ADVERSE SELECTION AND MORAL HAZARD EFFECTS IN THE MALAYSIAN MORTGAGE MARKET.

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INTRODUCTION

Adverse selection and moral hazard arise in markets with imperfect or asymmetrical information, i.e., one party has more information than the other, such as the labour market, credit market, and insurance market. Prices in markets with imperfect information may have two effects: sorting and incentive effects (Stiglitz and Weiss, 1981). Interest rates sort customers into three groups, namely, low risk, medium risk, and high risk group. With higher interest rates, low and medium risk groups are more likely to drop out of the market. Therefore, higher interest rates act as a screening device in rationing credit and may adversely sort bad customers with high risk from good customers with low risk.

Credit rationing is a situation where borrowers can not borrow even though they are willing to pay the going interest rate. Credit rationing takes place as a result of the perceived inability of the borrower to pay the loan (higher risk). The adverse selection takes place when honest or conservative borrowers are deterred from borrowing at higher interest rates. But customers who are reckless or careless will borrow because they do not expect to pay the loan back if they go bankrupt. As a result borrowers at higher interest rates may invest in riskier projects to generate higher rates of return and be careless about minimisation of risk (moral hazard).

To reduce the problem of adverse selection and moral hazards financial institutions ration credit, i.e., extending smaller amount of loans to all customers lower than the requirement of the customers (intensive rationing) (Jaffee and Russell, 1976) or to ration some of the customers out of the market (extensive rationing) (Bester, 1985). Therefore, In the presence of adverse selection and moral hazard, the supply of loanable funds will be backward bending or concave over the rising portion of interest rates if credit rationing is used or increasing function in the rate of interest if credit rationing is not used.

Theoretically, credit rationing has been studied extensively in the literature (see for example, Jaffee and Russel 1976; Bester 1981; Stigltz and Weiss 1981 and 1987; and Riley 1987). Empirically few studies have tested the implications of credit rationing (see for example, Nellis and Thom (1983), Stansell and Mitchell (1985), Goodwin (1986), Martin and Smyth (1991), and Marashdeh (1994)).

Marashdeh (1994) studies the impact of adverse selection and moral hazard on the Malaysian credit market over the 1983:1-1993:11 and finds that credit

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rationing is not practised in the Malaysian credit market, i.e., the presence of adverse selection. However, commercial banks were willing to give more loans at higher interest rates which contribute to the problem of moral hazard. He attributed the absence of credit rationing to the enforcement of lending guidelines to the priority sectors during the period of the study and the concern of banks about their profitability as well as the absence of a Deposit Insurance Agency.

Martin and Smyth (1991) tested empirically the implications of adverse selection and moral hazard on the US home mortgage market over 1968:6-1989:3. By using three stage least squares, they estimated two market models (representative loan model and aggregate loan model). They find that the mortgage supply under both models is concave function in the rate of interest, i.e., the presence of adverse selection and moral hazard. Moreover, they find that the optimal interest rate at which the supply function bends backward is equal to 11 percent.

Goodwin (1986) studies the impact of credit rationing on the mortgage market and how it spills over into the housing market. He finds that "a one standard deviation increase in excess mortgage demand (credit rationing) results in a 0.29 standard deviation decrease in houses sold" (p.459). Marashdeh (1993) studies the sectoral demand for credit in Malaysia over the 1972:2-1991:4. He finds that the demands for commercial banks' and finance companies' credit are positively related to real income and real lagged credit demand and negatively related to real interest rates on loans.

The impact of credit rationing on other mortgage markets has not been studied empirically so far, and especially in Malaysia. Moreover, the impact of credit rationing on the Malaysian mortgage market has not been studied yet. Indeed, most of the empirical studies have confined themselves either to the US or U.K mortgage markets. Therefore, the purpose of this paper is to test empirically the impact of adverse selection and moral hazard on the Malaysian mortgage market. The paper modifies the model used by Martin and Smyth (1991) to the Malaysian mortgage credit by using quarterly data over the 1980:1-1993:2 period which has seen two recessions and several years of sustained economic growth. Unconstrained 3SLS is used to estimate the model. The paper, also, highlights the regulatory structure of the mortgage market.

REGULATORY STRUCTURE

The central bank intervened in the housing credit market by adopting two policies to help the low and medium income families to own a house. First, the bank issued lending guidelines to commercial banks and finance companies to extend a certain amount of their credit to finance a minimum number of housing units for the low and medium income families; second, the bank sat a ceiling on the interest rate on housing loans to the low and medium income families. Prior to 1976, commercial banks and finance companies were required to extend at least 50 percent of their total savings to housing loans and long-term government securities. However, in 1976, they were required to extend at least

10 percent of loans outstanding at the end of the previous year to new housing loans. In 1979, new lending guidelines were imposed whereby commercial banks and finance companies were asked to allocate a percentage of their outstanding loans to individual housing. In the case of commercial banks this was 10 percent of their outstanding loans at the end of the previous year and 20 percent in the case of finance companies' outstanding loans at the end of the previous year.

Table 1: Housing Loan Commitments of Commercial Banks and Finance Companies (in thousands of units)

	1982	1983	1984	1985	1986-87	1988-89	April,92 -March,94
A. Commercial Banks							
Total	20	20	20	25	80	75	75
Low-cost houses	na	na	na	na	48	45	na
Bumiputera Community	6	6	6	6	24	22.5	na
Actually financed	19.503	21.708	25.738	26.334	61.529	66.956	54.92*
B. Finance Companies							
Total	5	5	5	7.5	20	25	25
Low-cost houses	na	na	na	na	12	15	na
Bumiputera Community	1.5	1.5	1.5	1.5	6	7.5	na
Actually financed	6.921	6.082	7.651	8.329	19.049	22.318	24.339*

Source: Bank Negara Malaysia, Annual Reports, 1982-1992.   * As at the end of 1993.

Table 1(Continued): Amount of Shortfall or Surplus and (number of non-complying institutions)

	1982	1983	1984	1985	1986-87	1988-89	April,92 -March,94
A. Commercial Banks							
Total	497	+1706	+5738(21)	+6334(11)	18471(26)	8044(16)	20080(21)
Low-cost houses	na	na	na	na	19851(30)	12197(25)	na
Bumiputera Community	1425	308	+1735(27)	+2108(16)	8087(31)	6694(27)	na
B. Finance Companies							
Total	+1921	+1082	+2651(5)	+3329(4)	951(14)	2682(16)	661(9)
Low-cost houses	na	na	na	na	1219(21)	2519(19)	na
Bumiputera Community	16	+373	+705(10)	+606(8)	866(19)	1171(21)	na

Source: Bank Negara Malaysia, Annual Reports, 1982-1992.
* As at the end of 1993, + represents a surplus, **na** is not available.

However, by 1982, commercial banks and finance companies were asked to make firm commitments to finance certain number of new units of houses for low income individuals (see Table 1). In 1985, for example, commercial banks were required to finance at least 25000 units of newly constructed houses costing RM 100,000 or less (7500 units in the case of finance companies), of which 6000 units should be for Bumiputera individuals (1500 units in the case of finance

companies). For the period April 1988- December 1989, commercial banks were required to make firm commitments to finance the purchase of at least 75000 units of houses costing RM 100,000 or less each of which 45,000 units should be for low cost houses costing RM 25,000 or less. Of the total, 25,000 units were for Bumiputera individuals purchase of houses (BNM, 1994, p.167). In March 1990, lending guidelines on housing loans were abandoned as a result of the strong growth of the economy. However, in April 1992, lending guidelines were reinstated because of the difficulty which lower income group found in financing housing costing RM 100,000 or less. As a result, commercial banks and finance companies were asked to finance at least 100,000 units (of which 25000 units by finance companies) costing RM 100,000 or less each, with a commitment value of RM 6 billion. The deadline for the compliance was set at mid March, 1994.

In addition to lending guidelines on housing loans, the central bank fixed the interest rate on housing loans. Effective April 1981, ceiling interest rate on housing loans was raised to 10 percent p.a. from 9 percent p.a. for loans exceeding RM 100,000. However, for loans less than RM 100,000 the ceiling remained at 9 percent p.a. The ceiling was further raised in March 30, 1985 to 11 percent p.a. for housing loans were the cost of land and the house on it is between RM 60,000 and RM 100,000, and to 10 percent p.a. on housing loans costing less than RM 60,000 (BNM, 1985). Interest rate on housing loans for owner-occupied houses costing RM 100,000 or less was set at 1.75 points above the base lending rate (BLR) of each banking institution or 9 percent p.a., /whichever is lower (BNM, 1994, p. 167). Effective November 2, 1992, the government provided an interest subsidy of 1 percent p.a. to commercial banks and finance companies for approved and firmly committed housing loans costing RM 100,000 or less, that is, the customer pays 9 percent p.a. interest. This subsidy was meant for first time buyer owner-occupied house with monthly income of not more than RM 1500 (combined income for married buyers) for purchase or construction of a house costing RM 50,000 or less; and not more than RM 2800 (combined income for married buyers) for houses costing between RM 50,001 and RM 100,000 each.

A question arises here is whether the policy of directing credit to the low and medium income families achieved its goal in giving these families access to house ownership. The answer to this question falls outside the scope of this paper but intuitively one can say to a certain degree it was partially successful with many problems such as the resale of low and medium cost houses by their owners, abandoned or uncompleted projects (around 300 projects), developers' reluctance to build low and medium cost housing. However, one could say that over the period of the study, commercial banks and finance companies were required to finance 407,500 units of low and medium cost housing compared to actual financing of 345,043 units, i.e., a shortfall of 62,457 units. Financial institutions were willing to pay penalty for the shortfall instead of extending credit to low and medium cost housing. Therefore, to evaluate the effectiveness of the policy, one would compare the number of eligible households to the number of units built thus far. However, this is not feasible as data on the

number of eligible household and a breakdown of the number of units built for low and medium cost housing are unavailable.

There are eight different financial institutions that finance housing in Malaysia. They are commercial banks, finance companies, Malaysia Mortgage Finance Bhd, Borneo Housing Mortgage Finance Bhd, Sabah Credit Corporation, Bank Rakyat, National Savings Bank, and Treasury Housing Loans Division. However, this study examines commercial banks' and finance companies' mortgage markets because of lack of quarterly data on other markets. Indeed for the period of study commercial banks and finance companies provided on average more than 50 percent of housing loans (see Table 2 for more details).

Table 2: Housing Loans Outstanding

	1	2		3		2+3
	ALL*	FINANCE COMPANIES		COMMERCIAL BANKS		
Year	Institutions	Total	%	Total	%	As of 1
1980	4986.0	619.8	12.43	2232.1	44.76	57.19
1981	7001.0	833.4	11.90	2811.4	40.15	52.06
1982	9468.3	1072.1	11.32	3197.3	33.76	45.09
1983	11406.9	1282.6	11.24	4157.7	36.44	47.69
1984	13635.3	1542.9	11.31	5129.5	37.61	48.93
1985	16373.0	1828.8	11.16	6306.3	38.51	49.68
1986	18085.0	2075.4	11.47	7038.7	38.92	50.39
1987	20362.0	2162.5	10.62	7259.3	35.65	46.27
1988	21055.0	2333.2	11.08	7713.3	36.63	47.71
1989	22436.0	2671.0	11.90	8142.6	36.29	48.19
1990	25581.0	3365.4	13.15	9588.6	37.48	50.63
1991	29911.0	4288.9	14.33	11587.9	38.74	53.08
1992	32321.0	5077.4	15.70	12702.6	39.30	55.01
1993	36714.0	6039.8	16.45	14508.3	39.51	55.96
Average	19238.2	2513.8	12.43	7312.5	38.12	50.56

Source: Bank Negara Malaysia Annual Reports and Quarterly Bulletins and the Author's calculations.
* All Financial Institutions include commercial banks, finance companies, Malaysia Mortgage Finance Bhd, Borneo Housing Mortgage Finance Bhd, Sabah Credit Corporation, Bank Rakyat, National Savings Bank, and Treasury Housing Loans Division.

THE MODEL

The mortgage loan supply is assumed to depend on interest rate (lending rate). However, in the presence of adverse selection and moral hazard, interest rate on loans is entered as a second degree polynomial which is negatively expected to influence mortgage loan supply if credit rationing is practised. However, if credit rationing is not practised, then interest rate squared is expected to influence mortgage supply positively. In addition, it is expected that the cost of funds will influence the availability of loans. The interest rate on deposits is used to capture

the costs of funds which is negatively expected to influence mortgage loan supply. Competing short and long-term interest rates are expected to influence the mortgage loan supply negatively. With higher interest rates banks and finance companies may divert their funds away from mortgage loans into investment in securities, thus negatively influencing mortgage loan supply. Default rate on loans is expected to influence mortgage loan supply negatively, that is, the higher the default rate is the lower the supply of mortgage loans will be. Profit is adversely affected by the inflation risk. The inflation rate is used to capture the inflation risk.

The mortgage loan demand is basically a derived demand, that is, it arises as a result of activities in the housing market. Therefore, factors affecting the housing market are expected to influence the mortgage loan demand concurrently. Therefore, the mortgage loan demand is assumed to depend on interest rate on loans, current income, rate of inflation in renter's cost, rate of inflation in homeowner's cost, real purchase price of the house, and down payment. Interest rate on loans is negatively influencing the mortgage loan demand. Current income is used rather than permanent income as it is the variable used by banks and finance companies to qualify customers for loans which is positively expected to influence mortgage loan demand (Goodwin, 1986). Down payment is expected to influence mortgage loan demand negatively. The rate of inflation in renter's cost is expected to influence mortgage loan demand positively (Martin and Smyth, 1991). The rate of inflation in homeowner's cost is expected to influence mortgage loan demand negatively (Martin and Smyth, 1991). The real purchase price of the house is expected to influence mortgage loan demand positively (Martin and Smyth, 1991). A dummy variable is added to the loan supply to capture the impact of the removal of lending guidelines on commercial banks and financed companies on the first quarter of 1990. The dummy variable for commercial banks and finance companies takes a value of 1 for 1990:1-1992:1 and a value of zero otherwise.

Therefore, the model could be written as follows for commercial banks and finance companies:

$$Ls_{i,t} = F(RL_{i,t}, RL\ SQUARED_{i,t}, RD_t, RBILL_t, RGS_t,$$
$$DEREGULATION_{i,t}, DEFAULT\ RATE_{i,t}, INFLATION_t)$$

$$Ld_{i,t} = G(RL_{i,t}, INCOME_t, INFRENT_t, INFCOST_t, PRICE_t,$$
$$DOWNPAYMENT_t)$$

where,

Ls is mortgage loan supply deflated by the consumer price index (CPI).

Ld is mortgage loan demand deflated by the CPI.

RL is average lending rate for commercial banks/ finance companies.

RD is the weighted mode deposit rate (rd) of savings and fixed deposits and is calculated as follows: RD= rs(savings deposits/ total deposits) +rf (fixed deposits/total deposits). where rs is the mode savings deposit rate, rf is the

mode 6-months fixed deposit rates, total deposits is the sum of fixed, current, and savings deposit.

DOWNPAYMENT is the down payment on mortgage loans.

RBILL is the rate of interest on 3 months treasury bills.

RGS is rate of interest on 10 years government securities.

INCOME is current income represented by the industrial production index (IPI) deflated by CPI.

DEFAULT RATE is the rate of default on loans.

INFRENT is the annualized rate of inflation in renter's cost.

INFCOST is the annualized rate of inflation in home owner's cost.

PRICE is the real purchase price of the house.

INFLATION is the annualized rate of inflation.

DEREGULATION is a dummy for deregulation of credit guidelines.

t is time index.

i is industry index for commercial banks or finance companies or both.

For estimation purposes the model could be written in semi-log form as:

$$\log Ls_{i,t} = a_1 + a_2 \log RL_{i,t}$$
$$- a_3 \log RL\ SQUARED_{i,t}$$
$$- a_4 \log RD_t$$
$$- a_5 \log RBILL_t$$
$$\pm a_6 DEREGULATION_t$$
$$- a_7 INFLATION_t$$
$$+ e_{1t}$$

$$\log Ld_{i,t} = b_1 - b_2 \log RL_{i,t}$$
$$+ b_3 \log INCOME_t$$
$$+ B_4 INFRENT_t$$
$$- B_5 INFCOST_t$$
$$+ e_{2t}$$

where e_{1t} and e_{2t} are error terms. Moreover, seasonal dummies for the second to the fourth quarter are added to the demand equation. Lack of data on RGS, PRICE, DOWNPAYMENT and DEFAULT RATE led to the exclusion of these variables from the model.

DATA ESTIMATION AND ESTIMATION PROCEDURE

All data for the variables are collected from the Quarterly Bulletin of Bank Negara Malaysia. The rate of inflation in renter's cost is proxied by the rate of

inflation in rent, fuel, and transportation which is calculated as 400*(the change in log(CPI for rent, fuel, and transportation)). The rate of inflation in home owner's cost is proxied by the rate of inflation in furniture, furnishings and house hold equipment which is calculated as 400*(the change in log(CPI for furniture, furnishings and house hold equipment)). The inflation rate is measured as 400*(the change in Log(CPI)).

Three stage least squares is used to estimate the model with partial and without partial adjustment. All exogenous variables in the model are used as instruments in the first stage to estimate the endogenous variables, i.e., average lending rate and loan quantity. Lagged average lending rate was used as an additional instrument for finance companies' average lending rate. The sample period is 1980:1-1993:2. The summary statistics of all variables is reported in Appendix I. The model was estimated in level form as well. The results remained the same as of those of the semi-log, i.e., the model is robust to functional specifications.

The model was re-estimated by using partial adjustment in both demand and supply equations. Partial adjustment in the demand equation enters as those who are denied credit by one institution may search for another (Martin and Smyth, 1991) and through the habit persistence hypothesis (Marashdeh, 1993). Partial adjustment enters the supply equation as lenders might be unable to adjust administratively due to rise in loan applications (Martin and Smyth, 1991).

EMPIRICAL RESULTS

The model was estimated separately for commercial banks, finance companies, and the aggregate of commercial banks and finance companies.

RESULTS FOR COMMERCIAL BANKS' MORTGAGE MARKET

Table 3 reports the three stage least squares estimate of commercial banks mortgage supply and demand over the 1980:3-1993:2 period. The overall fit of the model is good as indicated by the R-bar squared and SEE. For the supply equation, most variables are having the anticipated sign except for t-bill rate. However, the mortgage supply is insensitive to the average lending rate and average lending rate squared. This might be explained by the fact that banks tried to comply with lending guidelines to the housing sector. This, also, could be seen clearly from the sign and significance of the dummy variable for deregulation which measures relaxing of the lending guidelines. The highly significant positive sign for deregulation indicates that banks were willing to offer more mortgage loans when lending guidelines were lifted in 1990:1-1992:1 period. Indeed, lifting lending guidelines increased mortgage supply by 3.04 percent.

The cost of deposits is significantly negatively related to mortgage supply indicating that the higher the cost of deposits the lower the mortgage supply. A 1 percent rise in interest rate on deposits lowers the mortgage supply by 1.35 percent. Interest rate on three months treasury bills is highly significant but

having the wrong sign. This might be due to the fact that commercial banks are required to hold certain percentage of their assets in terms of t-bills. Inflation risk is having the anticipated sign but insignificant.

The demand for mortgage is negatively related to the rate of average lending rate and home owner's cost. A 1 percent rise in average lending rates reduces mortgage demand by 0.51 percent and a 1 percent rise in home owner's cost reduces mortgage demand by 0.3 percent. The demand for mortgage is positively related to income, and renters cost. A 1 percent rise in income increases mortgage demand by 1.18 percent and a 1 percent rise in renter's cost increases mortgage demand by 0.03 percent. The seasonal dummies are statistically insignificant except for the fourth quarter which is negatively influencing mortgage demand.

Table 3: Three Stage Estimate of Commercial Banks' Mortgage Supply And Mortgage Demand Without Partial Adjustment 1980:3-1993:2

	Supply		Demand	
VARIABLE	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
CONSTANT	-0.446932	-0.03	10.38976	40.62*
LENDING RATE	6.192815	0.60	-0.51051	-4.65*
LENDING RATE SQUARED	0.837554	-0.38		
T-BILL RATE	0.965624	9.35*		
DEPOSIT RATE	-1.348670	-9.39*		
DEREGULATION	0.304201	3.49*		
INFLATION RISK	0.002402	0.33		
RENT INFLATION			0.003687	3.95*
INCOME			1.194040	32.81*
COST INFLATION			-0.031469	-10.11*
SECOND QUARTER			-0.023164	-1.39
THIRD QUARTER			-0.007913	-0.47
FOURTH QUARTER			-0.003177	-1.75*
SUMMARY STATISTICS				
RBAR-SQUARED	0.824		0.987	
N	53		53	
DEGREES OF FREEDOM	46		45	
SEE	0.1698		0.0458	

* Statistically significant at the 5% level.

The results from the estimation of the model with partial adjustment in both demand and supply are reported in Table 4. The results are similar to those without the partial adjustment mechanism. The mortgage supply is insensitive to average lending rate. The mortgage supply is increasing function of t-bill rate and lagged mortgage credit supply and a decreasing function of deposit rate. The demand for mortgage is a decreasing function of average lending rate and home owner's cost and increasing function of income, renter's cost and lagged mortgage credit. The data do not support the adverse selection-moral hazard hypothesis in commercial banks' mortgage market.

Table 4: Three Stage Estimate of Commercial Banks' Mortgage Supply And Mortgage Demand With Partial Adjustment 1980:3-1993:2

VARIABLE	Supply		Demand	
	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
CONSTANT	-4.065271	-0.59	9.088143	15.65*
LENDING RATE	4.872619	0.83	-0.4172972	-3.69*
LENDING RATE				
SQUARED	-0.719339	-0.58		
T-BILL RATE	0.414883	5.39*		
DEPOSIT RATE	-0.627545	-5.83*		
LAGGED CREDIT	0.656522	10.44*	0.1190972	2.38*
DEREGULATION	0.168464	3.30*		
INFLATION RISK	-0.000339	-0.10		
RENT INFLATION			0.0033943	3.66*
INCOME			1.0673680	15.65*
COST INFLATION			-0.0292656	-9.12*
SECOND QUARTER			-0.0255814	-1.52
THIRD QUARTER			-0.0064608	-0.39
FOURTH QUARTER			-0.0330394	-1.85*
SUMMARY STATISTICS				
RBAR-SQUARED	0.9389		0.987	
N	52		52	
DEGREES OF FREEDOM	44		43	
SEE	0.0987		0.0461	

* Statistically significant at the 5% level.

Table 5: Three Stage Estimate of Finance Companies' Mortgage Supply And Mortgage Demand Without Partial Adjustment 1980:3-1993:2

VARIABLE	Supply		Demand	
	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
CONSTANT	-53.93113	-3.32*	8.251136	103.55*
LENDING RATE	47.53003	3.75*	-0.046438	-1.49
LENDING RATE				
SQUARED	-9.139160	-3.69*		
T-BILL RATE	0.987186	10.57*		
DEPOSIT RATE	-1.017071	-13.86*		
DEREGULATION	0.146179	2.16*		
INFLATION RISK	-0.001817	-0.30		
RENT INFLATION			0.004168	13.15*
INCOME			1.680626	210.71*
COST INFLATION			-0.024430	-29.37*
SECOND QUARTER			0.003239	0.57
THIRD QUARTER			0.000213	0.04
FOURTH QUARTER			0.005792	0.94
SUMMARY STATISTICS				
RBAR-SQUARED	0.83		0.9986	
N53	53			
DEGREES OF FREEDOM	46		45	
SEE	0.2044		0.01878	

* Statistically significant at the 5% level.

THE RESULTS FOR FINANCE COMPANIES' MORTGAGE MARKET

The three stage estimation of the model for finance companies' mortgage market is reported in Table 5. The overall fit of the model is good as indicated by the R-bar squared and SEE. The mortgage supply is a concave function of the average lending rate. The coefficient for RL is positive and highly significant. A 1 percent rise in RL increases mortgage supply by 47.3 percent. While the coefficient for RL squared is negative and highly significant. A 1 percent rise in RL squared reduces mortgage supply by 9.12 percent.

A point estimate of the finance companies' optimal interest rate at which the loan supply bends backward is obtained by differentiating the loan supply equation with respect to the   average lending rate (RL), that is,

$$dLs/dRL= (a_2 - a'_3 \log RL)Ls/RL$$

The optimal interest rate, RL*, is the implicit solution of dLs/dr=0, that is, the point solution is

$$\text{Log } RL= -a_2/2a_3 \qquad\qquad\qquad (1)$$

substitution of a_2 and a_3 in the above yields the point estimate of RL*= 13.41 for the equation without the partial adjustment. Using the gradient vector from equation 1 and the covariance matrix from the third stage estimates, the ninety-five percent confidence interval for the point estimate, RL*=13.47 percent lies between 11.45 percent and 15.37 percent. The upper bound of this confidence interval is well within the interest rate in the sample. The highest interest rate observed was 15.88 percent in the fourth quarter of 1983. That is, at RL*=13.47 finance companies start to ration credit to reduce the problems of adverse selection and moral hazards.

The coefficient for other variables are as expected except for t-bill rate. Inflation risk and deregulation are having the expected sign but statistically insignificant. Deposit rate is negatively influencing the mortgage supply. A 1 percent rise in deposit rate reduces mortgage supply by 0.95 percent.

All the variables in the mortgage demand are having the anticipated signs. The RL is having the anticipated sign but statistically insignificant. This might be due to the fact that borrowers from finance companies might not be able to borrow from commercial banks or other financial institutions with a lower interest rate. Thus accepting the high interest rates imposed by finance companies. As expected income is positively influencing mortgage demand. A 1 percent rise in income increases mortgage demand by 1.68 percent. Renter's cost is positively influencing mortgage demand. Home owner's cost is negatively influencing mortgage demand. The seasonal dummies are statistically insignificant.

The estimation of the model with the partial adjustment is reported in Table 6. The results of this estimation are similar to those without the partial adjustment model except for the inflation risk which becomes statistically significant at

better than 5 percent level. The mortgage supply is a concave function of RL. The mortgage supply is an increasing function of RL, t-bill rate, and lagged mortgage credit. The mortgage supply is a decreasing function of RL SQUARED, deposit rate, and inflation risk. The point estimate of the finance companies' optimal interest rate for the partial adjustment equation is RL*=13.66 percent. The ninety-five percent confidence interval for the point estimate, RL*=13.66 percent lies between 11.7 percent and 15.53 percent. The mortgage demand is an increasing function of income and renter's cost and a decreasing function of RL and home owner's cost.

Table 6: Three Stage Estimate of Finance Companies' Mortgage Supply And Mortgage Demand With Partial Adjustment 1980:3-1993:2

	Supply		Demand	
VARIABLE	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
CONSTANT	-26.05023	-1.98*	8.242802	48.19*
LENDING RATE	22.34651	2.13*	-0.050960	-1.55
LENDING RATE SQUARED	-4.27397	-2.09*		
T-BILL RATE	0.39969	4.12*		
DEPOSIT RATE	-0.39546	-4.92*		
LAGGED CREDIT	0.60294	8.11*	0.001800	0.10
DEREGULATION	0.06382	1.21		
INFLATION RISK	-0.01059	-2.34*		
RENT INFLATION			0.004450	12.69*
INCOME			1.671604	56.12*
COST INFLATION			-0.023638	-25.06*
SECOND QUARTER			0.005898	0.85
THIRD QUARTER			0.000907	0.13
FOURTH QUARTER			0.006801	0.92
SUMMARY STATISTICS				
RBAR-SQUARED	0.935		0.9986	
N	52		52	
DEGREES OF FREEDOM	44		43	
SEE	0.1251		0.0184	

* Statistically significant at the 5% level.

THE RESULTS FOR AGGREGATE MORTGAGE MARKET

The three stage estimation of the aggregate mortgage supply and demand is reported in Table 7. The mortgage supply is insensitive to the average lending rate and average lending rate squared as in the commercial banks' mortgage supply. The mortgage supply is significantly negatively related to deposit rates and positively related to t-bill rate, and deregulation. All variables in the mortgage demand are having the expected signs. The mortgage demand is a decreasing function of average lending rate, home owner's cost and the fourth quarter dummy.

Table 7: Three Stage Estimate of Aggregate Mortgage Supply And Mortgage Demand Without Partial Adjustment 1980:3-1993:2

	Supply		Demand	
VARIABLE	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
CONSTANT	1.865302	0.09	10.86780	45.31*
LENDING RATE	3.784924	0.22	-0.5720901	-5.71*
LENDING RATE SQUARED	-0.2179748	-0.06		
T-BILL RATE	0.9665203	10.08*		
DEPOSIT RATE	-1.318241	-11.31*		
DEREGULATION	0.2754461	3.44*		
INFLATION RISK	0.0022197	0.32		
RENT INFLATION			0.0045036	6.42*
INCOME			1.317423	57.14*
COST INFLATION			-0.0314611	-13.52*
SECOND QUARTER			-0.0166940	-1.40
THIRD QUARTER			-0.0056387	-0.47
FOURTH QUARTER			-0.0229540	-1.78*
SUMMARY STATISTICS				
RBAR-SQUARED	0.842		0.994	
N	53		53	
DEGREES OF FREEDOM	46		45	
SEE	0.16955		0.03228	

* Statistically significant at the 5% level.

Table 8: Three Stage Estimate of Aggregate Mortgage Supply And Mortgage Demand With Partial Adjustment 1980:3-1993:2

	Supply		Demand	
VARIABLE	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
CONSTANT	-4.700588	-0.39	10.28238	22.46*
LENDING RATE	5.248881	0.53	-0.505579	-4.88*
LENDING RATE SQUARED	-0.726236	-0.35		
T-BILL RATE	0.395207	5.27*		
DEPOSIT RATE	-0.611285	-6.39*		
LAGGED CREDIT	0.634022	10.42*	0.045487	1.27
DEREGULATION	0.150968	3.19*		
INFLATION RISK	-0.001278	-0.32		
RENT INFLATION			0.004175	5.88*
INCOME			1.269931	24.81*
COST INFLATION			-0.030253	-12.47*
SECOND QUARTER			-0.018726	-1.52
THIRD QUARTER			-0.005938	-0.49
FOURTH QUARTER			-0.024129	-1.83*
SUMMARY STATISTICS				
RBAR-SQUARED	0.947		0.994	
N	52		52	
DEGREES OF FREEDOM	44		43	
SEE	0.09735		0.03284	

* Statistically significant at the 5% level.

The mortgage demand is increasing function of income and renter's cost. The three stage estimation of the model with partial adjustment is reported in Table 8. The results are the same as those for the model without the partial adjustment. The partial adjustment in the demand function is insignificant, however.

CONCLUSION

The purpose of this paper was to test empirically the impact of adverse selection and moral hazards on the commercial banks' mortgage market, finance companies' mortgage market and the aggregate mortgage market over the 1980:1-1993:2 period. A mortgage supply and demand were specified in semi=log form and estimated by using unconstrained 3SLS. The model was estimated with partial adjustment and without partial adjustment for the three mortgage markets with a total of six models. The model is robust to functional specifications as the model was estimated in level form and the results remained the similar to those of the semi-log form.

Controlling for average lending rate and average lending rate squared, all the coefficients of the estimated supply and demand functions were significant at the 5 percent level except for inflation risk. The study shows that the commercial banks mortgage supply is insensitive to the average lending rate and average lending rate squared, that is, credit rationing is not practised by commercial banks. Thus the data do not support the adverse selection-moral hazard problem in the case of commercial banks. The results are the same for the aggregate mortgage supply as commercial banks account for the bulk of mortgage credit outstanding. This might be explained by the enforcement of lending guidelines and the imposition of a maximum interest chargeable on low and medium cost housing. Indeed, for the 1990:1-1992:2 period when credit guidelines were removed, mortgage supply increased but lending to the low and medium cost housing declined. This decline led the central bank to reimpose the lending guidelines in April 1992.

However, for finance companies' mortgage supply, the findings support the adverse selection-moral hazard problem, That is, finance companies used credit rationing to reduce the adverse selection moral hazard problem. The optimal average lending rate at which finance companies started to ration credit is around 13.5 percent. The ninety-five percent confidence interval for the point estimate falls between 11.45 percent and 15.55 percent.

The study recommends that the central bank should abandon the policy of fixing the rate of interest on housing loans for the low and medium cost housing in favour of quantitative lending guidelines. The policy of subsidising the interest rate for low and medium cost housing is a step in the right direction. The amount of the subsidy, however, should be determined based on the market forces to compensate financial institutions for the risk undertaken by financing such a group. In addition, to encourage lending to this group, the central bank or an insurance company should act as a guarantor of the housing loans to low and medium cost housing. This type of insurance will reduce the exposure of

financial institutions to the risk associated with lending to low and medium cost housing and thus motivate financial institutions to lend more to low and medium cost housing.

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APPENDIX I: SAMPLE STATISTICS ON DATA

Variable	N	Mean	STD Error	Minimum	Maximum
Endogenous Variables					
Aggregate					
Average lending rate (%)[1]	54	11.130	1.1717	9.4625	12.968
Mortgage credit (million)*[2]	54	9187.2	3800.8	3219.8	16570.
Commercial Banks					
Average lending rate (%)	54	10.607	1.3496	8.4200	12.810
Mortgage credit (million)*	54	6912.2	2686.7	2540.1	11736.
Finance Companies					
Average lending rate (%)	54	12.664	1.3351	10.390	15.880
Mortgage credit (million)*	54	2275.0	1131.7	679.73	4833.5
Exogenous Variables					
a. Instruments					
Deposit rate (%)	54	5.9300	2.1192	2.7576	10.500
T-bill rate (%)	54	5.0954	1.4420	2.1670	7.9770
Inflation rate (%)	53	3.4334	3.8090	-4.2126	16.431
Rent inflation (%)	53	2.3748	7.7622	-31.894	28.183
Cost inflation (%)	53	2.4223	2.8292	-1.3817	13.418
Income (%)*	54	78.406	22.431	44.561	117.83
Deregulation (banks)	54	0.1666	0.37618	0.0000	1.0000
Deregulation (finance)	54	0.4074	0.49597	0.0000	1.0000
b. Others					
CPI(1990=1)	54	0.9249	0.1057	0.7119	1.1220
IPI(1990=1)	54	0.7464	0.2907	0.3696	1.3138
CPI rent(1990=1)	54	0.9724	0.09298	0.7402	1.0930
CPI cost(1990=1)	54	0.9423	0.07580	0.7842	1.0810

* Variables are measured in real terms.

[1] Is a weighted average of commercial banks' average lending rate and finance companies' average lending rate. The weight is their share of the mortgage market.

[2] The total of finance companies' and commercial banks' mortgage credit.