LEVERAGE AND IPP RELIABILITY

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Introduction.

Independent power producers (IPPs) are nearly always heavily debt financed. It is typically argued that the guaranteed revenue stream that results from a take-and-pay contract between an IPP and an investor owned utility allows the IPP to support a high level of debt. However, the highly leveraged structure of IPPs give them very little margin for error in terms of cost increases.[1] A small increase in costs can make it difficult for an IPP to meet it's debt obligations. Thus, regulators are concerned about the reliability of highly leveraged IPPs. In fact, Section 712 of the National Energy Act requires state regulatory commissions to examine the extent to which the high amounts of financial leverage used by IPPs gives them an unfair advantage or threatens the reliability of service.

Rather than argue that IPPs have the incentives to choose more reliable technologies or claim that sophisticated lenders only provide capital to projects that are likely to be successful, we demonstrate (1) the conditions that must occur for the lender(s) to have an incentive to close an economically efficient plant and (2) show that these conditions are unlikely to hold. Our analysis of leverage and IPP reliability yields three major points.

1. An IPP's inability to pay creditors does not, per se, cause the IPP to not uphold its agreement with the utility. In other words, when an IPP cannot meet its debt obligations, its creditors do not necessarily foreclose on the loan and liquidate the plant.

2. The desirable outcome from the standpoint of consumers is to have the IPP operate only when it is an economic provider of electricity. The lender will consider the profitability of the plant when it decides whether to liquidate the plant or reorganize its debt and continue operations (i.e. honor the contract with the utility). Thus, the real issue with leverage and IPP reliability is whether the lender forecloses on an economically profitable plant.

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[1] Kahn, Meal, Doerrer and Morse, (1992) provide extensive data on these issues.

3. A systematic analysis of the IPP's choice to liquidate or continue that incorporates both the IPP's financial situation (leverage) and its profitability shows that creditors will liquidate a profitable IPP if either (1) the liquidation value of the plant sold for scrap is large relative to the amount owed to lenders or (2) a large number of lenders have claims on the IPP. Since neither of the these conditions holds for the typical IPP, leverage is unlike to adversely effect reliability.

Interestingly, very large amounts of leverage can actually enhance the reliability of the plant. When the amount owed the lender greatly exceeds the scrap value of the plant, the lender's incentives become the same as the owners. This is the idea behind the old adage, "borrow a little and you've got a creditor; borrow a lot and you've got a partner."

The intuition behind these results is as follows. If the lenders are myopic, in that they do not consider the possibility of a financial reorganization, they realize that liquidation may dominate continuing operations when the IPP is expected to be only marginally profitable. If costs decline or operating efficiency improves in the future, much of the gain goes to equity holders. On the other hand, the losses from cost overruns are borne by the creditors. Thus, financial leverage reduces the reliability of a marginally profitable IPP because the lender fails to capture the gains from continuation and bears most of the costs.[2]

However, if the debt can be easily renegotiated, financial leverage does not reduce the reliability of the IPP. If the lender is willing to accept some equity in exchange for its debt position (in other words if the lender does not take a myopic view), then it liquidates only when the company is worth more liquidated than as an ongoing concern. The lenders are better off if their debt is reorganized if and only if the IPP's going concern value is greater than its liquidation value. This criteria is exactly the rule that an all equity firm would use. Leverage has

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[2] This idea is widely recognized by financial economists. For example, see Bulow and Shoven (1979).

no effect on the IPP's liquidation calculus and thus has no effect on it's reliability.

The ability to renegotiate the debt depends critically on the number of lenders involved. The small number of lenders involved in an IPP indicate that the debt should be easily renegotiated. Finally, when the value of the plant if it is liquidated is much lower than the outstanding debt obligation, which is typically the case with an IPP as the scrap value of a power plant is low, then the lender shuts down under the same conditions as an all equity IPP.

AES Corporation is one of the largest IPPs in country. Their experience has been very consistent with the ideas expressed in this paper. While two of their projects have run into difficulty meeting their obligations to lenders (Deepwater and Cedar Bay), both projects have provided reliable service to their customers. Agreements with the lenders had to be reached in both cases, however, liquidation was avoided in both cases.

Concern is often expressed about a marginally profitable IPP being able to extract concessions from the utility in the form of higher contractual payments. The IPP can threaten to shut down operations if it does not receive higher payments from the IPP. Further, many are concerned that this "hold-up problem" is made worse by financial leverage. The highly leveraged IPP can claim that the lender will foreclose if the contract is not amended. If the debt can be easily reorganized, then the lender forecloses under exactly the same circumstances that an all equity IPP would shut down. Thus, leverage is not likely to effect the IPP's ability to "hold-up" the utility. Rather, the size of the hold-up problem depends on whether the utility can easily buy power elsewhere if the IPP defaults.

We also point out the consequences of the IPP's ability to hold-up the utility if were to exist. This hold-up problem does not make purchased power undesirable per se. In fact, the hold-up problem has no effect on the expected cost of power to the consumer. In a competitive IPP market, the potential gains from being able to extract a higher price from the utility in the future are factored into a lower initial bid by the IPP. However, regulators evaluating bids should recognize that an initial bid by an IPP understates the true cost of the contract to consumers to the extent that it may be renegotiated in favor of the IPP in the future.

The remainder of this paper is organized as follows. Section I provides a framework for analyzing the effect of IPP leverage on the IPP's choice to liquidate or continue. The effect of financial leverage on the IPP's ability to hold-up the utility for a more favorable contract in the future is examined in Section II.

I. Leverage and the IPP's liquidation/continuation choice.

We use a numerical example to demonstrate the effect of financial leverage. In this example, an IPP is faced with the choice of either defaulting on its obligation to deliver power (this is referred to as liquidating the plant) or continuing to honor the contract (this is referred to as continuing). Allowing the continuation of a project that has defaulted on its obligation to lenders requires some reorganization of the firm's liabilities. The IPP's choice is shown to depend on (1) the amount of financial leverage, (2) the ability to renegotiate its debt claims, (3) the revenues allowed in the contract and (4) the estimated costs of producing electricity.

A detailed appendix available from the authors provides a general model of the example considered here. While, we believe the values used in this example are realistic, the analysis in the appendix shows that the basic conclusions of the numerical example hold when different values are used in the numerical example.

The IPP in this example has built a 100 MW combined cycle power plant and has entered into a take-or-pay contract with the utility to produce power at 5 cents per kilowatt hour. The initial cost of the plant is $700 per kilowatt hour or $70,000,000. The plant is assumed to run at 100% of capacity. The power plant has a ten year useful life and is paid for the power delivered at the end of year. Likewise, the costs of producing the power are borne at the end of the year. The costs of producing the power are uncertain, however, the IPP is assumed to be able to produce the power if it chooses to. The profits earned at the end of the year (the total revenues minus the actual costs) are discounted at 10%.

When the plant is in the start up phase, its managers know about how much it will cost to produce the power. However, the actual cost of producing the power is only known for sure at the end of the first year of operations. The actual cost is the estimated cost (denoted C) plus or minus .7 cents per kilowatt hour. Thus, costs are equally likely to be C + .7 cents or C - .7

cents. For example, if managers estimate that the cost of producing power is going to be 4 cents, then the actual costs are equally likely to be 3.3 cents or 4.7 cents. If power is not produced, the plant is liquidated for $50 million. Later we show the implication of lowering the liquidation value.

Table 1 shows the ongoing concern value of the IPP for various levels of the cost of producing electricity. The ongoing concern value is the simply the present value of the profits from the plant. The present value is obviously smaller the higher the cost of producing electricity and is negative when costs are greater than 5 cents per kilowatt hour.

If estimated costs are sufficiently high (above a cut-off level defined below), then the IPP liquidates. The following analysis examines whether financial leverage effects the cut-off estimate of costs where the IPP liquidates. It is useful to begin with the case where the IPP has no financial leverage (this is referred to as the "all equity" IPP). This benchmark IPP makes the economically efficient liquidation/continuation choice.

The all equity IPP liquidates when the expected continuation value is less then the liquidation value of $50,000,000. In this example, when ever the costs of producing power are expected to be 4.10 cents per kilowatt hour or more, the all equity IPP liquidates. Consumers might prefer that IPP sell power to the utility at the agreed upon price of 5 cents even when the costs exceed 4.10 cents, however, consumers are better off with an arrangement that does not force the IPP to produce under these conditions. If the IPP could be forced to produce under these conditions, it would simply factor this into its initial bid. The best arrangement for consumers is one that allows the IPP to shut down under the conditions that an all equity IPP would shut down.

Now I examine the conditions under which a leveraged IPP would shut down to see the extent they deviate from the choice made by an all equity IPP. Suppose that the initial cost of the plant is again $70,000,000 and the plant is 80% financed by a one year 10% loan.[3] Thus, the IPP borrows $56 million today and promises to pay the lenders $61.6 million in one year. The column labeled "equity value" in Table 1 is the value of the owners position at various levels of the cost of producing electricity. The value of the equity is the present value of the ongoing concern value of the plant in one year minus the debt obligation so long as the firm is solvent. The equity value is zero when costs are greater than 3.90 cents per kilowatt hour.

The analysis considers two cases. First, suppose that equity makes the continuation choice. This situation presumes that the IPP has not defaulted on any aspect of the debt contract. Second, suppose that the lenders either implicitly or explicitly make the continuation choice. This is most likely the case since the IPP needs additional financing after one year (i.e. it must roll over the loan). In this case, the lender can implicitly veto a continuation by not providing the IPP with additional funds.[4] We assume that the lender must make this choice while there is still uncertainty about the costs of production. Otherwise, leverage cannot reduce reliability.

If equity makes the continuation choice, then it tends to continue "too often". Specifically, it continues even when expected costs are higher than 4.10 cents per kilowatt hour. If expected costs are 4.5 cents per kilowatt hour, they could still be as low as 3.8 cents per kilowatt hour in which case the equity value is still positive. This occurs because the end of year debt obligation exceeds the liquidation value of the IPP. Thus, the IPP owners receive nothing if the plant is liquidated and always prefer to continue.[5] Equity prefers to continue in hopes that it will "get

[3] The basic conclusions of this analysis are unaffected by the assumed maturity of the debt.

[4] If the IPP's existing lenders are unwilling to extend the IPP additional credit, then outsiders lenders would also being unwilling to provide the IPP with funds.

[5] The appendix shows that equity continues too often under a variety of more general conditions. The tendency for the equity holders of a leveraged firm to continue too often is described as the "overinvestment problem" by Myers (1977).

lucky" in that costs are lower than expected. Put another way, IPP owners not concerned about cost overruns because they are borne by the creditor. If the IPP owners draw a salary, they have a further incentive to continue.

This example shows that leverage may actually cause IPPs to stay in business longer. As long as the IPP does not need additional funds to continue, it does so under conditions that all equity firm would shut down.

Now suppose the lenders make the continuation/liquidation choice by agreeing or refusing to roll over the loan. The lender tends to liquidate even when it is profitable to continue. The column labeled "lender value" in Table 1 is the value of the lender's claim at various costs of producing electricity. The lender is paid in full so long as costs are below 3.80 cents per kilowatt hour. If costs exceed that amount, the lender takes over the plant which is worth its going concern value. If expected costs are 4.10 cents the lender would actually prefer to liquidate. To see this notice that if expected costs are 4.10 cents then costs will be either 4.80 cents or 3.40 cents. In this case, the expected payoff to the lender is actually less than $50 million. This occurs because if costs turn out to be higher than expected the lenders bear most of the costs because the IPP is insolvent. If costs turn out to be lower than expected, the owners benefit.

In fact, the lenders are indifferent between liquidating the asset today for $50,000,000 and continuing only when costs are less than 3.80 cents. Recall, that the all equity IPP continues when ever costs are less than 4.10 cents. Given that the cut-off value is higher for the all equity firm, leverage reduces "reliability" and distorts the liquidation/continuation choice.

This example shows how financial leverage can reduce the reliability of the IPP by making it less likely to continue. It is important to note that the extent to which the liquidation/continuation choice is distorted depends critically on the liquidation value. The less attractive is the liquidation option, the more the lender behaves like an owner. The lender prefers to liquidate at lower costs then the owners when liquidation results in a high payoff. In fact, in this example, if the liquidation value is less than $23.6 million dollars, the lender and all equity firm shut down at the same price. Since the liquidation value of the plant is likely to be very low, leverage is unlikely to effect reliability.

The discussion up to this point has viewed the lender as being quite myopic. The lender only considers two options: liquidation or continuation. Consider the case where expected costs are 3.80 cents. In this case, the myopic lender forces a liquidation of the assets because it receives a higher expected payoff in liquidation. However, the firm is worth more as an ongoing concern ($64.6 million) than it is liquidation ($50 million). Thus, both the IPP owners and lender can be made better off by not liquidating. In particular, the lender could be given 90% percent of the firm's equity in a financial reorganization. In this case, the value of the original lender's new equity position is $58.1 million which is much greater than what it gets in liquidation. The value of the original owners stake is now $6.5 million which is greater than what it would receive in liquidation. Alternatively, if expected costs are 3.80 cents, then the lender's debt could be bought out at $58 million which is much greater than what it would receive in liquidation.

Allowing for a financial reorganization in this example means that the leveraged IPP liquidates under exactly the same conditions that the all equity IPP liquidates. If expected costs are below 4.10 cents then the firm is worth more than its liquidation value and a reorganization that allows the firm to continue can be made that makes both the owners and lender better off.

The only problem with a financial reorganization occurs if there are multiple lenders.[6] Each lender realizes that the value of their claim is greatly enhanced if the other lenders agree

[6] Several studies of industrial firms show that financial reorganizations that can potentially make all parties better off, will not occur when there are multiple lenders. For example see, Asquith, Gertner and Scharfstein, (1992) Brown, James and Mooradian (1993), Bulow and Shoven (1979), Gilson, Lang and John (1992) and James (1993).

to take an equity claim. Thus, each lender has an incentive to "holdout" in a financial reorganization. However, the design of IPP financing mitigates this problem. The typical IPP is financed by one or two loans with a small number of lenders involved in each syndicate.

In summary, leverage may reduce the reliability of IPPs in that lenders potentially have an incentive to force the liquidation of a viable IPP. However, this problem is not likely to be large for an IPP for two reasons. First, the debt of typical IPP is not widely held. Thus, the typical IPP should be able to easily facilitate a financial reorganization. Second, the liquidation value of an IPP owned power plant is very small which reduces the lenders incentives to force liquidation.

This stylized problem considers the case where the IPP's costs vary depending on the efficiency of the plant. But the plant can always operate. Suppose that an inefficient plant may need a capital infusion to meet the operating standards of the contract. The owners of a highly leveraged IPP have a reduced incentive to contribute capital because the improvement in operating performance and profitability, at least in part, benefit lenders.[7] Thus, leverage may reduce the reliability of the plant by reducing the owner's incentives to keep it operating. However, if this situation arises, all parties stand to gain from a financial reorganization.

The experiences of AES Corporation are quite consistent with the our arguments. Two of AES's projects have run into difficulty meeting the terms of the loan agreement. However, neither project was shut down. One of the largest IPP funded projects to experience financial problems to date occurred with AES Corporation's $470 million Cedar Bay cogeneration project in Jacksonville Florida. This case is good example of how financial problems are not necessarily synonymous with default on the purchased power contract. The 250 MW project ran into trouble

[7] Generically, the incentive for owners to of highly leveraged firms to forego profitable investments or improvements is referred to as the "underinvestment problem" by Myers (1977).

over disagreements with the Florida Department of Environmental Regulation in early 1992 over how the steam host was to configure its boilers. However, while senior lenders substantially cut back construction funding, they actively pursued a buyer for the plant. Senior lenders negotiated the sale of the plant to U.S. Generating Corporation in the fall of 1992. The plant came on line in time to meet its January 1994 obligation to deliver power to Florida Power & Light.

AES Corporation also had difficulty meeting its obligations to lenders on its 140 MW Deepwater plant in Houston Texas when revenues fell substantially due to declines in natural gas prices in 1986. The price of its power sales contract with Houston Power & Light is indexed to natural gas prices. While the plant was not in compliance with its debt contract since June of 1986, lenders never exercised any remedies and the plant continued to operate. AES purchased the bank lenders' claims in January of 1995.

II. Leverage and the hold-up problem.

One common concern with purchased power is the potential for an IPP to ask the utility to increase the price paid for purchased power above the agreed upon price. The utility would agree to such concessions if (1) the IPPs costs are high enough that it would liquidate without a price increase <u>and</u> (2) the utility cannot find an alternative power source. I refer to the ability of the IPP to extract a higher price from the utility than originally agreed upon as the hold-up problem. This section develops two points. First, the highly leveraged nature of an IPP is unlikely to increase its ability to "hold-up" the utility. Second, the IPP's ability to hold-up the utility, if it exists, is not a problem with purchased power per se. However, this ability must be considered by regulators when evaluating competing bids by an IPP and a regulated utility for new capacity.

In order for an IPP to extract a higher price from a utility it must make a "credible threat" to shut down operations if the concession is not made. This means that the IPP's costs must be high enough that it is better off liquidating under the terms of the current contract. If the utility has no other alternative, then it must offer a high enough price for purchased power so that the IPP no longer prefers to liquidate.

The above analysis concludes that financial leverage is unlikely to effect the critical cost at which the IPP will liquidate. Recall that the ability and incentive to do a financial reorganization implies that the all equity IPP and the leveraged IPP will liquidate under the exact same conditions. Further, the availability of alternative sources of power limit the ability of the IPP to extract a higher price from the IPP. If there exist alternative power sources at below the price agreed to in the purchased power contract, then the utility will not agree to any concessions. The utility will only pay the IPP what it costs to obtain power elsewhere.

Suppose that an IPP can extract a higher price from the utility if its costs are higher than expected but it is not forced to offer the utility a lower price when its costs are lower than expected. This actually does not hurt consumers because the IPP will agree to a lower initial rate. Competition among IPPs will force them to pass on the expected savings from being able to recontract for a higher rate if costs are higher than expected.

However, to the extent that regulators do not allow a utility to fully pass on its cost over runs to consumers, means that a utility building the same plant would have to charge a higher rate than the IPP. However, the apparently less attractive utility bid is actually just as attractive to consumers (both plants have the same expected costs) as the IPP's bid. Thus, regulators should consider the IPP's ability to extract a higher using the analysis developed above when comparing bids from an IPP and utility. In particular, regulators should look at the availability of alternative power sources.

IV. Conclusion.

This paper indicates that the extreme financial leverage of IPPs is not likely to effect their reliability. While heavy debt burdens make the solvency of an IPP very fragile, if an IPP finds it difficult to meet its debt obligations, the lender will use the same criteria as the owners of an all equity IPP in deciding whether to liquidate. The key to this argument lies in recognizing the ability and the benefits of a financial reorganization when the IPP becomes insolvent. We go on to demonstrate that since the leverage IPP is likely to liquidate under the same conditions as the unlevered IPP, leverage does not create a hold-up problem.

The hold up problem and any competitive advantage to IPPs from the utility's "obligation to serve" are likely to be small because of the ability to purchase power from alternative sources. Further, these issues are not a problem with the use of purchased power. Rather, the regulator must evaluate competing bids by an IPP and utility with caution if it believes these problems to be large.

Table 1
IPP Project Values at Various Generating Costs

Cost	Ongoing Concern Value	Equity Value	Lender Value
3.50	$80.7	$19.1	$61.6
3.60	$75.4	$13.8	$61.6
3.70	$70.0	$8.4	$61.6
3.80	$59.2	$3.0	$61.6
3.90	$59.2	$0.0	$59.2
4.00	$53.8	$0.0	$53.8
4.10	$48.4	$0.0	$48.4
4.20	$43.1	$0.0	$43.1
4.30	$37.7	$0.0	$37.7
4.40	$32.3	$0.0	$32.3
4.50	$26.9	$0.0	$26.9
4.60	$21.5	$0.0	$21.5
4.70	$16.1	$0.0	$16.1
4.80	$10.8	$0.0	$10.8
4.90	$5.4	$0.0	$5.4
5.00	$0.0	$0.0	$0.0

Cost = the cost in cents per kilowatt hour of producing electricity.

Ongoing concern value = the present value of the profit stream in millions of dollars
= (5 cents - cost)(87,600,000 kilowatt hours per year)(.06145),
where .06145 is the ten year annuity factor at 10%.

Equity Value = value of equity in millions of dollars
= Maximum of Ongoing Concern Value - Lender Value and 0.

Lender Value = value of lender's claim in millions of dollars
= Minimum of $61.6 million and the ongoing concern value.

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Appendix

This appendix provides a general model of the liquidation/continuation choice faced by an IPP. Consider the following one period model. At the beginning of the period, $t=0$, the IPP gets a signal C about its costs. Specifically, its costs, which are realized at the end of the period, $t=1$, are equally likely to be either C+A or C-A. Revenues of R are received at $t=1$. The IPP can either continue and receive profits of R-C-A or R-C+A or break the contract and liquidate. The liquidation value of the plant is L. Finally, for simplicity we assume that all cash flows are discounted at an interest rate of 0% and all investors are risk neutral.

The following "shut down" conditions are simply the values of C for which the IPP will find it optimal to liquidate. We begin by considering the benchmark case of the all equity IPP.

A. Shut down conditions for an all equity IPP.

The all equity IPP liquidates when the continuation value R-C is less than L. Thus, the all equity IPP liquidates for all $t=0$ values of C greater than $C^* = R-L$. Since the criteria used by an all equity firm is not distorted by financial leverage it is referred to as the "first best" choice.

B. Shut down condition for a leveraged firm assuming the debt cannot be reorganized.

Now we assume that the firm owes D in face value of debt at $t=1$. The analysis considers two cases. First, suppose that equity makes the continuation choice. This situation presumes that the IPP has not defaulted on any aspect of the debt contract. Second, suppose that debt makes the continuation choice. The idea here is that either there has been a default or the IPP needs periodic cash infusions which implicitly give the lender the ability to veto any continuation.

The continuation/liquidation outcome depends, in part, on whether the amount borrowed is greater or less than the liquidation value of the assets. Thus, two cases are considered: (1) $L < D$, and (2) $L > D$.

B.1. Equity in Control.

The analysis indicates that equity tends to continue too often. It continues for values of $C > C^*$. Cases 1 and 2 are considered in turn.

<u>Case 1.</u> $L < D$. In this case, equity receives zero in liquidation. Thus, it elects to continue for all values of C. Equity continues even when it is not profitable to do so.

<u>Case 2a.</u> $L > D$ and $A < L - D$. In this case, the firm liquidates when ever
$C > C^* = R - L$. In other words, the continuation choice is first best.

<u>Case 2b.</u> $L > D$ and $A > L - D$. In this case, the firm liquidates when ever
$C > C^{**} = (R - L) + A + (D-L) > C^*$.

Equity has an incentive to continue too much because it does not bear the down side (debt does) when the firm defaults. In other words, if $R - C - A < D$, then equity gets nothing.

B.2. Debt in Control.

The analysis indicates that debt has an incentive to liquidate too often. It chooses to liquidate for value of $C < C^*$. The same two cases as in B.1. are considered: (1) $L < D$, and (2) $L > D$.

Case 1a. $L < D$ and $A < L - D$. Here the lender is indifferent between continuation and liquidation.

Case 1b. $L < D$ and $A > L - D$. In this case, debt bears all of the down side if costs are high and equity receives at least part of the benefits when costs are low. The lender liquidates too often. The lender liquidates when $C > C^{***} = (R-L) + (D-L) - A < C^*$.

Case 2. $L > D$. In this case, debt always wants to liquidate. It gets paid in full in liquidation.[8]

C. The debt can be easily reorganized.

Focus on Case 1b in part B.2. The potential for deviations from first best come about when the company observes some C that is greater than C^{***} but less than C^*. The lender has an incentive to liquidate, however, the liquidation reduces value. The following shows what a financial reorganization would look like that made both parties better off. The surplus comes from making a better liquidation choice.

Proof. Suppose that the firm observes a cost of C^{***}. If the creditor liquidates, then it's payoff is L and equity gets nothing. However, suppose it agrees to scale down it's debt claim to $D' = L$ and takes $0 < \alpha < 1$ of the equity. The payoffs to the lender if it continues are

$(.5)(R-C^{***}-A) + (.5)(D' + \alpha(R-C+A-D'))$ which is greater than L for some $\alpha < 1$.

[8] There are some values of C (sufficiently high) for which the lender is indifferent between liquidation and continuation. In particular, the lender is indifferent when it get paid in full with certainty. Further, in Case 1 of Part B.1. if the value of C is sufficiently low that equity will not get paid even the profits are $R - C + A$, it is indifferent between continuation and liquidation.