

**Discrimination in Hire/Purchase Lending
By Retailers of Consumer Durables
In Apartheid South Africa**

by

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Published in *Development Southern Africa*, Vol. 13, No. 6, pp. 847-860

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Abstract

A double-hurdle partial observability model of hire/purchase lending is specified and estimated to test for racial discrimination by retailers of consumer durables during apartheid. *Discrimination* is defined as supplying no loans or less desirable loans to two borrowers who do not differ with respect to creditworthiness but who do differ with respect to race. There is strong evidence of discrimination. In particular, black households are 13 percentage points more likely to desire a hire/purchase loan but not to have one supplied to them than are other households equivalent in all ways except race. Although the statistical test cannot determine whether race affected lending because lenders were bigoted or because race is correlated with unobserved characteristics correlated with creditworthiness, increased access to formal loans for all South Africans could be promoted by relaxing the Usury Act and by removing information from loan applications that could reveal an applicant's race.

I. The Importance and Structure of Hire/Purchase Lending

One goal of the Reconstruction and Development Programme (RDP) is to provide access to financial markets to all South Africans. After savings deposits, the most common formal financial product used by black South Africans are hire/purchase agreements between households and retailers of consumer durables such as televisions or furniture (Schreiner, Graham, and Coetzee, 1996). These loans are common among all racial groups in South Africa.

Of all households with access to loans from formal lenders, the poorest households are those with hire/purchase agreements. Therefore, understanding the structure of hire/purchase lending may inform attempts under the RDP to extend the frontier of formal lending.

Even though hire/purchase agreements are legally structured as rental agreements, they are equivalent to conventional installment loans. For example, a borrower may agree to make rental payments of 120 Rands per month for 12 months for a wardrobe with a cash price of 1,000 Rands. Although there is no explicit interest rate, the implicit effective interest rate is about 73% per year.¹ If the borrower misses a payment, then the rental contract is terminated and the lender may repossess the wardrobe. Unless a fee is paid, the borrower loses the wardrobe and the accumulated equity implicit in any payments made before falling into arrears.

The structure of hire/purchase loans is such that lenders are willing to supply them to relatively poor households and that borrowers from relatively poor households are willing to

¹ The cash price is the equivalent of the principal of a loan, and the monthly rental payments are the equivalent of the installment payments of a loan. The monthly effective interest rate is the monthly discount rate that would make the present value of the inflow of the loan principal followed by the outflows of the loan installments be zero. The annual effective interest rate is the monthly effective interest rate multiplied by 12.

demand them. On the supply side, there are at least two reasons why lenders are willing to incur the relatively high transactions costs of supplying small, short loans. First, hire/purchase loans generate their own collateral and are therefore relatively well-secured. If the borrower falls into arrears, then the lender can repossess the consumer durable purchased with the loan. Second, hire/purchase loans generate high yields. As illustrated above, the effective interest rates earned by the lender can easily exceed the limit of imposed by the Usury Act.²

On the demand side, there are at least two reasons why households accept the stringent terms and relatively high interest rates of hire/purchase loans. First, there is a strong demand for the consumer durables that may be financed by hire/purchase loans. Nearly every household uses or would like to use the consumer durables that may be financed with hire/purchase loans. Second, many households that cannot qualify for other types of loans nevertheless have cash flows sufficient to qualify for hire/purchase loans.

Discrimination is defined as providing smaller loans and/or providing loans with more stringent terms to borrowers who are identical with respect to creditworthiness but who differ with respect to characteristics unrelated to creditworthiness, such as race. Even under apartheid, there are at least two reasons to suspect that retailers might not have discriminated in hire/purchase lending for consumer durables. First, a high proportion (14 percent) of black households had hire/purchase debt; indeed, most hire/purchase loans went to black households

² The Usury Act (No. 73 of 1968) limits the interest rate charged on loans larger than 6,000 Rands to 10 percentage points above the prime rate. There is no limit on the interest rate that may be charged on loans smaller than 6,000 Rands. Even if interest rates exceed legal ceilings, they are not necessarily usurious (*e.g.*, Adams, Graham, and Von Pischke, 1984). Making small, short loans to poor households is costly, and cost-coverage requires high interest rates on small loans. Most of the costs of lending do not vary with the size of the loan, and thus the average cost of lending a rand increases as loan size decreases.

(Schreiner, Graham, and Coetzee, 1996, pp. 23-24). Second, profit-maximizing retailers of consumer durables may have based lending decisions purely on creditworthiness.

II. Possible Policy Implications of This Investigation

This study investigates if, during the waning months of apartheid, a potential customer's race affected hire/purchase lending. There are policy implications associated with each of the two possible outcomes of the investigation.

The first possible outcome is that there *is not* any statistical evidence that race affected hire/purchase lending. This would imply that hire/purchase lending embodies a technology and a market structure that reaches relatively poor households regardless of race. There are at least two policy implications of a lack of evidence that race affects hire/purchase lending. First, it implies that if lenders can make well-secured loans and can circumvent interest-rate ceilings and so earn effective interest rates high enough to cover costs, then the natural forces of competition and the market may circumvent artificial political institutions such as apartheid. Second, it implies that profits can induce lenders to incur the costs of supplying small, short loans to relatively poor households. Hire/purchase loans are profitable precisely because their structure skirts the Usury Act and provides for high effective yields.

Of course, many hire/purchase loans would not be subject to the Usury Act even if they were conventional loans because the implicit loan principal is less than 6,000 Rands. The high effective interest rates on hire/purchase loans are not immediately obvious, and thus the structure of hire/purchase loans not only enable them to avoid the Usury Act when applicable, but it also shields them from the public disapproval. Relaxing or repealing the Usury Act would reduce the stigma attached to high interest rates and thus encourage other providers of consumer credit to

supply small, short loans.

In summary, no statistical relationship between race and hire/purchase lending would imply that lenders will supply loans to the poor if it is profitable. If there is competition as well as non-discrimination, then the profits from lending to the poor do not imply exploitation. If lenders are competitive, the extension of formal loans to more households could be facilitated by removing any legal limitations of social stigmas that discourage lenders from covering the costs of extending small, short loans. This could increase the availability of credit cards or bank loans for small consumer purchases, further increasing competition, lowering interest rates for the borrower, and increasing the number of households with access to consumer loans.

The second possible outcome is that there *is* some statistical evidence that race affected hire/purchase lending. The policy implication of this outcome depends on the specific channel through which race affected hire/purchase lending. On the one hand, race may have affected hire/purchase lending not because lenders were bigots but because race may be correlated with economic characteristics which are unobserved by the lender but which are correlated with creditworthiness.³ In this case, the solution is to develop technology so that it is more profitable for the lender to directly observe all characteristics correlated with the creditworthiness of a potential borrower rather than taking race as a proxy for unobserved characteristics.

On the other hand, race may have affected hire/purchase lending because lenders were bigots and, because competition was weak and the desire for profit was weaker than the prejudice, market forces were not the remedy. In this case, the solution is more difficult. Economic incentives clearly are not enough; if they were enough, lenders would not have

³ This is often labeled *statistical discrimination*.

discriminated in the first place. Although a bigoted lender profited from loans to black households, the lender could have made more loans and more profits by lending to more black households.

There are at least two ways to combat prejudice, given that hearts and habits are not completely subject to laws nor to economic incentives. The first way to combat prejudice is by relaxing or repealing the Usury Act, making lending for the purchase of consumer durables more attractive to issuers of credit cards and to banks, the competitors of hire/purchase lenders. Eventually, competition will drive bigots out of business (Becker, 1971).

The second way to combat prejudice is by removing all traces of the race of an applicant from the written credit application. Although race is not explicitly recorded on written applications for hire/purchase loans, applications do include the applicant's address, the applicant's name and, in many cases, the names of parents and relatives. Given the linguistic and cultural/ethnic history of South Africa as well as the geographic implications of apartheid, a person's race is often easily and accurately guessed from an address or a surname. Although written applications are accepted at retail outlets, evaluation usually occurs somewhere else. Thus, the officer in charge of accepting or rejecting the loan application does not meet the potential borrower and does not have firsthand knowledge of the applicant's race.⁴

In summary, reducing the legal limitations and the social stigma associated with high interest rates would encourage lenders to charge interest rates high enough to make lending small amounts to poor households profitable would eventually drive bigoted lenders out of business by

⁴ Of course, the retail outlet must somehow record the name and address of the potential borrower, but this information need not be transmitted to the office where evaluation occurs.

creating competition from other forms of consumer lending, such as bank loans or credit cards. Even in the absence of discrimination, relaxing or repealing the Usury Act would also increase competition and ultimately benefit poor households. Finally, removing obvious clues to a borrower's race from written applications would make being bigoted more difficult.

It turns out that there is strong evidence that hire/purchase lenders discriminated against black households. Controlling for economic factors that affect creditworthiness (and thus supply) and for factors that affect desire for consumer durables (and thus demand), black households are 13 percentage points more likely to desire a hire/purchase loan but not to have one than are other households.⁵

Even though black households have more hire/purchase loans than do other households, some black households without loans are just as creditworthy as some other households with loans. The RDP could facilitate the extension of the frontier of formal loans to black households by relaxing or repealing the Usury Act, thereby increasing the competition faced by the suppliers of hire/purchase loans, and by removing obvious clues to a potential borrower's race from the written loan application.

III. Fundamental Characteristics of Loan Markets and Their Implications For Detecting Discrimination

A model used to detect discrimination should incorporate at least five fundamental characteristics of loan markets. First, observed debt depends on both demand by borrowers and on supply from lenders (Maddala and Trost, 1982). To observe a hire/purchase loan, borrowers must desire a consumer durable, be willing to borrow if they are unable to pay cash or desire not

⁵ *Other households* encompasses coloured, Indian, and white households.

to pay cash even if they can pay cash, and the lender must be willing to supply the loan. If the proportion of black households with hire/purchase debt is relatively high even in the face of discrimination because black households have an even higher demand, then a model ignoring demand could misleadingly find no evidence of discrimination.

The second fundamental characteristic of loan markets is that, even in equilibrium, loans are rationed (Stiglitz and Weiss, 1981). For this paper, *rationing* is defined as when the price and contractual terms do not fully adjust to equalize supply and demand. The main cause of rationing in loan markets is, of course, default; prudent lenders will not meet the demand of non-creditworthy borrowers. In addition, asymmetric information about a potential borrower's creditworthiness may lead to signaling, learning, and enforcement costs so high that the potential transaction never takes place. It also may be prohibitively costly for suppliers of hire/purchase loans to tailor interest rates, transactions costs, and other contractual terms to the individual circumstances of individual borrowers.

On the one hand, rationing implies that if the demand of the borrower is satisfied, then the lender probably would have liked to have lent more. On the other hand, rationing implies that if the lender has lent all the lender would desire, then the demand of the borrower probably is not satisfied. Rationing is not the exception but the rule; it is highly unlikely that borrower and lender would desire exactly the same hire/purchase loan at a given price.

The third fundamental characteristic of loan markets is that both borrower and lender have veto power. Either may ration the other. Under *demand rationing*, the demander is unwilling to borrow as much as the supplier would like to lend. *Supply rationing* is the converse. Both types of rationing are not infrequent with hire/purchase loans. For example, the customers whom the

lender is likely to perceive as creditworthy are exactly those most willing and able to pay cash.

The fourth fundamental characteristic of loan markets is that rationing by either borrower or lender may take two forms. Under *loan rationing*, no loan is transacted although one party would have preferred a transaction. Under *amount rationing*, a loan is transacted but the loan is smaller than one party would have liked. In the case of hire/purchase loans, there is loan rationing because some customers pay cash even though the retailer would like to lend to them and because some customers are denied credit even though they would like to borrow. There is also amount rationing because, in general, the loan is not for the amount one party would have liked.

The fifth and final fundamental characteristic of loan markets is that not all creditworthy households wish to hold debt at all times. Some households that are creditworthy and are willing to borrow to finance consumer durables will not always hold hire/purchase debt simply because they buy consumer durables infrequently and thus may have spells without hire/purchase debt.

The econometric model designed to detect discrimination must account for all five of these factors. Rationing must be carefully distinguished from discrimination, and rationing may originate either with the borrower or with the lender and may take the form of vetoing the entire transaction or a reduction in the amount of the loan. Finally, even creditworthy households usually will not desire to always be indebted, and so lack of debt at any specific time must be distinguished from inability to acquire debt.

There is a correspondence between supply rationing and discrimination. Discrimination is supply rationing that is correlated with race. Supply rationing that is random or supply rationing correlated with economic criteria is not discrimination, but rationing correlated with non-economic criteria is discrimination.

Discrimination may take two forms. The first possible form of discrimination is supply-loan rationing correlated with race. That is, lenders may refuse to supply a loan to black households who are otherwise equivalent to other households who are supplied with a loan.

The second possible form of discrimination is supply-amount rationing correlated with race. That is, lenders may supply smaller loans to black households who are otherwise equivalent to other households who are supplied with larger loans.

IV. Hypothesis and Data

The null hypothesis is that hire/purchase lenders did not discriminate against black households. Independent variables were constructed from comprehensive demographic and economic measurements from a nationwide random sample of 8,848 households surveyed during August-December of 1993, the last months of apartheid (May *et. al.*, 1995; Project For Statistics On Living Standards and Development, 1994).⁶

The survey included questions concerning the sources of the household's outstanding debts, the amount outstanding, and the amount repaid monthly. Even though the data were obtained from households, the model includes all the variables that lenders observe.

The dependent variable was taken as the monthly payment for hire/purchase debt.⁷ The ideal dependent variable would have been the cash price of the consumer durable or the average amount of implicit principal outstanding over a loan's life, but the survey did not collect these

⁶ The authors thank Simon Mpele and Dudley Horner of the South African Labour and Development Research Unit at the University of Cape Town for providing access to the data.

⁷ For black households, non-hire/purchase debts were usually informal debts with shopkeepers, while the most common sources of debt for other households were bank loans or mortgages.

data. The monthly payment for hire/purchase debt is appropriate as a dependent variable because the matching of installment payments to a household's cash flow is very important for both the borrowing and lending decision.

Independent variables may affect only demand, only supply, or both demand and supply. The first two columns of Table I classify the independent variables by inclusion in the supply equation, in the demand equation, or in both equations.⁸

On the demand side, some variables influence demand because they influence repayment ability and thus creditworthiness without influencing supply because they are not observed by the lender. In particular, the lender cannot observe the amount of monthly payments to informal creditors, the existence of other formal debts, nor the employment status of non-applying household members in the primary or secondary labor markets. These economic variables affect demand but not supply.

Several demographic variables influence demand but not supply because they proxy for the life-cycle stage of the household and thus for the desire of the household to acquire consumer durables and to desire finance for them. These variables do not influence supply because the lender does not care why a household wants to buy a consumer durable; the lender only cares about ability and willingness to repay. In particular, the age of the head of the household, the size of the household, and the recent migratory status of the household are likely to influence demand because younger, larger, and newer households are likely to have higher demands for consumer durables. While these demographic variables influence demand, they do not influence willingness

⁸ A table of the means of all independent variables for black households, other households, all households, and all households classified by monthly expenditure quintile is available from the authors.

and ability to repay and are thus unimportant to the lender.

Some economic characteristics influence supply but do not influence demand because they affect the ability to signal repayment capacity without necessarily affecting actual repayment capacity. In particular, applications for hire/purchase loans gather information on the employment status of the borrower and enough information to enable checking for past defaults with a credit bureau. Thus the employment of the household head and home ownership, which may proxy for having a formal credit history, are likely to affect the borrower's ability to signal creditworthiness, even though these variables may not affect actual creditworthiness.

Finally, some monthly expenditure influences both supply and demand because it influences the ability to repay, which in turn influences both supply and demand. For example, large monthly expenditures generally indicate large cash flows and thus large repayment capacity.

The location of a household's residence affects transactions costs and thus influences both demand and supply. In particular, it is more costly for a lender to lend to a rural household than to an urban household because increased geographic distance increases both the level of asymmetric information and the cost of reducing the asymmetry. Delivering the consumer durable is also more expensive when the household is rural. The costs of borrowing also increases for the rural household because distance increases the costs of shopping and of making payments.

The sex of the household head may influence demand because female-headed households are usually single-parent or older households and thus are structurally different than two-parent or younger households. Thus households headed by females may have different demands for consumer durables than do households headed by males. Suppliers may also discriminate on the basis of sex, although the issue is not addressed here.

Race may affect supply through discrimination, and it may affect demand through cultural habits or other effects of the legacy of apartheid.

V. Specifying a Model to Test For Discrimination

One way to test for discrimination via supply-loan rationing correlated with race is with a partial observability model. The model is termed *partial observability* because even though it may be observed that a household does not have any monthly payment for hire/purchase debt, the reasons for this absence are not observed. In particular, the observed absence of debt at the time of a survey could be explained by any of the following unobserved events:

- ! *No rationing*. Neither borrower nor lender desires a transaction, or the borrower is uncreditworthy;
- ! *Demand-loan rationing*. Households are unwilling to borrow, but retailers are willing to lend;
- ! *Supply-loan rationing*. Retailers are unwilling to lend, but households are willing to borrow;
- ! *Purchase infrequency*. The household is willing to borrow and the retailer is willing to lend, but it happens that the household did not buy a consumer durable recently enough that it had not completed payments by the time of the survey..

Of course, if it is observed that a household does have a monthly payment for hire/purchase debt, then it is known that the household was willing to borrow, the retailer was willing to lend, and the household bought a consumer durable via a hire/purchase agreement recently enough that it had not completed payments at the time of the survey.

Thus, the first possible form of discrimination, supply-loan rationing correlated with race, may be detected with a partial observability model where the presence or absence of a monthly payment for hire/purchase debt is observed, but the reasons behind the absence of a monthly payment are not observed.

The second possible form of discrimination, supply-amount rationing correlated with race,

also requires a partial observability model.⁹ If a monthly payment for hire/purchase debt is observed, then the level of the payment is also observed, but it is not observed whether this level results from constraints on the demand side or from constraints on the supply side. That is, the observed monthly payment cannot be greater than what the borrower is willing to pay, nor can it be greater than what the lender is willing to accept in payment.

Thus, the observed monthly payment is the minimum of borrower demand and lender supply. Either supply or demand is unobserved, and, for a given household, it is not known which is observed and which unobserved. The observed amount of monthly payments could result from:

- ! *Supply-amount rationing*. Retailers are unwilling to lend as much as households demand;
- ! *Demand-amount rationing*. Households are unwilling to borrow as much as lenders supply.

These considerations lead to the specification of a double-hurdle model (Cragg, 1971) which incorporates a partial observability model at each of the two hurdles. The first hurdle is a hire/purchase loan occurs or not; the second hurdle is the amount of the monthly repayment. Each hurdle is itself a partial observability model in which the observed outcome is the minimum of unobserved supply and demand (Fair and Jaffee, 1972). It is assumed that the decision of whether to transact or not is independent of the decision of the amount to transact, given that both sides desire a transaction.

Let DL^* be a household's unobserved demand for a hire/purchase loan, where the household demands a loan if DL^* is unity. Let DA^* be the households unobserved demand for a level of monthly payments. Define SL^* and SA^* analogously for supply. Let QA be the observed

⁹ This model is usually called a *disequilibrium* model (Maddala and Nelson, 1974). It is formally equivalent, however, to a partial observability model.

amount of monthly payment. QL , the observed existence of a hire/purchase loan, is unity if QA is positive and zero otherwise.

X_i , with $I=D, S$, are vectors of independent variables influencing supply or demand. X_D includes the regressors common to both demand and supply and the regressors unique to demand. X_S includes the regressors common to both demand and supply and the regressors unique to supply. Identification requires that $X_D \neq X_S$. The elements of X_D and X_S are listed in section IV above and in the first two columns of Table I.

Finally, assume that supply and demand have random elements that are independent and normally distributed and represented by \hat{a}_i , $I=DL^*, SL^*, DA^*$, and SA^* .

In the first hurdle, there is partial observability because QL is observed to be zero if either DL^* or SL^* are negative, but QL is observed to be unity only if both DL^* and SL^* are positive:¹⁰

$$DL^* = \begin{cases} 1 & \text{if } \hat{a}'_{DL} X_D + \hat{a}_{DL} > 0, \\ 0 & \text{otherwise} \end{cases},$$

$$SL^* = \begin{cases} 1 & \text{if } \hat{a}'_{SL} X_S + \hat{a}_{SL} > 0, \\ 0 & \text{otherwise} \end{cases},$$

$$\hat{a}_{DL}, \hat{a}_{SL} \sim Normal(0,1),$$

$$QL = \min(DL^*, SL^*), \text{ and}$$

$$Prob(QL = 1) = Prob(DL^* = 1) Prob(SL^* = 1)$$

$$= Prob(\hat{a}'_{DL} X_D > 0) Prob(\hat{a}'_{SL} X_S > 0).$$

In words, the probability of observing a monthly payment for hire/purchase debt is the product of the probability that the borrower demanded a loan recently enough not to have

¹⁰ This formulation is discussed in Schneider (1993) and is a version of the standard disequilibrium model with limited dependent variables. The model of Abowd and Farber (1982) assumes uncorrelated error terms, while Poirier (1980) allows for correlation. For the model studied here, the Poirier model and the Abowd-Farber model did not differ significantly on the basis of a likelihood ratio test.

completed payments at the time of the survey and the probability that the lender was willing to supply a loan.

For the first hurdle, the probability of supply-loan rationing is $\text{Prob}(DL^*=1)\text{Prob}(SL^*=0)$, that is, the probability that the household demands a loan and that the lender is unwilling to supply one. Discrimination is estimated as the influence of race on the supply-loan rationing. This is simply the difference between the probability of supply-loan rationing for a black household and the probability of supply-loan rationing for an other household, all else held equal:

$$[Pr(DL^* = 1) Pr(SL^* = 1) | Black household] - [Pr(DL^* = 1) Pr(SL^* = 1) | Other household]$$

In the second hurdle, there is partial observability because the observed monthly payment is the minimum of the payment demanded and the payment supplied. The second hurdle is relevant only when the first hurdle has been passed, that is, when households have hire/purchase debt and thus QA is positive:

$$\begin{aligned}
DA^* &= \hat{a}'_{DA} X_D + \hat{a}_{DA}, \\
DS^* &= \hat{a}'_{DS} X_S + \hat{a}_{SA}, \\
QA &= \min(DA^*, SA^*).
\end{aligned}$$

In words, the observed monthly payment is the minimum of the payment demanded and the payment supplied. For the second hurdle, any supply-amount rationing is estimated as the maximum of zero and the difference between the estimated SA^* and the estimated DA^* . Discrimination is estimated as the influence of race on the supply-amount rationing. This is simply the difference between the amount of supply-loan rationing for a black household and the amount of supply-loan rationing for an other household, all else held equal:

$$[\min(DA^*, SA^*) | \textit{Black household}] - [\min(DA^*, SA^*) | \textit{Other household}].$$

This specification is believed to be unique in the literature in that, using cross-section survey data, it considers both supply and demand, the disequilibrium nature of loan markets, the existence of rationing, and the distinction between the loan decision and the amount decision. The models of racial discrimination in lending of Munnell *et. al.* (1996), Leece (1995), Duca (1993), Avery (1981), and Maddala and Trost (1982) use different data or omit one or more of these considerations.

At each hurdle, there are two ways to consider the significance of discrimination. First, discrimination is statistically significant if race has a statistically significant effect on the estimated probability of supply-loan rationing or on the estimated amount of loan-amount rationing. Second, discrimination is economically significant if race has a meaningfully large estimated effect on

supply-loan rationing or on supply-amount rationing.¹¹

VI. Results and Conclusions

The first-hurdle partial observability model was estimated as a Bivariate Probit with LIMDEP (Greene, 1991, pp. 463-472). The estimated coefficients and measures of statistical significance appear in Table I. Most coefficients, in particular those on race and expenditure, are highly statistically significant, and all statistically significant coefficients have the expected sign.

Table I also contains the estimated effects of each regressor on the probability of supply-loan rationing. The average effect of race on the probability of supply-loan rationing over all observations in the data set is 13 percentage points. The size of this effect suggests that discrimination is economically significant. The average standard error of this estimated effect is 7 percentage points. The ratio of the estimated effect of race on the probability of supply-loan rationing to its estimated standard error suggests that discrimination is also statistically significant.¹²

The estimated effects of other important regressors on supply-loan rationing have plausible signs and also seem statistically and economic significant. In particular, employment of the head of the household reduces the probability of supply-loan rationing by 3 percentage points, and changing from the first expenditure quintile to the fourth changes the change in probability of

¹¹ It is not the estimated coefficient associated with race itself that matters, but rather the estimated effect of race on supply-loan rationing and supply-amount rationing. These effects are not equal to the estimated coefficient itself.

¹² The asymptotic standard errors of the changes in the probabilities were calculated by the delta method (Greene, 1993, pp. 297, 645). The distribution of the ratio of the average estimated effect to its average standard error is unknown and so statements about significance are not rigorous.

supply-loan rationing (relative to that of the first quintile) from 23 percentage points to 6 percentage points.

Results that are not presented here but which are available from the authors indicate that the probability of supply-loan rationing is 75 percent for black households and 14 percent for other households. Of the 75 percentage points for black households, 13 percentage points can be attributed to race and 61 percentage points to economic factors such as the correlation between poverty and race.

The second-hurdle partial observability model could not be estimated for technical reasons. The maximum likelihood techniques of Maddala and Nelson (1974) failed because the log-likelihood function is so highly multi-modal that different maxima were achieved for every different set of starting values. In addition, as noted in Maddala (1983), the likelihood function for this model can be unbounded for certain parameter values. Explorations of the parameter space using a genetic algorithm (Dorsey and Mayer, 1995) have thus far produced unreasonable parameter values. Research into these technical estimation problems will continue.

Black households are 13 percentage points more likely to demand a hire/purchase loan but not to have one than are otherwise identical other households. The evidence strongly suggests that retailers in South Africa during apartheid discriminated against blacks when supplying hire/purchase loans. Still, the model cannot rule out the possibility that not all of this result is due to bigotry rather than to any correlation of race with characteristics correlated with creditworthiness but unobserved by lenders.

Whatever the motivations behind supply-loan rationing, it can be reduced by enabling other forms of consumer credit to compete more effectively with hire/purchase loans. The best way to do this is by relaxing or repealing the Usury Act so that small, short loans can be profitable and non-disgraceful to those lenders that would compete with hire/purchase lenders. Small, short loans are costly, but they are the loans demanded by those households beyond the current frontier of formal lending in South Africa.

If bigotry accounts for at least some of the supply-loan rationing associated with race, then formal loans may be extended to more households by removing obvious clues to a potential borrower's race from the written loan application for hire/purchase loans. In particular, there is no reason why a loan evaluator would need to know an applicant's surname or address, but these data reveal an applicant's race. This facilitates bigotry, even if the written application never explicitly asks for an applicant's race.

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Table I: Partial Observability Model For Joint Desire to Borrow/Lend:
Estimated Coefficients and Statistical Difference From Zero,
and Average Estimated Change in Probability of Supply Loan Rationing
Caused By a Change In an Independent Variable and Average Standard Error

| Variable | | Demand | | | Supply | | | Supply Loan Rationing: Effect on Pr(D=1)Pr(S=0) | |
|------------------------------------|---|--------|---------|-----|--------|---------|-----|--|-----------|
| | | Coef. | p-value | | Coef. | p-value | | Ave. Effect | Ave. S.E. |
| Common to Demand and Supply | Black (dummy) | 0.96 | 0.00 | *** | -1.07 | 0.00 | *** | 0.13 | 0.07 |
| | Female Head (dummy) | 0.28 | 0.04 | ** | -0.16 | 0.02 | ** | 0.03 | 0.02 |
| | Rural (dummy) | 0.26 | 0.15 | | 0.03 | 0.67 | | 0.03 | 0.02 |
| | 1 Exp. Quintile (Poorest) (dummy) | 1.91 | 0.06 | * | -4.44 | 0.00 | *** | 0.23 | 0.09 |
| | 2 Exp. Quintile | 1.09 | 0.02 | ** | -1.04 | 0.00 | *** | 0.17 | 0.09 |
| | 3 Exp. Quintile | 1.04 | 0.00 | *** | -0.64 | 0.00 | *** | 0.17 | 0.08 |
| | 4 Exp. Quintile | 0.32 | 0.01 | *** | -0.26 | 0.05 | * | 0.06 | 0.03 |
| Regressors Unique to Demand | Constant | -1.53 | 0.00 | *** | | | | | |
| | Adults in Primary Labor Market | 0.12 | 0.03 | ** | | | | 0.01 | 0.01 |
| | Adults in Secondary Labor Market | 0.29 | 0.03 | ** | | | | 0.03 | 0.02 |
| | Log (Monthly Informal Debt Payment) | 0.03 | 0.00 | *** | | | | 0.00 | 0.00 |
| | Non-hire/purchase Formal Debt (dummy) | 0.10 | 0.31 | | | | | 0.01 | 0.01 |
| | Household Head Age \geq 65 (dummy) | -0.93 | 0.00 | *** | | | | -0.10 | 0.05 |
| | Household Head 36<Age \leq 64 (dummy) | -0.47 | 0.00 | *** | | | | -0.04 | 0.02 |
| | Childless (dummy) | -0.10 | 0.27 | | | | | -0.01 | 0.01 |
| | Adult Equivalents | 0.33 | 0.00 | *** | | | | 0.01 | 0.01 |
| | Migrated in past 5 years (dummy) | 0.15 | 0.17 | | | | | 0.01 | 0.01 |
| Regressors Unique to Supply | Constant | | | | 0.78 | 0.00 | *** | | |
| | Employed Head (dummy) | | | | 0.17 | 0.01 | *** | -0.03 | 0.01 |
| | Non-mortgage, Non-hire/purchase Formal Debt | | | | -0.00 | 1.00 | | 0.00 | 0.02 |
| | Log (Equity in Home) | | | | -0.02 | 0.03 | ** | 0.00 | 0.00 |
| | Mortgage (dummy) | | | | 0.20 | 0.12 | | -0.04 | 0.02 |
| | Own Home (dummy) | | | | 0.12 | 0.15 | | -0.02 | 0.01 |

Log-likelihood: -2513.2, n=6018

*** Significant at .01, ** Significant at .05, * Significant at .10