGAT BANYAK (>20%)***
1.7	Tambang tambang turun **kurang daripada RM1.00**	☐	☐	☐	☐	☐
1.8	Tambang turun antara **RM1.00 hingga RM2.00**	☐	☐	☐	☐	☐
1.9	Tambang turun antara **RM2.00 hingga RM3.00**	☐	☐	☐	☐	☐
b)	***PENGURANGAN MASA PERJALANAN***					
1.10	Masa perjalanan turun **15 hingga 30 minit**	☐	☐	☐	☐	☐
1.11	Masa perjalanan turun **31 hingga 45 minit**	☐	☐	☐	☐	☐
1.12	Masa perjalanan turun **46 hingga 60 minit**	☐	☐	☐	☐	☐
c)	***PENGURANGAN MASA MENUNGGU DI STESEN***					
1.13	Masa menunggu turun **15 hingga 30 minit**	☐	☐	☐	☐	☐
1.14	Masa menunggu turun **31 hingga 45 minit**	☐	☐	☐	☐	☐
1.15	Masa menunggu turun **46 hingga 60 minit**	☐	☐	☐	☐	☐
d)	***TAHAP KESESAKAN DI DALAM PENGANGKUTAN AWAM.***					
1.16	Tiada kesesakan	☐	☐	☐	☐	☐
1.17	Keadaan sederhana sesak	☐	☐	☐	☐	☐
1.18	Keadaan sangat sesak	☐	☐	☐	☐	☐

TERIMA KASIH DI ATAS KERJASAMA ANDA

Sebarang pertanyaan emailkan kepada: nurulhuda@um.edu.my

Appendix E

Proposed Public Transport Network



Source: The Star, 27 June 2005.