"LENDING TO INSOLVENT COUNTRIES: PARADOXICAL STORY"

by

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ABSTRACT

The present paper considers the strategy of a bank being faced with a severe case of default in its country-risk portfolio. Using a simple three-period adverse-selection model where bank managers have private information on the exact quality of their portfolio, it is shown that the bank's managers may choose to lend fresh money even to *insolvent* countries in order to keep them temporarily liquid on paper and postpone the spread of bad news onto financial markets. The concept of Wilson equilibrium is used to identify conditions under which such a strategy is viable.

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1. Introduction

Large-scale lending to debtors who appear, at least with hindsight, to have been of dubious creditworthiness is widely acknowledged as a major contributing element to the present debt crisis. It is a major puzzle as well, and the large number of hypotheses proposed to explain the behaviour of banks in the international lending market of the 1970's testifies to the continued perplexity of economists. Common explanations of a general nature stress optimism based on strong commodity prices and buoyant LDC exports, as well as the need for recycling the so-called petrodollars. Wellon (1987) suggests another hypothesis. He shows with precisely documented examples that banks were in some instances encouraged by their home governments to grant credits tied to export contracts for home industries. The competitive edge of an exporter was often reflected in generous credit rather than low prices, with little consideration to the credit risks involved. The seeds of repayment difficulties were thus sowed early.

The late 1970's witnessed the onset of debtor difficulties, starting with Zaire in 1976. The continuation of international lending in this second phase calls for different explanations. Krugman (1988) argues that, in general, refinancing troubled debtors has an option value, as it keeps the debt alive while leaving creditor banks free to declare default at a later point. Other authors point to moral hazard problems created by the existence of a safety net for banks, leading them to believe that

the risks of international lending were in effect shifted onto taxpayers (Weintraub, 1983; Folkerts Landau, 1985; see also Bulow and Rogoff, 1986, for a different version of the moral hazard argument). Guttentag and Herring (1984) resort to a psychological explanation, arguing that "cognitive dissonance" prevented bankers from correctly assessing mounting danger signals during a critical pre-crisis period. Their line of reasoning reflects a widely shared belief that banks somehow acted irrationally in their lending decisions.

This paper focusses on the critical period where a debtor country is perceived by its own creditor banks to be in difficulty, while the information has not yet fully spread onto financial markets. It argues that it is not necessary to assume that bankers were either irrational or misinformed to account for continued lending in such critical phases. As noted by Swoboda (1985), much of the literature on international debt abstracts from the special characteristic of banks as both lenders and borrowers. This special position may, however, raise interesting agency problems between bankers and ultimate creditors, especially if the bankers face a finite horizon. The paper analyses such a situation and shows conditions under which banks loaded with bad claims can temporarily mimick the lending behaviour of more successful banks, thus postponing the time where detrimental information spreads onto financial markets (on the effect of exposure to Latin American debt on bank equity, see Kyle and Sachs, 1984). Because the model is based on the assumptions of heterogeneous country types, imperfect

information of creditors and free entry, it shares many of the theoretical features of adverse selection models, in particular the difficulty of showing the existence of a pooling equilibrium (see Rothschild and Stiglitz, 1976). The equilibrium notion adopted here is that of Wilson (1977), which assumes a slightly different form of rationality than that underlying the Nash equilibrium concept. In a Nash equilibrium, entrants take the existing contracts for given and introduce any contracts making nonnegative expected profits given the existing ones. In a Wilson equilibrium, entrants anticipate that introducing new contracts may render the existing ones unprofitable and lead to their withdrawal. A "Wilson" entrant therefore introduces contracts susceptible of competing out the existing ones only if they are still profitable after the existing ones have been withdrawn.

2. The model

The model has three types of risk-neutral agents: creditor banks, sovereign debtors and a financial market composed of atomistic, perfectly diversified asset-holders. In period zero, each bank borrows on the bond market and lends to one country[1]. All

[1] This is equivalent to assuming the existence of a country-specific setup cost sufficiently high to make banks unwilling to diversify. It is possible to relax this assumption by allowing banks to lend to a finite, "small enough" number of countries without altering the results; however, calculations become vastly more cumbersome.

countries and banks are identical *ex ante*, so that it is possible to speak of a representative contract between a bank and a country. All contracts are restricted to be one-period, so that a three-period model is the minimal vehicle needed to study issues of debt renegotiation. In period one, all loan contracts are liquidated and bond issues are redeemed, while new contracts are started. All period-one contracts are liquidated in period two. Banks finance their country loans entirely by bond issues, but have other assets, denoted by a, which serve as a collateral for bond issues. These assets yield a stream of benefits valued internally at the bank's discount rate, and are consumed by the bankers at the beginning of each period, while the assets themselves are consumed at the end of period two. The existence of these assets ensures that the bank benefits from operating even at zero profits. The bonds are issued by the bank itself and not merely underwritten. Following Sachs and Cohen (1982), I assume that banks can renegotiate (reschedule or refinance) country debt, while the bond market cannot renegotiate the terms of bank bond issues when they fall due. Countries are of two unobservable types, good or bad, according to their capacity to transfer resources X_t abroad; the proportion of good countries is γ. For good countries, $X_t = x^H$, all t. For bad countries, X_t can take on two values, x^H or x^L, with $x^L < x^H$, and follows a process characterized by the following one-step transition probabilities:

$$\begin{aligned} &Prob\ (X_{t+1} = x^L | X_t = x^H) = p \\ &Prob\ (X_{t+1} = x^L | X_t = x^L) = 1 \\ &t = 0,1 \end{aligned} \tag{1}$$

The process is common to all bad countries, so that if a transition from x^H to x^L occurs, it occurs for all. This can be interpreted as a description of a world economy facing, in each period, a probability p of being hit by a shock that would permanently separate countries according to their type.

Countries borrow if and only if they can obtain funds at a rate lower than their rate of intertemporal preference. The bond market observes a transition in the state of X_t, but does not observe individual country quality (i.e. the individual value of X_t) unless it is revealed by banks. The bond market also observes loan contracts between banks and countries, without observing any sequence of competitive offers and counter-offers that might have led to these final contracts. If a shock has occurred between periods zero and one, each bank having lent in period zero observes, in period one, the quality of its own debtor country as well as that of all other debtor countries. For this reason, it is called an "insider bank". Other banks not having entered the market in period zero are free to offer contracts in period one, but do not possess more information than the bond market and are thus called "outsider banks". Parameters x^H, x^L, p and γ are common knowledge. Banks are assumed to borrow but not to lend on bond markets.

Formally, a loan contract $\mathcal{L}$ at time zero is a sequence $\{\mathcal{L}_0, \mathcal{L}_1\}$ where $\mathcal{L}_0 < 0$ is the amount lent and $\mathcal{L}_1 > 0$ is the amount to be repaid contractually, both principal and interest. A loan contract at time one is denoted by $\ell = \{\ell_1, \ell_2\}$, so that $\mathcal{L}_1 + \ell_1$ is the net

flow of funds *from* the country at time one. Similarly, $B = \{B_0, B_1\}$ is a bond issue at time zero and $\beta = \{\beta_1, \beta_2\}$ is a bond issue at time one, with the same sign convention. Banks choose $\mathcal{L}$, ℓ, B, β to maximize intertemporal profits discounted by a factor $\delta = 1/(1+r)$, where r is the risk-free interest rate. Borrowing countries maximize intertemporal consumption discounted by a factor ρ common to all, by choosing whether or not they borrow[2]. I assume that "banks move first", i.e. that they make contract offers which countries can either accept or refuse, without any bargaining[3]. This assumption is extended to reschedulings and refinancings in the advent of a default. In the next section, the model is solved under the assumption that banks have unlimited access to loanable funds. This can be rationalized by supposing that the banks' "other assets" constitute a sufficient collateral, so that their own solvency is never at stake. This assumption is relaxed in section 3.

2.1. Solution for a default at time two

Because banks and bondholders are risk-neutral, it is possible for countries to borrow against the *maximum* amount of resources x^H (though at an interest rate higher than the risk-free rate r), so

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[2] I assume without loss of generality that non-transferable resources are zero, so that countries maximize $X_0 - \mathcal{L}_0 + \rho(X_1 - \mathcal{L}_1 - \ell_1) + \rho^2 (X_2 - \ell_2)$.

[3] Contract offers are made simultaneously, but in a second stage, banks can use information revealed by the equilibrium contracts to accept or refuse applicants.

that default occurs, for bad countries, with positive probability[4]. As the model has a finite horizon, clearly punishment must be simultaneous with default: here, transferable resources are seized.

At t=1, a country has been offered a loan contract $\{\ell_1, \ell_2\}$. This contract was such that, *ex ante*, its expected return just covered the cost of funds to the bank. Suppose now that a transition has occurred between periods one and two, so that, for a bad country, $x_2 < \ell_2$ (realized resources are less than contractual obligations). The country cannot fully repay the loan; the bank therefore offers a settlement leaving the country just indifferent between accepting and refusing. Let ℓ_2^R be the country's repayment under this offer. The value of the offer to the country is $x_2 - \ell_2^R$, i.e. the value of its resources minus the repayment proposed by the bank. The value of rejecting the offer, on the other hand, is zero, since the country's resources are entirely seized. The bank therefore sets $\ell_2^R = x_2$.

2.2. Solution for a default at time 1

Suppose that the country has taken a loan $\{\mathcal{L}_0, \mathcal{L}_1\}$ at t=0, and that it is unable to repay it at t=1, because $x_1 < \mathcal{L}_1$. Consider first a rescheduling $\mathcal{L}^R$ characterized by a sequence of revised contractual repayments $\{\mathcal{L}_1^R, \mathcal{L}_2^R\}$, with $\mathcal{L}_1^R < \mathcal{L}_1$ (repayment obligations are downscaled from the initial loan contract at t=1). In a general setting, the value of the rescheduling to the country is

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[4] I assume that legal restrictions prevent banks from offering fully contingent contracts. For instance, many countries impose limitations on foreign ownership of equity.

$$E[g(\mathcal{L}^R)] = (x_1-\mathcal{L}_1^R) + \rho E[\max(X_2-\mathcal{L}_2^R;0)] \tag{2}$$

Here, because no uncertainty is left for the country after a transition has occurred, the above expression becomes

$$g(\mathcal{L}^R) = (x^L-\mathcal{L}_1^R) + \rho\max(x^L-\mathcal{L}_2^R;0) \tag{3}$$

If it refuses the deal, the bank seizes its exports, leaving arrears equal to $\mathcal{L}_1-x_1$, and the country ultimately gets

$$g(0) = \rho\max[x^L-(1+r_1)(\mathcal{L}_1-x^L);0] \tag{4}$$

where r_1 is the rate of interest on arrears. For the country to be indifferent between accepting and rejecting the offer, $\mathcal{L}^R$ must satisfy

$$x^L-\mathcal{L}_1^R + \rho\max(x^L-\mathcal{L}_2^R;0) = \rho\max[x^L-(1+r_1)(\mathcal{L}_1-x^L);0] \tag{5}$$

If the country had borrowed initially up to the common credit ceiling given by $\mathcal{L}_1 = x^H$, this reduces to

$$\begin{aligned} \mathcal{L}_1^R &= x^L \\ \mathcal{L}_2^R &= \min[x^L;(1+r_1)(x^H-x^L)] \end{aligned} \tag{6}$$

It is easy to check that, for any acceptable rescheduling offer (i.e., for any sequence $\{\mathcal{L}_1^R, \mathcal{L}_2^R\}$ satisfying (5)) one can find an equivalent refinancing $\ell = \{\ell_1,\ell_2\}$ conditional on its use, in whole or in part, to pay obligations on past loans[5]. In other words, under complete information, the form of debtor rescue does not matter. We now turn to a case where an asymmetry of information

[5] The refinancing offer is $-\ell_1 = \mathcal{L}_1-\mathcal{L}_1^R$, $\ell_2 = \mathcal{L}_2^R$.

destroys the equivalence, i.e. where refinancing dominates rescheduling as a debtor-rescue device.

3. Default with an imperfectly informed bond market

If there is uncertainty over the amount of transferable resources that individual borrowing countries will be able to produce in the future, and banks are imperfectly diversified[6], country risk spills over to the bond market in the form of financial risk. In the present model, uncertainty over the amount of transferable resources available in the future from debtor countries may come from two sources. Either no transition has yet occurred in the sense of equation (1), so that lenders do not know with certainty what level of resources any particular country will be able to produce at t+1. Or else a transition has occurred, but the bond market does not observe individual country type. This last case is the subject of this section.

Let $\{B_0, B_1\}$ be the bond issue made by all banks in period zero. If $B_1 > x^L$, a bank having claims on a bad country is illiquid at the beginning of period one. Two cases are then possible. If

$$a \geq (1+r)B_1 + rx^L \tag{7}$$

[6] I.e., in this model, $a+x^L < x^H$

then the bank can offer a rescheduling $\mathcal{L}^R$ defined by equation (6), and make a new bond issue $\beta_1 = B_1 - x^L$, $\beta_2 = -\beta_1/\delta$, whose proceeds it can use to redeem the first bond issue[7]. If (7) is not verified, the bank cannot obtain funds on the bond market and is forced into liquidation of its own assets. The question is then, if (7) is not verified, is it possible for a bank having lent in period zero to a country that is revealed in period one to be a bad one to mimick the behaviour of a bank having lent to a good country? Clearly, banks having lent to good countries in period zero will offer in period one new loan contracts to these countries. Because the bond market observes loan contracts, banks having lent to bad countries must relend to bad countries under the exact same terms, both amount and rate, to prevent the market from seeing any difference. By preventing the revelation of country type in period one, banks having claims on bad countries create a financial risk for the bond market, so that all banks face a cost of funds higher than the risk-free rate, unless they borrow an amount so small that repayment is ensured whatever the country's type. This implies that banks with claims on bad countries exert a negative externality on banks with claims on good countries, as the latter would be able to borrow at the risk-free interest rate to relend to the same

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[7] Condition (7) is obtained as follows. In order to avoid liquidating its own assets, the bank must obtain funds equal to at least $B_1 - x^L$, its current liquidity need at the beginning of period one. Furthermore, these funds can be obtained through a new bond issue (β_1,β_2) if and only if $\beta_2 \leq a+x^L$. If the last inequality holds, the bonds carry the risk-free interest rate, so that $\beta_2 = -\beta_1/\delta$, where $\delta = 1/(1+r)$. We must therefore have $B_1 - x^L \leq \delta(a+x^L)$, which gives (7).

countries under complete information. The existence of such an externality creates an incentive for banks with claims on good countries to try to signal themselves to the bond market by voluntarily revealing the quality of their debtor country. However, it is clear that, given the postulated unobservability of country data, mere speeches by bankers to the effect that their assets are of the good type may be imitated by other bankers and have little credibility. Because "deeds speak louder than words", the only way for banks with good claims to signal themselves to the bond market is to adopt a lending strategy that banks with bad claims could not, or would not, mimick. The equilibrium has the pooling property only when such a strategy does *not* exist.

3.1 Cost of loanable funds under pooling

Whenever a bank's repayment obligations (to the bond market) do not exceed $a+x^L$, repayment is certain, so that the funds can be obtained at the risk-free interest rate. The maximum amount that a bank can borrow at the risk-free rate is thus $\delta(a+x^L)$. In order to borrow more, it must offer to the market an *expected* return matching the risk-free rate, which implies a higher interest rate. Formally, if a transition has already occurred between periods zero and one, we must have for a bond issue $\{\beta_1, \beta_2\}$:

$$\gamma\beta_2 + (1-\gamma)(a+x^L) = -\frac{\beta_1}{\delta} \tag{8}$$

or

$$\beta_2 = -\left(\frac{1-\gamma}{\gamma}\right)(a+x^L) - \frac{\beta_1}{\gamma\delta} \tag{9}$$

Furthermore, no bank can make a bond issue such that its repayment obligations exceed $a+x^H$. Letting $y = \gamma x^H + (1-\gamma)x^L$, we have therefore the following cost-of-funds curve in pooling:

$$\beta_2 = \begin{cases} -\beta_1/\delta & \textit{if} \quad 0 < -\beta_1 \le \delta(a+x^L) \\ -\left(\frac{1-\gamma}{\gamma}\right)(a+x^L) - \frac{\beta_1}{\gamma\delta} & \textit{if} \quad \delta(a+x^L) < -\beta_1 \le \delta(a+y) \\ \textit{undefined} & \textit{elsewhere} \end{cases} \tag{10}$$

It is important to note that under pooling, i.e. provided that country types are not revealed to the bond market, the above expression for the cost of funds is equally valid for insider or outsider banks. The reason is that, even though imperfect information stands between the outsider bank and the country, while it stands between the insider bank and the bond market, the latter is always upstream of the information imperfection. If country types were revealed, banks lending to good countries would be able to borrow up to $\delta(a+x^H)$ at the risk-free interest rate. By contrast, banks lending to bad countries would be able to borrow only up to $\delta(a+x^L)$, provided that they had not defaulted on the previous bond issue. If they had defaulted on the previous bond issue, they would be bankrupt. Let us call these two types the "lucky type" and the "unlucky type" respectively. It is clear that the unlucky type's ability to attract funds depends on its ability

to mimick the behaviour of the lucky type. We proceed, in the next subsection, to determine the contract offered by the lucky-type bank to a good country, which is also the contract that the unlucky-type bank must offer to a bad country in pooling. Then, we determine the contract available to any country from *outsider* banks.

3.2 The supply of and demand for loanable funds under pooling

For a lucky-type insider bank, relending to a country which it knows to be a good country involves no risk. This does not mean, however, that the bank is able to provide funds at the risk-free interest rate, since, under pooling, it cannot itself obtain funds on the bond market at the risk-free rate. On the other hand, the relationship between an insider bank and a good country is not a bilateral monopoly, since other insider banks have information about that particular country's quality[8]. The country can therefore obtain funds at a rate such that the bank's profits are zero, given the cost of funds derived in the previous section. This means that if $\ell_2 \leq a+x^L$, funds can be obtained by the country at the risk-free rate, while if $a+x^L < \ell_2 \leq x^H$, $\ell_2(\ell_1)$ has a form identical to (9), with $\ell_1 = \beta_1$. We can therefore define a function Φ^i mapping the closed interval $[0,((1-\gamma)a + y]$ into the real line and such that, if $\ell_2 = \Phi^i(-\ell_1)$, then

[8] Loan offers are made simultaneously, so that competition between insider banks is of the Bertrand type. Note that *ex ante* competition does not preclude a one-one relationship *ex post*.

$$\ell_2 = \begin{cases} -\ell_1/\delta & \text{if} \quad 0 < -\ell_1 \le \delta(a+x^L) \\ -\left(\frac{1-\gamma}{\gamma}\right)(a+x^L) - \frac{\ell_1}{\delta\gamma} & \text{if} \quad \delta(a+x^L) < -\ell_1 \le \delta[(1-\gamma)a+y] \\ \text{undefined} & \text{elsewhere} \end{cases} \tag{11}$$

The function Φ^i is illustrated in figure 1.

For an outsider bank, lending to a country involves risk, even after the occurrence of a transition in the sense of equation (1), because the outsider bank does not know individual country types. There is therefore a region where the outsider bank obtains funds at the risk-free interest rate (because $\beta_2 \le a+x^L$), but is unwilling to relend them at that same rate (because $\ell_2 > x^L$). This implies that the zero-profit curve of an outsider bank is not identical to that of an insider bank. Formally, define $z = \gamma^2 x^H + (1-\gamma^2)x^L$ and a function Φ^0 mapping the interval $[0, \delta((1-\gamma)a + z)]$ into the real line, such that, if $\ell_2 = \Phi^0(-\ell_1)$, then

$$\ell_2 = \begin{cases} -\ell_1/\delta & \text{if} \quad 0 < -\ell_1 \le \delta x^L \\ -\left(\frac{1-\gamma}{\gamma}\right)x^L - \frac{\ell_1}{\delta\gamma} & \text{if} \quad \delta x^L < -\ell_1 \le \delta(\gamma a+x^L) \\ -\left(\frac{1-\gamma}{\gamma^2}\right)a - \left(\frac{1-\gamma^2}{\gamma^2}\right)x^L - \frac{\ell_1}{\delta\gamma^2} & \text{if} \quad \delta(\gamma a+x^L) < -\ell_1 \le \delta[(1-\gamma)a+z] \\ \text{undefined} & \text{elsewhere} \end{cases} \tag{12}$$

The function Φ^0 is illustrated in figure 1.

We now derive country preferences in the space $(-\ell_1, \ell_2)$. Any repayment obligation in excess of a country's maximum level of transferable resources is irrelevant to it. In the case of a bad country, resources available in period two are frozen to the extent that the country is on arrears on an initial loan. Without loss of

generality, I assume that the amount of arrears exceeds the resources available in period two (i.e., $x^H - x^L > x^L$), so that any financing offered in period one is essentially free, and we can draw a vertical indifference curve in the space $(-\ell_1, \ell_2)$. In the case of a good country, the point beyond which further repayment obligations become irrelevant is $\ell_2 = x^H$. Whenever ℓ_2 is lower than this threshold, a good country is willing to trade resources at time two against resources at time one at its rate of intertemporal preferences, given by $1/\rho$. Noting that indifference curves are piecewise differentiable, we can write (with some abuse of notation) for a good country:

$$\frac{d\ell_2}{d(-\ell_1)} = \begin{cases} 1/\rho & if \quad 0 < \ell_2 < x^H \\ \infty & if \quad x^H < \ell_2 \end{cases} \tag{13}$$

Indifference curves for good and bad countries are shown in figure 1. We can now state a pretty simple but useful result: provided that $\rho < \delta$, for any contract on the supply curve of outsider banks, one can find another contract on the supply curve of insider banks that strictly dominates it for good and bad countries. This fact can be easily checked by inspection of figure 1.

3.3 Equilibrium contracts

In this section, we determine a "candidate" equilibrium contract having the pooling property, and show that it fails the requirement of a Nash equilibrium, but passes the requirement of a Wilson equilibrium, in the sense of Wilson (1977).

Let us start with a definition of feasibility for candidate

pooling contracts embodying four logical elements. First, the contract must be on the supply curve of lucky-type insider banks. Second, the contract must be the "best", for good countries, among contracts available on the supply curve of lucky insider banks. Third, it must involve enough funds to keep bad countries liquid, so that unlucky banks can mimick it. Finally, contractual repayments must not exceed maximum resources. These four properties are described formally in the definition below[9].

Definition 1 *(feasibility)*

Let $\pi^k(\ell|\ell')$ be the expected profit, for a bank of type k (k = i,o), from offering contract ℓ when contract $\ell' \neq \ell$ is offered simultaneously on the market, and let $\pi^k(\ell|\emptyset)$ be the expected profit when only ℓ is offered on the market[10]. Letting g^g (g^b) be the gain function for a good (bad) country, contract ℓ is feasible as a pooling contract if

a) $\pi^i(\ell|\emptyset) \geq 0$

b) $g^g(\ell) > g^g(\ell')$ for any pooling contract ℓ' such that $\pi^k(\ell'|\emptyset) \geq 0$, $k = I,O$

c) $-\ell_1 \geq x^H - x^L$

d) $\ell_2 \leq x^H$.

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[9] Feasibility in this simple sense does not imply any assumption on the bank's foresight and is therefore not identical with Miyazaki's notion of Wilson-feasibility (see Miyazaki, 1977).

[10] By this, I mean that all individual contracts offered on the market are of type ℓ.

Proposition 1

Let ℓ^e be a contract such that $-\ell_1^e = \delta[(1-\gamma)a+y]$, $\ell_2^e = x^H$. If $\rho < \delta\gamma$ and

$$a \geq \left(\frac{1-\delta\gamma}{\delta(1-\gamma)}\right)x^H - \left(\frac{1+\delta(1-\gamma)}{\delta(1-\gamma)}\right)x^L \tag{14}$$

then ℓ^e is feasible as a pooling contract.

Proof

Let us first check c). We must have

$$\delta[(1-\gamma)a+y] \geq x^H - x^L$$

which, upon rearrangement, gives condition (14).

As for b), whenever $\rho < \delta\gamma$, all good countries prefer ℓ^e to any other feasible pooling contract. To see this, consider another pooling contract ℓ^c such that $-\ell_1^c = \delta(a+x^L)$, $\ell_2^c = a+x^L$. A good country prefers ℓ^e to ℓ^c if and only if

$$x^H + \delta[(1-\gamma)a+y] > x^H + \delta(a+x^L) + \rho[x^H-(a+x^L)]$$

Using the fact that $y = \gamma x^H + (1-\gamma)x^L$, we get

$$(1-\gamma)a + \gamma x^H + (1-\gamma)x^L > a+x^L + \frac{\rho}{\delta}(x^H-a-x^L)$$

Collecting terms, this reduces to $\gamma > \rho/\delta$, or $\rho < \delta\gamma$. Therefore, ℓ^e strictly dominates ℓ^c under the postulated condition. Since country preferences are linear in the interval $[\ell^c,\ell^e]$, any nontrivial convex combination of ℓ^c and ℓ^e is also strictly dominated by ℓ^e. Finally, it is easily checked that the origin is strictly dominated by ℓ^c, so that any contract in the interval $[0,\ell^c)$ is strictly

dominated by ℓ^c and therefore by ℓ^e. Therefore ℓ^e is the best contract on the supply curve of insider banks under pooling. Using the fact that every contract on the outsider bank supply curve is dominated by some contract on the insider bank supply curve, we get that ℓ^e fulfills condition b).

Finally, since ℓ^e is on the insider bank's supply curve, condition a) is verified. *QED*

Note that, using similar reasoning, it can be shown that, whenever $\rho < \delta\gamma^2$, the best contract that *outsider* banks can offer is a contract ℓ^f such that $-\ell_1^f = \delta[(1-\gamma)a + z]$, $\ell_2^f = x^H$. It is clear that if ℓ^f is the best contract available from an outsider bank, ℓ^e is the best contract available from an insider bank. From now on, the analysis is restricted to the case where this postulate holds; it can easily be extended to other cases.

Feasibility ensures that contract ℓ^e is sufficient to cover the arrears of bad countries on their initial loans, so that unlucky banks can offer ℓ^e to bad countries on the condition that the loan is used, in whole or in part, to repay obligations on the initial loan. This ensures that unlucky banks do not have to classify their claims on bad countries as non-performing, a move which would naturally be observed by the bond market. The question is now, can any bank deviate from ℓ^e and, by so doing, credibly claim that it is lending to a good country? We will first show that the classical argument against the existence of a pooling equilibrium in adverse selection models (Rothschild and Stiglitz,

1976) holds in the present context as long as the relevant equilibrium concept is Nash. The outcome is then a simple separating equilibrium where all information is revealed to the market and unlucky banks default. Next, we will show that if the slightly less stringent equilibrium notion of Wilson (1977) is used, the model may admit contract ℓ^e as a pooling equilibrium, with a sharply different outcome.

Proposition 2

ℓ^e is not a Nash equilibrium.

Proof

Suppose that an outsider bank offers a contract ℓ^d such that $-\ell_1^d = \delta[(1-\gamma)a + y - \epsilon]$, $\ell_2^d = (1-\gamma)a + y$, for some small $\epsilon > 0$. For a good country,

$$\begin{aligned} g^g(\ell^d) &= x^H - \ell_1^d - \mathcal{L}_1 + \rho \max[x^H - \ell_2^d; 0] \\ &= x^H + \delta[(1-\gamma)a + y - \epsilon] + \rho[x^H - (1-\gamma)a - y] \end{aligned}$$

$$g^g(\ell^e) = x^H - \mathcal{L}_1 + \delta[(1-\gamma)a + y]$$

$$\begin{aligned} g^g(\ell^d) - g^g(\ell^d) &= -\delta\epsilon + \rho[x^H - (1-\gamma)a - y] \\ &= -\delta\epsilon + \rho(1-\gamma)[x^H - (a + x^L)] \end{aligned}$$

The second term on the right-hand side is strictly positive by assumption; therefore, there is always an ϵ small enough so that the right-hand side is positive, implying that if ℓ^d is offered, all good countries prefer it to ℓ^e. For bad countries,

$$g^b(\ell^d) = x^L - \ell_1^d - \mathcal{L}_1 + \rho \max[x^L - \ell_2^d; 0]$$

where $\mathcal{L}_1$ is the contractual repayment on the initial loan. But

$$\begin{aligned} x^L - \ell_2^d &= x^L - (1-\gamma)a - \gamma x^H - (1-\gamma)x^L \\ &= \gamma(x^L - x^H) - (1-\gamma)a \\ &< 0 \end{aligned}$$

so

$$g^b(\ell^d) = x^L - \mathcal{L}_1 + \delta[(1-\gamma)a + y - \epsilon]$$

Similarly,

$$g^b(\ell^e) = x^L - \ell_2 + \delta[(1-\gamma)a + y]$$

so

$$g^b(\ell^d) - g^b(\ell^e) = -\delta\epsilon < 0$$

All bad countries prefer ℓ^e. Therefore, given that insider banks offer ℓ^e, outsider banks can credibly claim that only good countries will take ℓ^d and obtain their funds at the risk-free rate. Then, since

$$\frac{\ell_2^d}{-\ell_1^d} = \frac{(1-\gamma)a + y}{\delta[(1-\gamma)a + y - \epsilon]} > \frac{1}{\delta}$$

$\pi^0(\ell^d | \ell^e) \geq 0$, i.e. contract ℓ^d makes positive profits. *QED*

Proposition 2 thus establishes that there exists an incentive for outsider banks to break the pooling equilibrium by offering a contract that perfectly separates good countries from bad ones. This argument against the existence of pooling equilibria in adverse selection models, first established by Rothschild and

Stiglitz (1976), relies on the Nash postulate that the entrant (here, the outsider bank) takes for given the contract already offered. It fails, thus, to take into account the fact that its own offer will disturb the market outcome, resulting in the initial contract being withdrawn.

We now turn to an alternative equilibrium notion due to Wilson (1977). Entering firms are assumed to be farsighted enough to recognize that, by introducing a self-selecting contract that creams off the good type from the existing pooling contract, they will force the latter to be withdrawn. This will induce the bad types to seek the entrant's contract as well, which will no longer induce self-selection. Under suitable conditions, the entrant's contract will become unprofitable after the pooling one has been withdrawn, and the entrant, recognizing this *ex ante*, will stay out. When this form of rationality is postulated of the entrant, a pooling equilibrium may exist for adverse selection models[11]. Following Judd (1985) and using previously introduced notation, I define a Wilson equilibrium in the following way:

Definition 2 *(Wilson equilibrium)*

A feasible pooling contract ℓ is a Wilson equilibrium if $\nexists\ \ell' \neq \ell$ such that either

a) $\pi^i(\ell|\ell') \geq 0$ and $\pi^k(\ell'|\ell) \geq 0$, $\quad k = i,o,$ $\quad$ or

b) $\pi^k(\ell'|\ell) \geq 0$ and $\pi^k(\ell'|\emptyset) \geq 0$, $\quad k = i,o.$

---

[11] However, it is usually not efficient. Welfare considerations will be mentioned briefly in section 4 below.

The first part of the definition states that two distinct pooling contracts cannot coexist as equilibrium contracts, while the second states that there must not exist any "breaking" contract making nonnegative profits both when offered simultaneously with the equilibrium contract and after the latter has been withdrawn.

Proposition 2

If $\rho < \delta\gamma$ and

$$x^H - x^L < \frac{\delta\rho x^L - \delta^2\alpha}{\rho - \delta(1-\delta\gamma^2+\rho)} \qquad \textbf{(25)}$$

where

$$\alpha = x^L + (1-\gamma)a$$

then ℓ^e is a Wilson equilibrium.

Proof

We begin with part a) of definition 2, and suppose that $\exists\ \ell$ such that $\pi^k(\ell|\ell^e,\ell^f) \geq 0$ for some k. If $g^g(\ell) > g^g(\ell^e)$, then $\pi^i(\ell^e|\ell,\ell^f) < 0$. If $g^g(\ell) < g^g(\ell^e)$, then either $g^b(\ell) < g^b(\ell^e)$, in which case no country takes ℓ, or $g^b(\ell) \geq g^b(\ell^e)$, in which case only bad countries take contract ℓ, so that $\pi^k(\ell|\ell^e,\ell^f) < 0$. Finally, if $g^g(\ell) = g^g(\ell^e)$, then $\ell = \ell^e$ unless $\rho = \gamma\delta$, which is ruled out by assumption[12]. Therefore no such ℓ exists.

Next turn to part b). For lucky insider banks to have an

[12] Contracts ℓ violating point d) of definition 1 are ruled out, because such contracts would introduce a trivial indeterminacy in the model.

incentive to break ℓ^e, given that ℓ^f is always available to any country from outsider banks, there must exist a contract ℓ such that (i) $\pi^i(\ell|\ell^e,\ell^f) \geq \pi^i(\ell^e|\ell^f)$ and (ii) $-\ell_1 < x^H - x^L$. Constraint (i) implies that $g^g(\ell) \geq g^g(\ell^f)$, since otherwise $\pi^i(\ell|\ell^f) = 0$. Consider the sup ℓ^* of all contracts satisfying (ii), and suppose that $\delta\ell_2^* = \ell_1^*$. We have

$$\begin{aligned} g^g(\ell^f) &= x^H - \mathcal{L}_1 - \ell_1^f + \rho\,[x^H - \ell_2^f] \\ &\quad - \delta\,[(1-\gamma)a + y] \\ g^g(\ell^*) &= x^H - \mathcal{L}_1 - \ell_1^* + \rho\,[x^H - \ell_2^*] \\ &= (x^H - x^L) + \rho\,[x^H - \frac{1}{\delta}(x^H - x^L)] \\ &= \left(1 - \frac{\rho}{\delta}\right)(X^H - X^L) + \rho X^H \end{aligned} \tag{26}$$

We have therefore the following inequality:

$$\left(1 - \frac{\rho}{\delta}\right)(x^H - x^L) + \rho x^H > \delta\,[(1-\gamma)a + y] \tag{27}$$

or, after some simplification,

$$x^H - x^L \geq \frac{\delta\rho x^L - \delta^2\alpha}{\rho - \delta\,(1 - \delta\gamma^2 + \rho)} \tag{28}$$

for $\alpha = (1-\gamma)a + x^L$.

Finally, for an outsider bank, one is looking for a contract ℓ such that (i) $\pi^o(\ell|\ell^e,\ell^f) \geq 0$ and (ii) $\pi^o(\ell|\ell^f) \geq 0$[13]. If ℓ^e is feasible in the sense of definition 1, $g^g(\ell^e) > g^g(\ell)$ for any pooling contract $\ell \neq \ell^e$ such that $\pi^i(\ell|\ell^f) \geq 0$. Therefore (ii)

[13] Contract ℓ^f should be assumed to be available after E has been broken, because we are considering incentives for individual deviations, not for group deviations. However it will be clear from the proof that contract ℓ^f is irrelevant, so that $\pi^0(\ell|\ell^f) = \pi^0(\ell|\emptyset)$.

implies either $g^g(\ell^e) > g^g(\ell)$, in which case no one takes ℓ, or $g^g(\ell^e) \leq g^g(\ell)$ and ℓ is separating. If ℓ is separating, $g^b(\ell^e) > g^b(\ell)$ or $-\ell_1 < x^H - x^L$. But separation also implies (by information revelation) $g^b(\ell^e) = 0$; so it must be true that $-\ell_1 < x^H - x^L$. Consider the sup of all such contracts, ℓ^*, and assume that $\delta\ell_2^* = -\ell_1^* = x^H - x^L$. We have

$$\begin{aligned} g^g(\ell^e) &= \delta\,[\,(1-\gamma)\,a + y] \\ g^g(\ell^*) &= (x^H - x^L) + \rho\,[x^H - \frac{1}{\delta}(x^H - x^L)] \\ &= \left(1 - \frac{\rho}{\delta}\right)(x^H - x^L) + \rho x^H \end{aligned} \tag{29}$$

If $\exists\ \ell^*$ such that $-\ell_1^* < x^H - x^L$ and $g^g(\ell^*) \geq g^g(\ell^e)$, it must be true that

$$\delta\,[\,(1-\gamma)\,a + y] \leq \left(1 - \frac{\rho}{\delta}\right)(x^H - x^L) + \rho x^H \tag{30}$$

It is clear by inspection that this condition implies condition (28). Therefore, if (28) does not hold, (30) does not hold either and it is sufficient to check (28). *QED*

The intuition of the proof is that, if (28) is verified, an insider bank can find a contract ℓ that only good countries can take, sell it to a good country in competition with ℓ^f, and thus attract funds at the risk-free rate, so that $\pi^i(\ell\,|\,\ell^f) \geq 0$. Notice that the argument of the Wilson equilibrium does not apply to insider banks, since they know individual country types. The proof would obviously be easier if each bank had information only about its own customer, but it is best to consider the least obvious

case. Geometrically, the argument is fairly simple: figure 2 illustrates a case where a breaking contract ℓ exists for insider banks, figure 2' illustrates a case where no such contract exists. As for outsider banks, the introduction of a breaking contract immediately attracts good countries, but it also attracts bad countries since information revelation would drive the value of the existing contract ℓ^e to zero (as banks offering it would not be able to attract funds). But the breaking contract makes negative profits as a pooling contract, so outsider banks refrain from introducing it, unless it is possible to make it "small enough" that it does not cover the liquidity need of bad countries, which is condition (30). The case where such a contract is available to outsider banks is illustrated in figure 3, while the opposite case is illustrated in figure 3'.

4. Concluding remarks

The analysis has several implications for our understanding of the way that the syndicated Eurocredit market has functioned in the early 1980's. First, it suggests that, in general, lending banks exposed to bad risk may be tempted to cover up crises with fresh money, as indeed they have, at least when difficulties are serious enough to threaten their own standing. Of course, such a strategy can only be temporary; however, it may involve substantial increases in a country's indebtedness. For instance, the flow of funds to Chile reached a peak in 1981, *after* the Chilean stock

market crashed and after a deep depression set in. This paper argues that a concern for reputation on financial markets may not have been foreign to the willingness of U.S. bankers to attempt to rescue (without much success) their Chilean customers (this episode of Chilean history is described in Edwards and Edwards, 1985). This analysis stands in contrast with a result by Detragiache (1987) who argues that repudiation has a value to lenders, by revealing the quality of debtors. The crucial difference is that the present paper stresses the position of banks as financial intermediaries rather than final creditors.

Second, if continued lending to debtors of dubious creditworthiness may be interpreted as a strategy designed to prevent panic from spreading on financial markets, as this paper suggests, the existence of a safety net for banks may *reduce*, rather than increase, the incentive for overlending. The reason is that financial fragility makes banks vulnerable to bad news, so that their large debtors, in a sense, hold them hostage. Protection of the banks' ultimate creditors reduces this phenomenon and improves their bargaining position vis à vis their debtors. While it is clear that the existence of a safety net creates, *ex ante*, a moral hazard problem in that it suggests that if loans go wrong, the taxpayer may be expected to foot the bill, it may also alleviate the problem *ex post*. There is therefore a time-consistency problem for regulatory authorities: while they would like to commtit, *ex ante*, to a policy of no protection, they are likely to be forced into intervention at a later stage for the

reasons analyzed in this paper.

Third, although bank behaviour in this model may be viewed as reflecting an agency problem between banks and ultimate creditors, the latter lend at zero expected profits and do not bear any burden *ex ante*. The cost of the lending banks' pooling strategy is borne by high-quality debtor countries, who are denied the benefit of improved creditor information concerning their creditworthiness because they are pooled with bad debtors. Under such conditions, high-quality debtor countries may be expected to attempt to circumvent the syndicated loan market. This is consistent with the observed "securitization" of borrowing by creditworthy countries in the mid-1980's.

It may be interesting to enquire as to what kind of change in the model's structure would lead to a breakdown of the pooling equilibrium. The most obvious candidate is an improvement in the information available to financial markets on the quality of country risks. Lending banks may have had private information in the late 1970's and early 1980's, but this informational advantage has since been eroding. Another possibility is an improvement in the creditworthiness of debtor countries making pooling unnecessary. Creditor banks may also reduce their own vulnerability by increasing their capital base or their loan-loss reserves. All three factors may be argued to have been at play in the period extending approximately from 1982 to 1987.

Finally, it should be noted that the analysis is carried out under the assumption that banks finance their country risk

activities by issuing bonds. This is obviously only partially true, as many other forms of funding are available to banks. As long as these alternative forms of bank liabilities are imperfectly insured, however, the analysis of this paper remains relevant.

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FIGURE 1

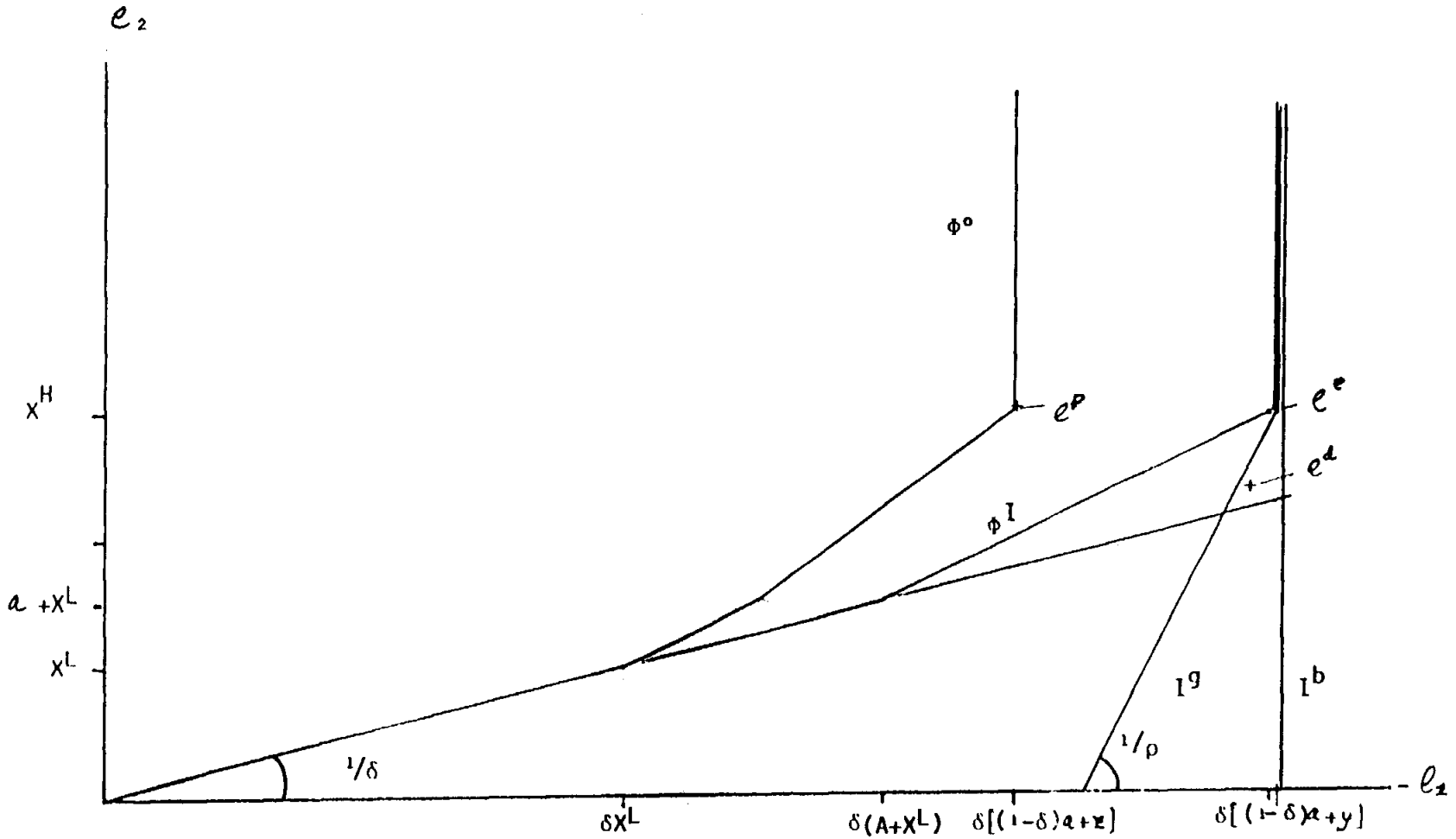

e_2
X^H
$a + X^L$
X^L
Φ^o
e^p
e^e
e^d
Φ^I
I^g
I^b
$1/\delta$
$1/\rho$
e_1
δX^L
$\delta(A+X^L)$
$\delta[(1-\delta)a+z]$
$\delta[(1-\delta)a+y]$

FIGURE 2

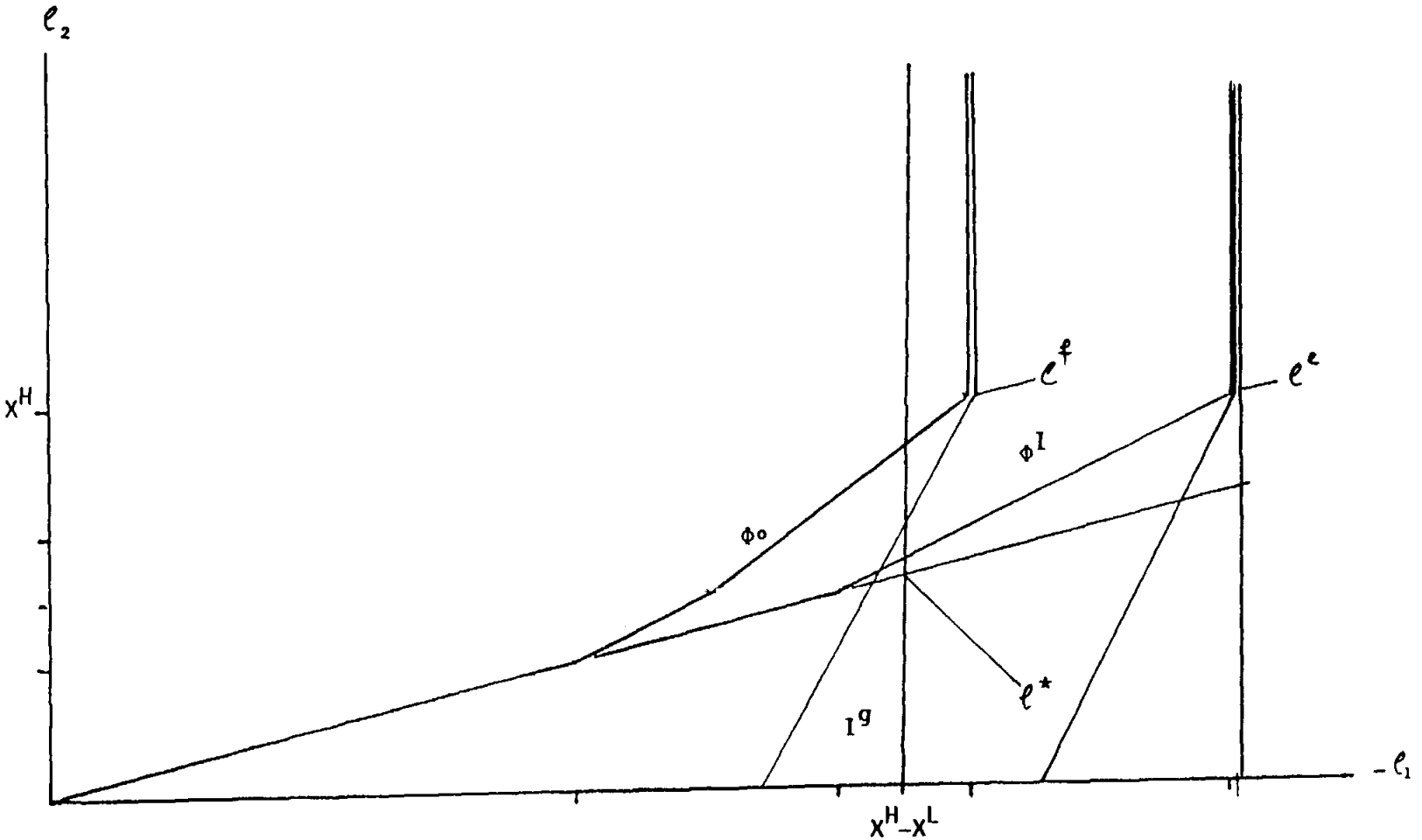


FIGURE 2'

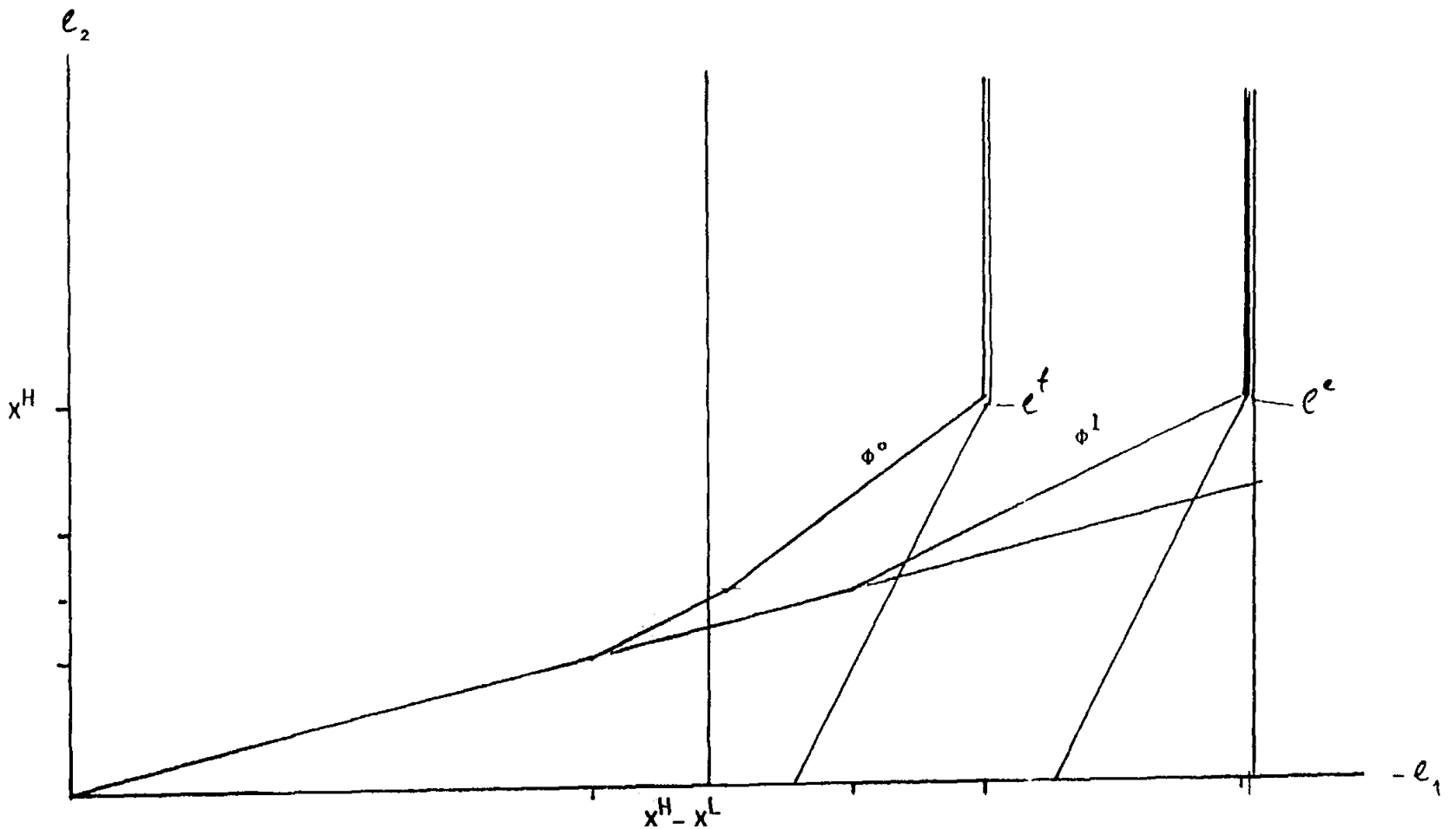


FIGURE 3

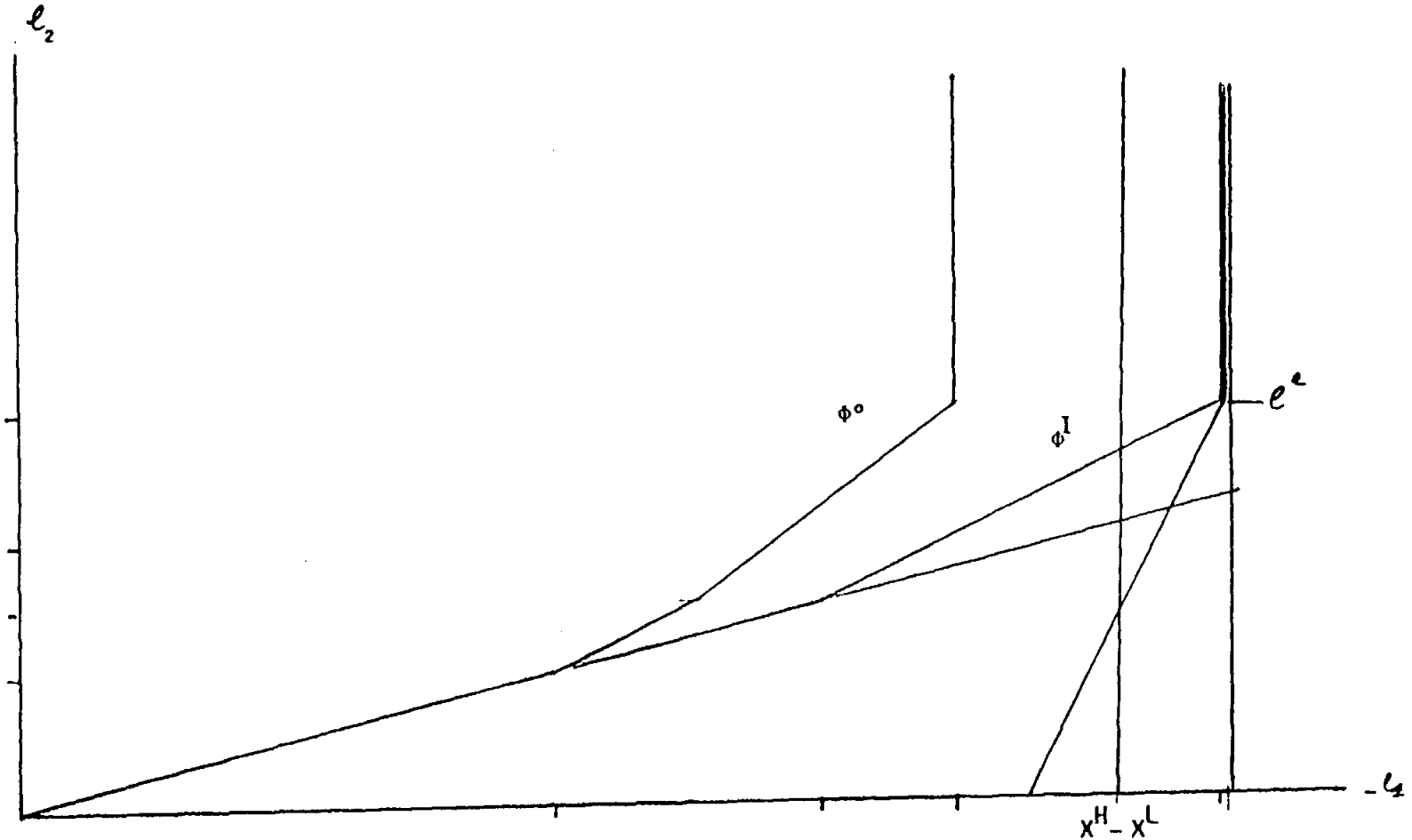
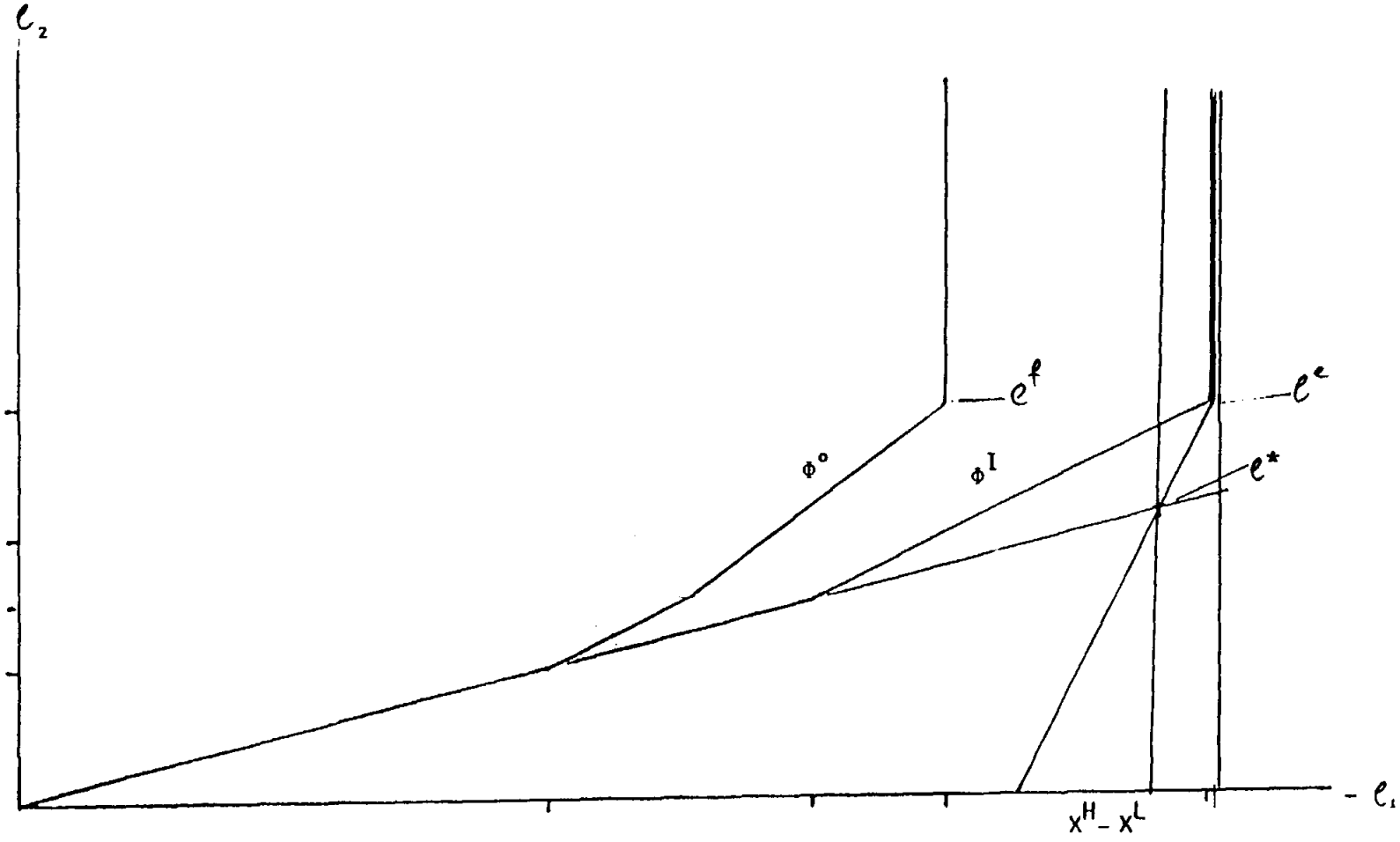


FIGURE 3'



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