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by

B. Hillier and T. Worrall

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Department of Economics and Accounting,
University of Liverpool
P.O. Box 147, Liverpool, L69 3BX
Fax No: 051-794-3028

THE WELFARE IMPLICATIONS OF COSTLY MONITORING

IN THE CREDIT MARKET

Brian Hillier and Tim Worrall

Department of Economics and Accounting
University of Liverpool

ABSTRACT

Various explanations of credit rationing are based upon asymmetries of information. It has been suggested that rationing represents a sub-optimal allocation. We examine this claim using a general equilibrium model with hidden information and costly monitoring. If credit is rationed the equilibrium is indeed sub-optimal yet social efficiency requires that credit be more tightly rationed. The reason is that loan applicants are charged for the average expected monitoring costs whereas efficiency dictates that they should bear the marginal monitoring costs which includes the effect of a rise in the interest rate on the total number of defaulting loans. A similar inefficiency can occur even in the absence of rationing and may require the introduction of rationing to correct it.

1. Introduction

A substantial literature examines how credit markets respond to problems of asymmetric information.[1] One common conclusion is that borrowing is reduced below the socially optimum level.[2] This paper examines the welfare implications of asymmetric information in the credit market and in particular whether credit rationing *per se* provides a rationale for government intervention.

There are a number of important problems in using existing results to justify policy intervention. First, the results themselves are not robust to small changes; for instance the Stiglitz and Weiss (1981) model of adverse selection is transformed into a model of favourable selection if the assumption that project payoffs differ according to a mean preserving spread is replaced by the assumption that project payoffs differ in means rather than in spreads.[3] Second, in much of the literature agents are not fully optimising and the form of the debt contract is assumed rather than derived from features of the model. Third, the appropriate benchmark for assessing the efficacy of intervention is constrained efficiency; that is what a social planner who does not have access to private information can achieve. It is not enough simply to show that the market solution does not attain the first-best. Fourth, most models are partial equilibrium and less amenable to welfare analysis than a general equilibrium model in which it is possible to trace through all of the effects of any policy.

One model that does not suffer from these defects is Williamson (1986). He presents a general equilibrium model with two types of agents, capitalists and entrepreneurs, and costly monitoring of entrepreneurs' project returns. The form of the debt contract is derived from

[1] For a recent survey of this literature see Hillier and Ibrahimo, (forthcoming).

[2] There are models where asymmetric information leads to increased borrowing. See e.g. Bester (1985) and de Meza and Webb (1987).

[3] See Hillier and Ibrahimo (1992) for a discussion.

optimising behaviour. Using this model and adopting a utilitarian approach (assuming that the welfare of capitalists and entrepreneurs can be added together) we derive the welfare implications of costly monitoring and examine various policy interventions.[4]

Our main result is that monitoring costs operate within the model like an externality such that the market equilibrium, with or without rationing, may be inefficient. There may, therefore, be a role for policy to correct for this inefficiency. The optimal policy depends upon assumptions about the information and instruments available to the government but, perhaps surprisingly, even when there is rationing a corrective policy might be aimed not at increasing the level of investment but at reducing it. The intuition is that the market may produce too much of the externality so that there is excessive monitoring in equilibrium and policy should then aim at a reduction in investment.[5]

Sections 2 and 3 present the model. Section 4 examines the efficiency of the market solution and Section 5 considers policy options. The final section concludes. .

[4] Williamson was reluctant to use the model "to draw normative conclusions for monetary policy" since to do this the "model would have to be embedded in a more fully-specified dynamic general equilibrium framework" (1986, p.178). Having embedded the model in such a framework in a later paper, he concluded only that "rigorous welfare analysis in this model would be a topic for another paper, there appears (at least to me) to be no obvious role for 'stabilization policy' that arises from the existence of unemployed resources and credit rationing in equilibrium" (1987, p.1215).

[5] The asymmetry of information in the model of this paper gives rise to the problem of moral hazard with hidden information. Other papers which have examined the policy implications of adverse selection or moral hazard with hidden actions include Stiglitz and Weiss (1981), Mankiw (1986) and Hillier and Ibrahimo (1992) although none of these papers adopt the general equilibrium perspective we adopt and all take the form of the debt contract as given exogenously. Papers which have examined agency problems in a more macroeconomic context include Williamson (1987) and Bernanke and Gertler (1989).

2. The Model

There are two periods. Period zero is a planning period in which borrowing, lending and investment can take place. In period one loans are settled with monitoring if necessary and consumption takes place. There is a single consumption good which if not invested perishes between period zero and period one. There is a countable infinity of agents; there is a proportion α of capitalists and a proportion $(1 - \alpha)$ of entrepreneurs in the population. $\overline{w}$

Entrepreneurs

Each entrepreneur is risk neutral and is endowed with zero units of consumption good in period zero. Each has access to an investment project of size K, where K is an integer greater than or equal to 2, which yields a random return of Kw units of the consumption good in period one if funded. It is assumed that w is distributed according to the probability distribution function $F(.): [0, \overline{w}] \rightarrow [0,1]$ identically and independently for each entrepreneur and that F is twice continuously differentiable. The information asymmetry in the model is that although all agents know $F(.)$, the ex post realization of w is the private information of the entrepreneur concerned. In order to learn the return on any one risky project in period one, any other agent must expend c units of effort per dollar loaned, where $c > 0$.

Capitalists

At period zero each capitalist has a single indivisible unit of capital and access to a technology which transforms this single unit into $t \geq 1$ units at period one. This term t is the safe rate of return for capitalists. Denote $H( ) : [\underline{t},t] \rightarrow [0,1]$ as the probability distribution function such that $H(t')$ is the probability that a capitalist picked at random has a safe return $t \leq t'$. A capitalist can either put his capital on deposit with a bank, invest in his own safe project or lend to an entrepreneur.

Banks

Williamson (1986) shows that within this framework a standard debt contract is the optimal financial contract and financial intermediation via banks dominates direct lending by individuals. Entrepreneurs are offered standard debt contracts so the bank collects

$$\begin{array}{lll} R & \text{if} & w \geq R \\ w & \text{if} & w < R \end{array}$$

per dollar loaned. Banks observe w by expending c units of effort on monitoring only if $w < R$. We call R the quoted loan factor (i.e. one plus the quoted interest rate on loans).

The intuition for these results is simple. Given the information asymmetry the non-default payoff R is a constant because no entrepreneur would ever choose to pay to the lender more than the minimum amount necessary to prevent monitoring. The default payoff, $R(w)$, must obviously be less than or equal to w. If $R(w) < w$ then it would be possible to raise $R(w)$ whilst lowering R so that the borrower's expected repayment remains the same; this would leave the borrower no worse off but yield a gain to the lender by reducing expected monitoring costs and would proceed until $R(w) = w$. Lenders monitor whenever entrepreneurs claim to be unable to repay R per dollar loaned since if they did not do so entrepreneurs would have an incentive to default and keep returns to themselves even when projects were successful.[6] Intermediation dominates direct lending since banks economize on monitoring costs; a bank monitors a defaulting loan only once compared with each lender needing to monitor individually under direct lending. Given the dominance of intermediation we do not consider direct lending in this paper.

Supply of funds

If banks offer an interest factor r on deposits then those capitalists whose safe rate is less than r will put their unit of consumption good on deposit at a bank. Therefore the per capita supply of funds from capitalists to banks is

$$q^S(r) = \alpha H(r). \tag{1}$$

[6] Like Williamson we consider only pure strategy contracts, ie those with deterministic monitoring of defaulting loans.

Per capita supply increases in r and is vertical at $q = \alpha$ for $r \geq t$. By competition between banks the deposit rate is equal to the rate of return earned by banks on a dollar loan in equilibrium and banks make zero profits. Therefore, given the standard debt contract

$$r = \int_0^R (w-c)\, dF + \int_R^{\bar{w}} R\, dF.$$

Integrating by parts and rearranging gives

$$R = r + \int_0^R F(w)\, dw + cF(R). \qquad (2)$$

The quoted loan factor is made up of three terms: the interest factor on deposits, a default risk premium and the average expected monitoring cost. The default risk premium reflects the fact that only non-defaulting loans actually pay R per dollar to the bank. Entrepreneurs and banks know that there is a probability of default attached to each funded project. The amount per dollar paid to the bank from defaulting loans is less than R and the expected payment per dollar loaned is, therefore, less than R. The third term, $cF(R)$, is the expected average monitoring costs which are incurred by the bank on each dollar loaned; c is the monitoring cost per dollar loaned and this is incurred on all defaulting loans i.e. those with a payoff less than R.

Write the deposit factor as a function of the quoted loan factor, $r = r(R;c)$. Assume that $r(R;c)$ has a unique maximum at R_{max} in the interior of $[0,w]$ and that $r(R;c)$ is strictly increasing for $R < R_{max}$[7]. Differentiating equation (2) R_{max} satisfies[8]

$$F(R_{max}) + cf(R_{max}) = 1.$$

The supply of loans from banks to entrepreneurs can therefore be written as a function of R

$$q^s(R) = \alpha H(r(R;c)) \qquad (3)$$

which since H is increasing reaches a maximum at $q_{max} = \alpha H(r(R_{max};c))$ so that the loan supply curve bends backward above R_{max}.[9] The intuitive explanation of the backward bending supply curve is as follows. As the quoted loan factor rises banks earn greater returns from non-

[7] A sufficient condition is that r(R;c) is concave which requires $f(R)+cf'(R)>0$. This is satisfied by the uniform distribution and the exponential distribution, $f(w)=1-e^{-\lambda w}$ for $\lambda<1/c$.

[8] An increase in monitoring cost will reduce $R_{max}(c)$ and $r(R_{max}(c);c)$ at the margin.

[9] Concavity of the supply function requires $h(r)r''(R;c)+h'(r)(r'(R;c))^2<0$.

defaulting loans but incur extra monitoring costs as more borrowers default. When the latter effect dominates the expected returns for the lender fall as the quoted loan factor rises and the supply of loanable funds will decline as a result. Therefore banks will never choose to set the quoted loan factor above R_{max} at which point the monitoring cost effect begins to dominate.

Demand for loans

If p is the price entrepreneurs expect to pay for a dollar loan then, because all entrepreneurs are identical and risk neutral, per capita demand for loans is

$$\begin{aligned} q^d(p) &= 0 \qquad && \text{if} \qquad && p > Ew \\ q^d(p) &= (1-\alpha)K \qquad && \text{if} \qquad && p \leq Ew \end{aligned} \tag{4}$$

where Ew is the expected output. Given the standard debt contract the expected payment p is given by the equation

$$p(R) = R - \int_0^R F(w)\, dw \tag{5}$$

which from equation (2) is equal to $r(R;c) + cF(R)$, the deposit factor plus the average expected monitoring cost. Thus defaults cause p to be less than R and monitoring costs cause p to exceed r. Since $p(\overline{w}) = Ew$ entrepreneurs will demand no loans for $R > \overline{w}$.

3. Market Equilibrium

Assume that $\alpha H(Ew) > (1-\alpha)K$ so that absent information asymmetries credit will not be rationed.[10] With asymmetric information the backward bending supply curve for loanable funds means that the market equilibrium may or may not involve credit rationing as illustrated in Figure 1. The figure has per capita loans, q, on the horizontal axis and the quoted loan factor, R, and deposit factor, r, on the vertical axis. The loan supply schedule as a function of R, $q^s(R)$, is

[10] Absent information asymmetries r equals $r(R,0)$. Thus r is $E(w)$ when R is w so that the supply of funds becomes $\alpha H(Ew)$.

backward bending and the loan demand schedule as a function of R, $q^d(R)$, is the simple step function with demand equal $(1\text{-}\alpha)K$ for $R \leq w$ and zero otherwise. Figure 1(a) shows the equilibrium with rationing, which following

[FIGURE 1 ABOUT HERE]

Williamson we call the RA case, and figure 1(b) shows the non-rationing, or NRA, case. Letting R^* be the equilibrium quoted loan factor, equilibrium quantity is $q^* = \alpha H(r(R^*;c))$. In Figure 1(a) $q_{max} = \alpha H(r(R_{max};c)) < (1\text{-}\alpha)K$ so the market equilibrium in this case involves credit rationing with $q^* = q_{max}$ and $R^* = R_{max}$ and the deposit rate is $r^* = r_{max} = r(R_{max};c)$. There is excess demand for loans in equilibrium: loan supply q_{max} is less than demand $(1 - \alpha)K$. Loan applicants are randomly rationed, each having a probability of $q_{max}/(1\text{-}\alpha)K$ of receiving a loan.[11] Unsuccessful applicants cannot bid loans away from other entrepreneurs or draw additional funds into the market by offering a higher interest factor since banks would lose from charging an interest factor above R_{max}. In figure 1(b) competition between banks drives the equilibrium quoted loan factor to the intersection of the loan demand and loan supply schedules. In this case $\alpha H(r(R_{max};c)) > (1\text{-}\alpha)K$ and the equilibrium R^* satisfies $(1\text{-}\alpha)K = \alpha H(r(R^*;c))$ and the equilibrium deposit rate is $r^* = r(R^*;c)$.

4. Market efficiency

The market equilibrium need not be socially efficient because it does not equate marginal social benefit to marginal social cost. In finding the efficient quantity of loans it is helpful to

[11] In general rationing may be either proportional or random or, to use Keeton's (1979) terminology, `type 1' or `type 2' rationing. In type 1 rationing an individual borrower receives a smaller loan than he would like given the quoted interest rate. In type 2 rationing even though all applicants appear identical to lenders some loan applicants receive credit whilst others do not; this is the type of rationing examined in this paper.

invert the supply of funds function of equation (1) and write $r(q) = H^{1}(q/\alpha)$. Also since no R greater than R_{max} will be quoted in equilibrium we restrict R to $[0,R_{max}]$ and since $r(R;c)$ is increasing by assumption in this interval it is possible to invert the supply function in equation (3) and write $R = R(q)$ where the dependence upon the monitoring cost is notationally suppressed. Average monitoring cost as a function of q is $amc(q) = cF(R(q))$ and from equation (5), $p(q) = R(q) - \int_0^{R(q)} F(w)\, dw$. Therefore substituting into equation (2) gives

$$p(q) = r(q) + amc(q).$$

Average monitoring cost is an increasing function of q with an infinite slope at q_{max}. In the RA case $p^* = p_{max} = r(q_{max}) + amc(q_{max})$ and in the NRA $p^* = p(q^*) = r((1-\alpha)K) + amc((1-\alpha)K)$.

Efficiency requires that marginal social benefit be equated to marginal social cost. Marginal social benefit is measured by the demand for loans schedule as a function of p and is given in equation (4). The marginal social cost is the sum of the marginal cost of funds as measured by the deposit factor r and the marginal monitoring cost.[12] Denoting marginal social cost as *msc* and marginal monitoring cost as *mmc* we have

$$msc(q) = r(q) + mmc(q).$$

Since $amc(q)$ is increasing $mmc(q) > amc(q)$ and hence $msc(q) > p(q)$. The marginal social cost curve asymptotes to infinity at q_{max}. There are three possibilities which are illustrated in Figure 2. Figure 2 has q on the horizontal axis and *msc, p* and *r* on the vertical axis; the demand schedule, $q^d(p)$, is the simple step function with demand equal $(1-\alpha)K$ for $p \leq Ew$ and zero otherwise, with market equilibrium either at the intersection of the $q^d(p)$ and $p(q)$ lines in the market clearing cases or at $q^* = q_{max}$ and $p^* = p_{max} < Ew$ in the rationing case. Figure 2(a) illustrates the RA case. In the NRA case either the marginal social cost curve cuts the marginal benefit curve below $(1-\alpha)K$, $msc((1-\alpha)K) > Ew$ (Figure 2(b)(i)) or $msc((1-\alpha)K) < Ew$ (Figure 2(b)(ii)).

[12] We shall see in the next section that it is possible to avoid monitoring costs altogether under a particular policy intervention, thus making marginal social cost equal to the deposit factor.

[FIGURE 2 ABOUT HERE]

In Figure 2(a) the market equilibrium involves credit rationing with $q^* = q_{max}$ and $p^* = p_{max} < Ew$. The total surplus at this point is the area between the marginal benefit and marginal social cost curves, $a+d+h+l+s$ minus the area v. Clearly the total surplus is maximised by reducing the quantity of loans to q' where the marginal benefit and marginal social cost curves intersect. The increase in total welfare is the area v, which is equal to the excess of marginal social costs over marginal social benefit lines between q^* and q'.[13]

In Figure 2(b)(i) there is no rationing at the market equilibrium yet efficiency requires that loans should be rationed to q' and if this is done there will again be a welfare increase equal to area v. In Figure 2(b)(ii) even though marginal social cost lies above the $p(q)$ curve the market provides the efficient quantity of loans, namely $(1-\alpha)K = q^*$ since at this quantity the marginal social cost curve still lies below the marginal benefit curve.

The reason for the potential inefficiency is not hard to find: monitoring costs act as an externality. Banks in deciding whether an extra loan is worthwhile consider only if the expected repayment will cover the expected average monitoring cost plus what must be paid to depositors to secure funds. A bank does not care that the extra loan will lead to a rise in the quoted loan factor leading to more defaults and higher monitoring costs since these costs are passed on to borrowers. The market outcome produces too many loans and excess monitoring costs.

5. Policy Options

In this section we consider various policy options available to a social planner who wishes to maximize the sum of welfare of the population. Throughout it is assumed that the

[13] An alternative way to see this is to examine the changes in the component parts of the surplus (ie entrepreneurs surplus and capitalists surplus) in moving from q^* to q'.

planner has no informational advantage over lenders in the market. In particular the planner cannot observe the outcome of entrepreneurs' projects. It will however be assumed that the planner knows the distribution function *F( )* and the distribution function *H( )*.

lump-sum taxes

Consider first the case where the planner can impose lump-sum taxes on capitalists; that is he can distinguish *ex ante* between capitalists and entrepreneurs. By assumption in the absence of monitoring costs it is optimal to fund all projects. If the planner can impose lump-sum taxes on capitalists then he can achieve this by circumventing monitoring costs entirely. The planner confiscates all the initial endowments held by capitalists. He transfers these endowments to entrepreneurs giving each K units and allows capitalist to borrow back the remaining funds, $\alpha-(1-\alpha)K$, at a given interest factor $r_s = r((1-\alpha)K)$. Capitalists whose safe projects have interest factors greater than r_s will choose to borrow, those with lower safe factors will choose not to borrow.[14]

[FIGURE 3 ABOUT HERE]

Figure 3(a) illustrates the policy for the RA case. The market equilibrium is at q^* with $p^* = p_{max}$ and $r^* = r_{max}$. Confiscation of the capitalists endowments means that they loose welfare equal to the area $a+b+c+d+e+l$ but those capitalists with safe rates higher than r_s regain the area l. The entrepreneurs' surplus increases by $a+b+c+d+f+g+h+i+j+k$ and the planner raises revenue equal to area e. The total net gain of the policy is equal to the area $f+g+h+i+j+k$. This can be divided into two parts: the savings in monitoring costs equal to area $f+g+i+j$, and the welfare "triangle", $h+k$, which arises as more projects are funded at an expected price below the expected return.

If the planner can identify each capitalist with his safe rate of return then the proceeds

[14] It is assumed that any capitalists who borrow and default will have all their returns confiscated so that default is never optimal for a capitalist.

could be redistributed to capitalists who chose not to borrow, but if this is not the case and the returns were given to any capitalist who chose not to borrow then some capitalists with a safe factor above r_s would choose not borrow to self invest, i.e. there would be a reduction in area *l* unless the interest charged to capitalists who borrow was adjusted appropriately.

Figure 3(b) shows the effects of the policy in the NRA case. Here $r_s = r^*$ and there is no welfare triangle gain as all projects are funded in market equilibrium anyway but the policy does lead to a saving in monitoring costs equal to the area f+g.

Since the lump-sum tax policy completely eradicated monitoring costs it is the welfare maximizing policy. Nevertheless there are a number of reasons why the lump-sum tax policy may be unacceptable. First, the policy does not bring about a Pareto improvement: although it increases total welfare entrepreneurs gain considerably at the expense of capitalists. It is not possible to eliminate monitoring costs and simultaneously tax entrepreneurs since by assumption they would have to be monitored before any taxes could be collected. Also the policy of completely subsidising risky loans would seem a rather special feature of this particular model. Indeed it is doubtful that the proposal would be robust if the model were extended to allow for problems of moral hazard with hidden actions and/or adverse selection. Furthermore, this policy can only be carried out if the government is able to distinguish capitalists from entrepreneurs and confiscate their endowments before they engage in transactions with banks.

regulation

If lump-sum taxes are infeasible it is possible to increase total welfare through regulation of the banking sector by imposing a cap on the interest factor charged or paid by banks, which may either increase or introduce rationing depending on the circumstances. For example in the RA case of figure 2(a) a regulation-Q type policy of imposing a maximum deposit rate factor of r' will cut the amount of deposits and investment to q' and the quoted loan factor to R'. This increases rationing and yields a net gain in welfare equal to area v, which is the excess of marginal social costs over marginal social benefits as investment rises beyond q' towards q_{max} in the absence of the policy intervention. In the NRA case of figure 2(b)(i) a similar policy could also yield a gain in welfare equal to area *v*. It may, therefore, be beneficial to introduce rationing by capping the interest rate on deposits; although it is possible that no such intervention is merited for the NRA case as may be seen by examining figure 2(b)(ii), since in that case marginal social benefits exceed marginal social costs at q^* and it would not be beneficial to reduce investment.[15]

As with the lump sum tax policy discussed above, the welfare improvement brought about by the interest rate cap is measured by the increase in the population sum of welfare and does not represent a Pareto improvement: entrepreneurs gain *ex ante* and in sum *ex post*, but individual entrepreneurs hit by the introduction or increase in rationing lose *ex post* as do capitalists whose safe rate lies below r^*. The welfare gain, area *v*, may be shown to be the difference between the expected gain to entrepreneurs and the loss to capitalists. Since this policy does not eliminate monitoring costs it is clearly less effective, even if more plausible, than the lump-sum tax policy; it is, however, as we shall see, the next best policy and more efficient than any tax-based intervention.[16]

corrective taxes

In the case of a standard technological externality it would be possible to find a corrective tax which could achieve the same gain in welfare as the policy of regulation discussed above. In a figure like 2(a) if the externality were technological it would be desirable and straightforward to impose taxes designed to reduce the quantity of loans to q'.

Monitoring costs, however, are a pecuniary externality in the sense that the amount of monitoring costs produced by the economy depends not only on the quantity of loans produced (as with a technological externality) but also on the price of loans, a higher quoted loan factor, *R,*

[15] Another regulatory policy which could have identical effects within the framework of the model would be to control the quantity of loans rather than to cap the deposit rate.

[16] A similar usury law was also proposed by Stiglitz and Weiss (1981) although in a different model.

inducing more monitoring costs for a given quantity of loans than a lower *R*.[17] Since taxes work through prices as well as quantities they affect the position of curves derived for specific combinations of *R* and *q*, for example the *msc(q)* curve in figure 2(a) which was derived for those combinations of *R* and *q* produced in the absence of taxes (introducing taxes will change the loan factor *R* associated with any *q* and so change the position of the *msc(q)* line). Thus the quantity of loans at which marginal social cost equals marginal social benefit cannot be determined independently of the tax regime. Tax policy cannot, therefore, be simply designed to produce a given quantity of loans equal to that which equates marginal social costs and benefits in the absence of taxes.

Since different taxes operate differentially on prices and quantities it is necessary to calculate the optimum tax or mix of taxes to use. The planner could consider taxes on: a) monitoring costs; b) entrepreneurs' returns; c) loans; d) deposits. Of these four possibilities the first dominates the rest. Briefly, a tax on entrepreneurs' returns would have to involve a lump-sum tax on non-defaulting entrepreneurs (since any other tax would necessitate monitoring all returns to observe them) and a possibly return-dependent amount for defaulters. Since the tax on defaulters would reduce the return to banks from defaulting loans it is equivalent to a tax on monitoring costs and the scheme as a whole is equivalent to a tax on monitoring costs plus a tax on non-defaulters. The tax on non-defaulters serves only to push up the before-tax return necessary to avoid default and so pushes up the default rate and associated monitoring costs for any level of loans; it is, therefore, counter-productive and a better way to reduce loans is to tax only monitoring costs. Taxes on loans or on deposits produce a higher loan factor for any

[17] In classic competitive models pecuniary externalities have distributional and allocative effects but create no deadweight loss. However this is not the case here. Our result supports the earlier argument by Arnott and Stiglitz that "in an economy with moral hazard, pecuniary externalities 'matter' ... government intervention is justified to internalize the externality" (1986, p17). Arnott and Stiglitz were talking about moral hazard with hidden actions so our result extends theirs by providing an example for the case of moral hazard with hidden information. Although Greenwald and Stiglitz concluded for economies characterized by moral hazard with hidden actions that "there virtually always exists a tax subsidy that is Pareto improving" (1986, p.238) we are unable to find Pareto improvements in our model economy

quantity of loans and, therefore, more monitoring costs than would be produced by a tax on monitoring costs capable of producing the same loan quantity.[18] Thus the preferred tax is a tax on monitoring costs.

A per unit tax on monitoring costs, τ, will reduce the supply of loans at any loan factor since it reduces the average returns to the banks. It also reduces q_{max} and R_{max}. If rationing occurs in the absence of intervention an increase in τ will cause the loan factor and quantity of loans to fall, both these effects causing a reduction in monitoring costs through a lower default rate on a lower level of loans. The beneficial effects must be balanced against the lower expected level of returns due to the lower quantity of loans. The optimal τ is that at which the marginal saving in monitoring costs equals the marginal loss of expected returns. The government's tax revenues could be redistributed as lump-sum transfers but it would be better to use them to subsidize loans (either by subsidizing borrowers or banks) so as to reduce the return on an entrepreneur's project necessary to avoid default and, thereby, to lower the default rate and reduce monitoring costs. The optimal intervention is, therefore, to tax monitoring costs and to use the proceeds to subsidize loans.[19]

6. Conclusions

[18] Since the latter reduces q_{max} and R_{max}. on the loan supply function whilst the first two options reduce q_{max} but leave R_{max} unchanged as may be seen by examining the derivation of the loan supply function.

[19] In principle similar policies may be considered for the non-rationing case. Depending on parameter values the optimal policy may be to set taxes and subsidies at zero or to introduces taxes on monitoring costs and/or deposits and subsidise borrowing. If the net effect of the policy is to raise the loan factor associated with any quantity of loans compared to the regulation case above then the policy will be less effective than regulation since it will involve higher monitoring costs.

Policy prescriptions should be based upon rigorous welfare analysis. This paper has shown that it is possible for a model of the credit market with costly monitoring. Various policy interventions have been analysed which promise welfare gains compared to the market outcome. However no Pareto improvement has been found and the efficacy of intervention depends crucially upon the assumptions made about the particular market. The model omits the problems of moral hazard with hidden actions and adverse selection which are likely to be important in the credit market and future work should take account of these possibilities.

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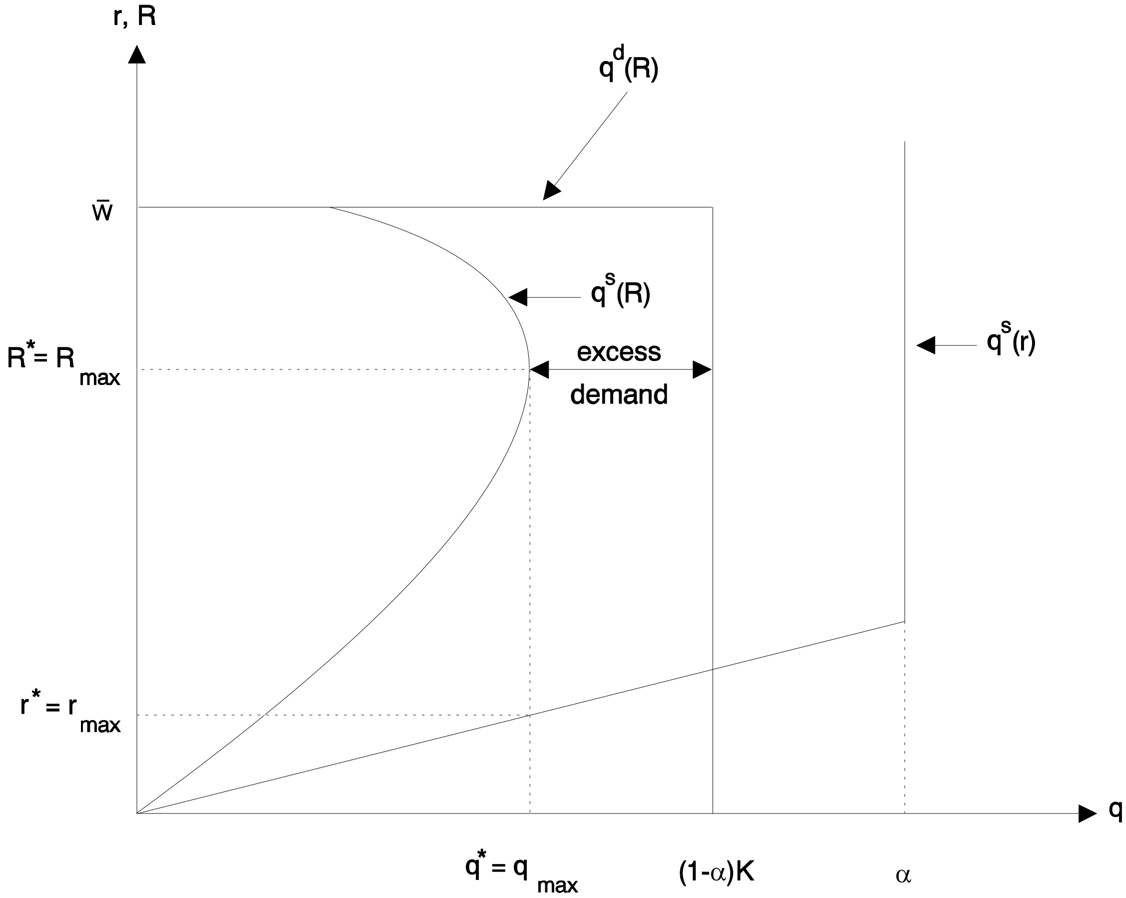

Figure 1(a) - RA Case

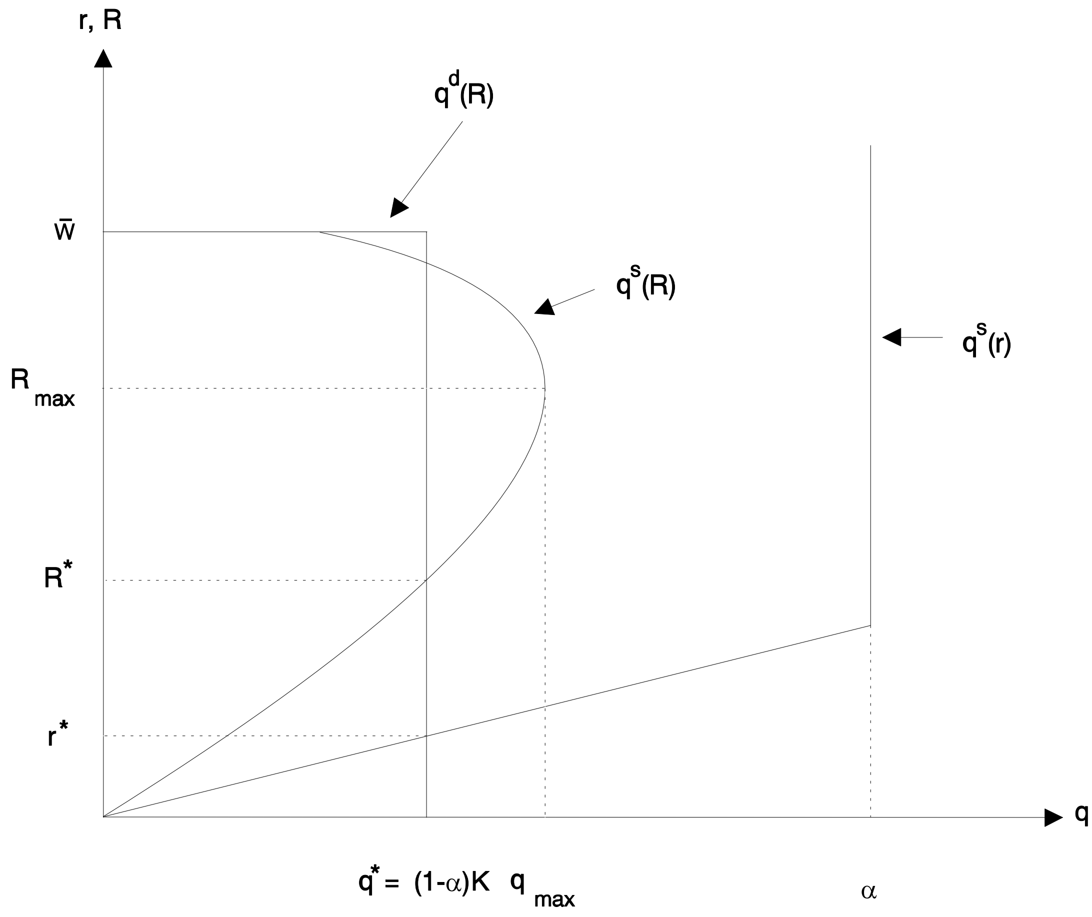

Figure 1(b) - NRA Case

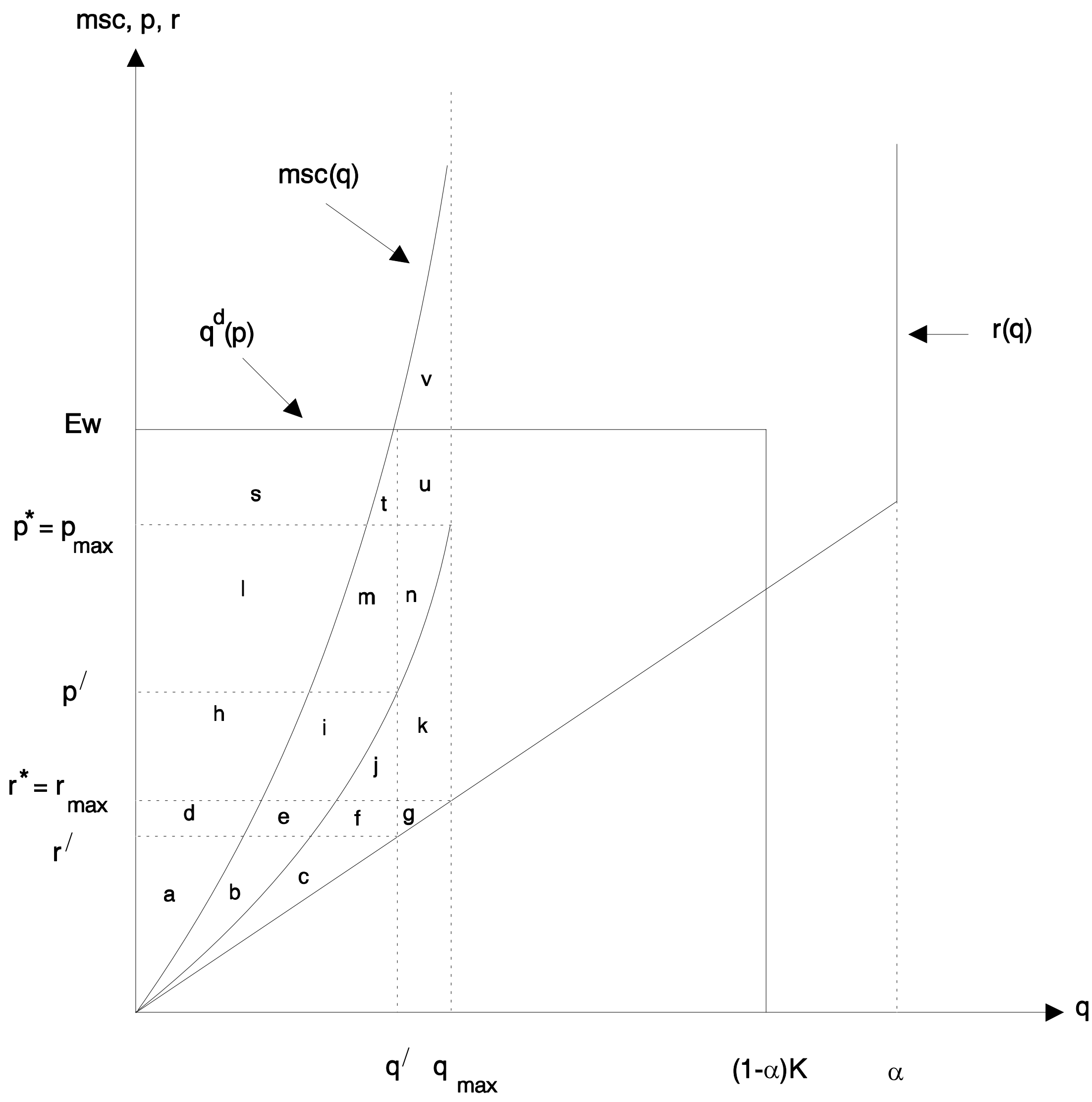

Figure 2(a) - RA Case

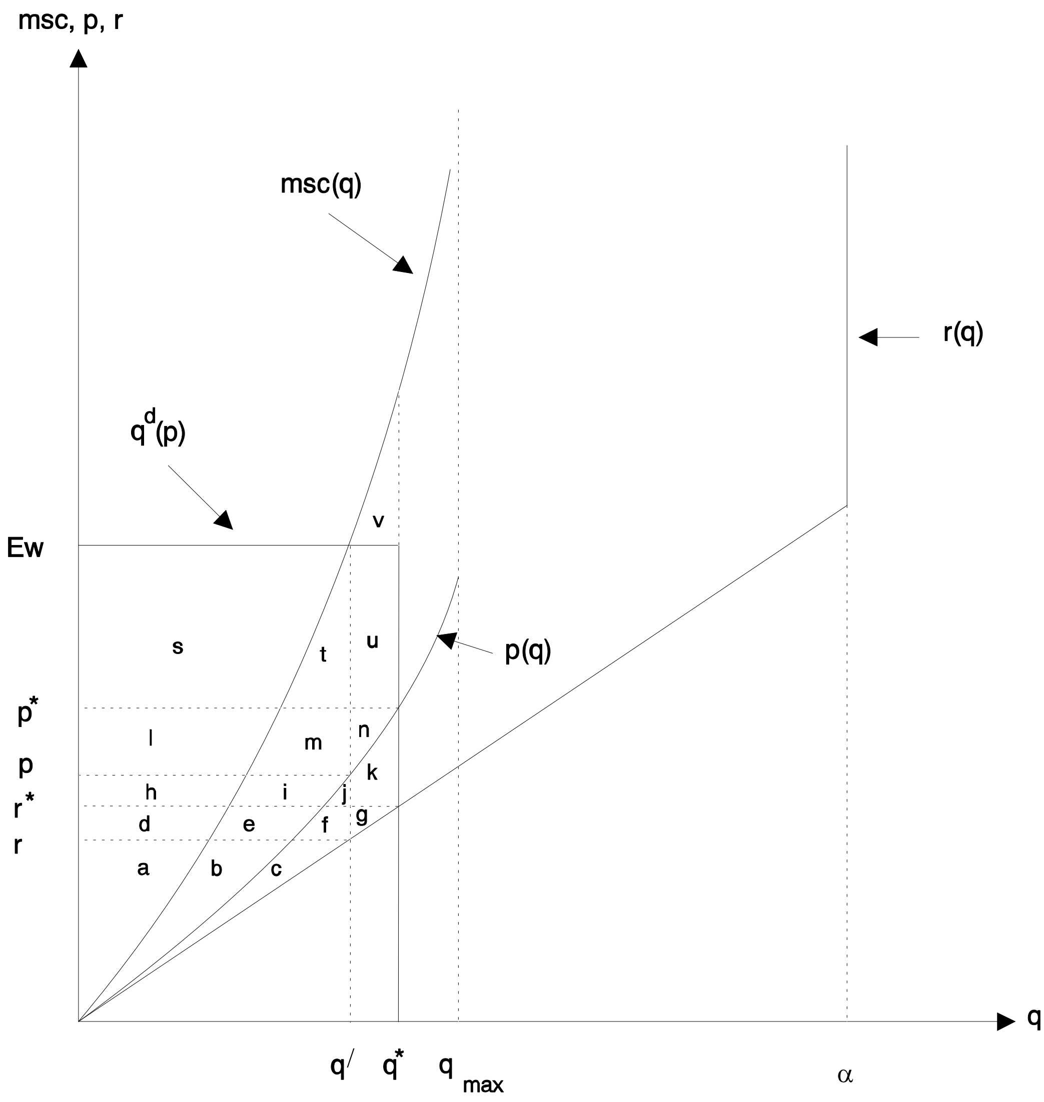

Figure 2(b)(i) - NRA Case: inefficient

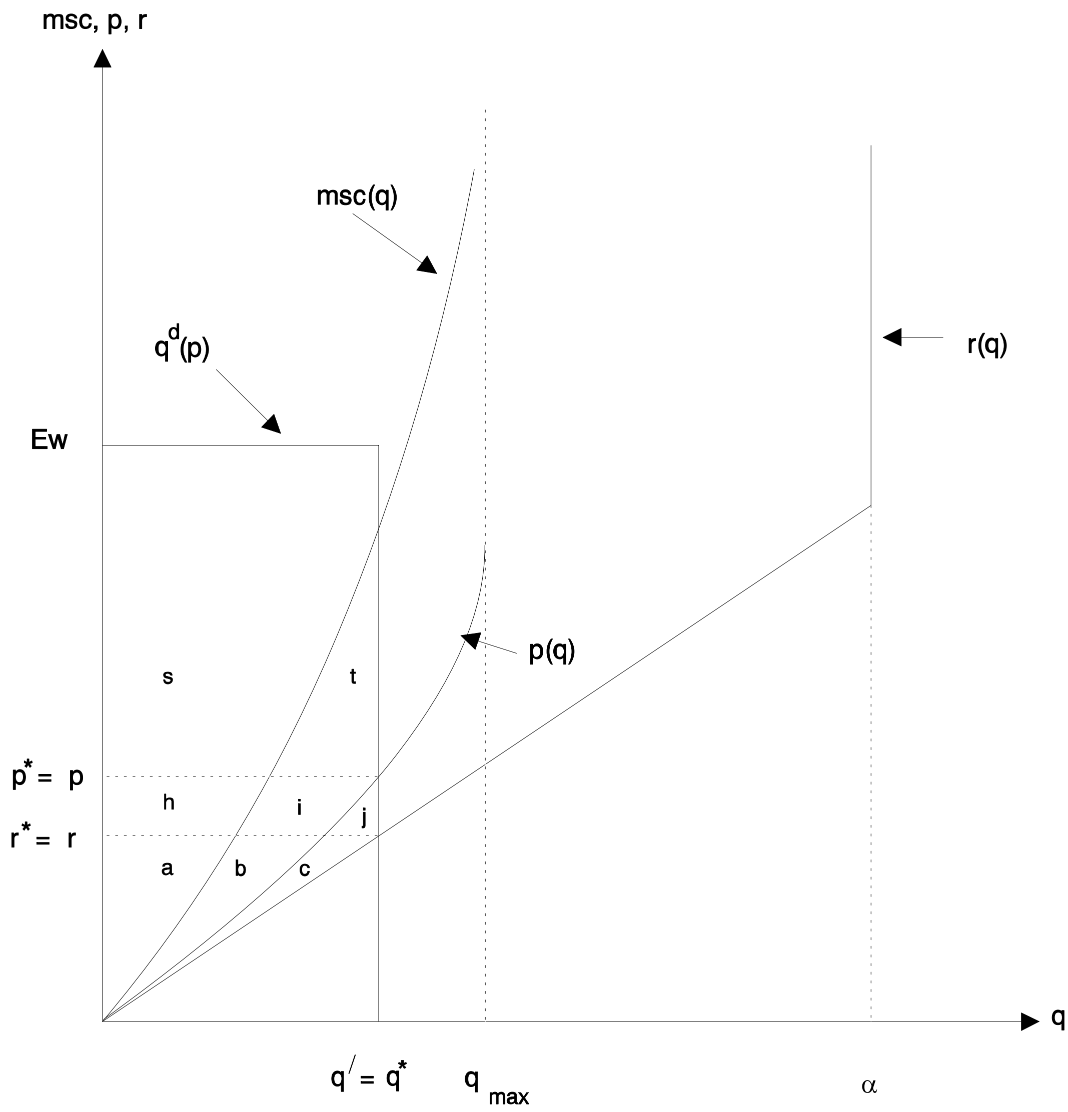

Figure 2(b)(ii) - NRA Case: efficient

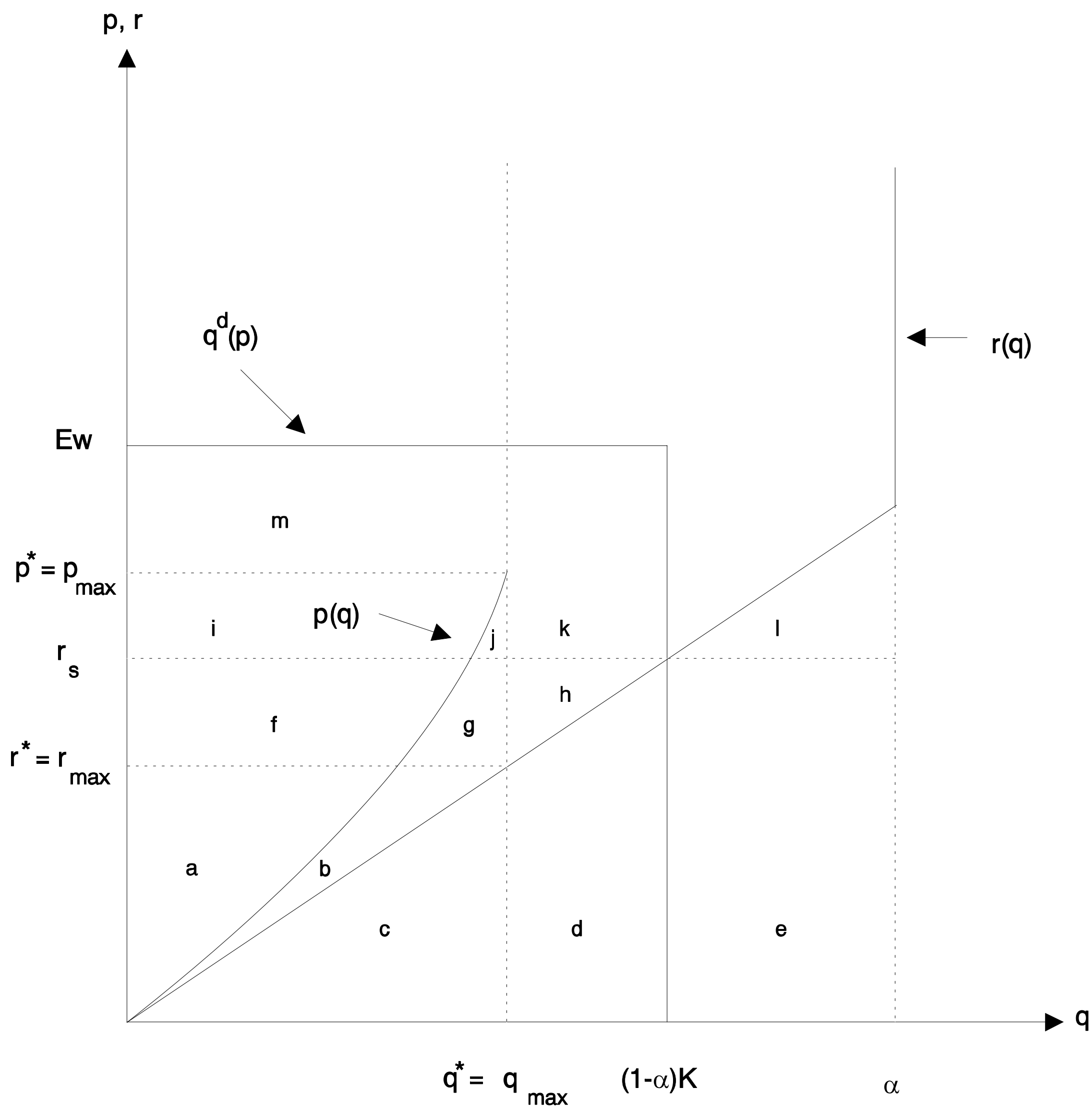

Figure 3(a) - RA Case

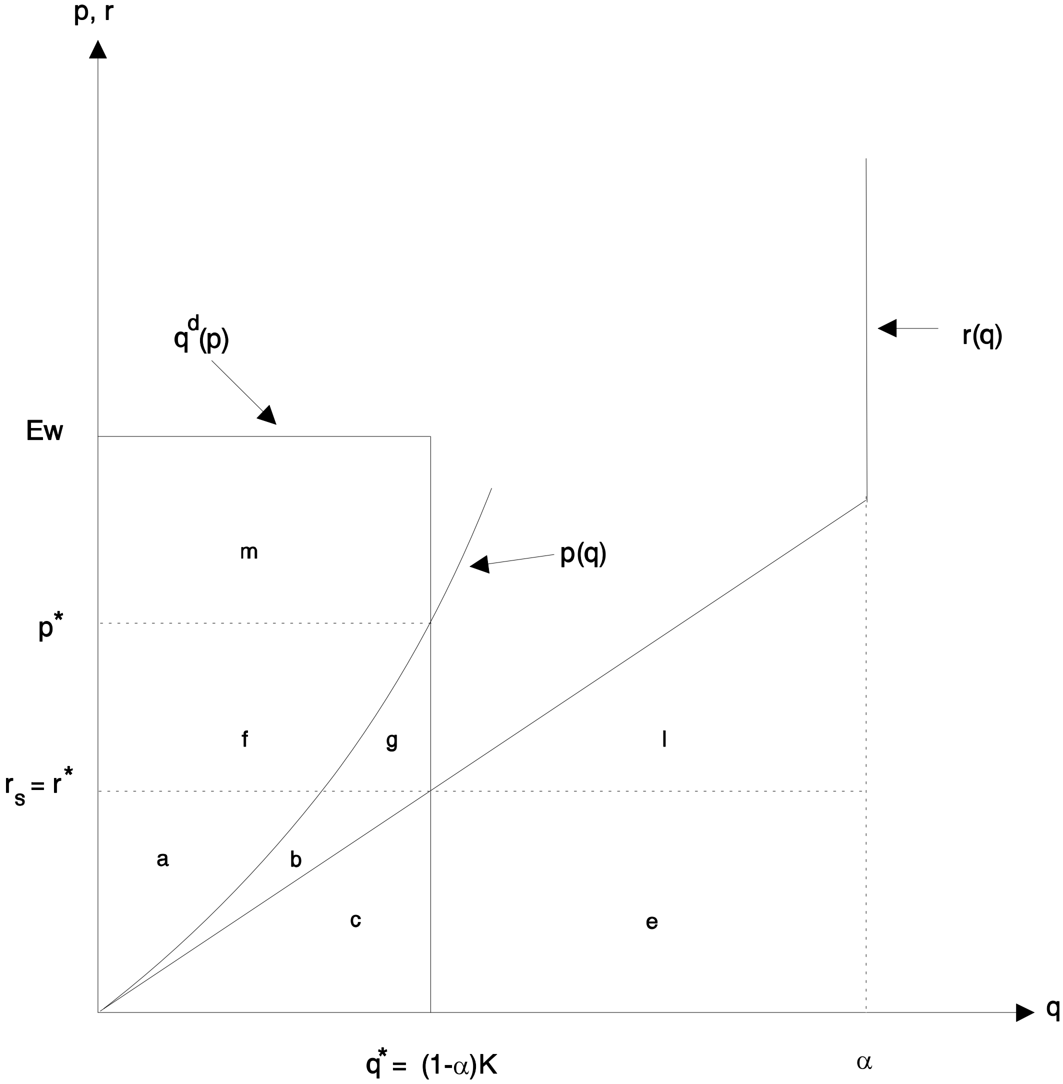

Figure 3(b) - NRA Case