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Shielding of Assets and Lending Contracts

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ABSTRACT

The primary means of enforcement of legal liabilities is through the seizure of debtors' assets. However, debtors can shield their assets in various ways and thereby reduce the power of enforcement. This paper studies the circumstances under which a debtor would choose to shield assets and the value of assets that would be shielded.

A key idea is that borrower's wealth mutes shielding incentives. Intuitively, avoiding debts through shielding requires that enough assets will be shielded, for else the debts can be collected from exposed assets. A wealthier debtor would thus need to shield more assets, and at a greater cost, than a debtor with limited wealth. Using this basic understanding, I develop a theory of asset shielding and explore its implications for incomplete lending contracts, explaining the role of equity agreements, equity cushions and collateral, and debt forgiveness, and explore the some of the policy implications.

1. INTRODUCTION

The primary means of enforcement of civil legal liabilities, such as debt contracts, taxes, or tort judgments, is through the seizure of debtors' assets. However, as Section 2 discusses, debtors are often in a position to circumvent asset seizure by the use of such methods as hiding cash, transferring ownership of property to family members, and using shell corporations. After shielding, creditors will be dissuaded from collecting their debts and debtors may file for bankruptcy and discharge their obligations.

Despite the importance of shielding decisions to the modern economy, the literature has not provided an account of when shielding will take place and the magnitude of assets that would be shielded. This paper develops a theory of asset shielding that explains shielding behavior and its impact on the credit market. It argues that richer debtors would often not find it in their self-interest to shield assets. Conversely, poorer debtors, even if formally solvent, pose a shielding risk. This risk would tend to harm debtors by limiting their access to credit and therefore they would benefit from being able to commit not to shield. Such a commitment is difficult to secure and the paper explores several public and private strategies of limiting shielding risk.

The model, described in Section 3, is a stylized lending model with incomplete contracts where an entrepreneur borrows money from a lender for an investment and then faces an opportunity to shield the investment returns at some per-unit cost. The focus on incomplete contracts is relevant to high transaction costs environments where more sophisticated contracts are unavailable. An important benefit of this assumption is that it allows us to generalize much of the analysis to include non-contractual settings, such as accidents, fines, and taxes. The assumption that there is sufficient opportunity to shield assets ex-post (due to Hart and Moore 1989) is motivated by the relative simplicity and rapidness of various shielding techniques and the costliness of monitoring borrowers.

We start by examining the question how much value a borrower who decided to shield assets would choose to shield, because this will inform all other decisions. In answering it, it is useful to dispel first two common perceptions. Firstly, the borrower may be thought to attempt to shield the amount he owes. On reflection, however, such a decision is revealed to be irrational. If the borrower only shields what he owes, than he will often leave other assets exposed. The (oft-overlooked) recourse principle (Scott 1913) holds that a debt-holder has a right to substitute his debt with those other assets. The lender will then be able to collect despite shielding effort, rendering shielding pointless. Secondly, the borrower may be thought to choose an amount to shield such that the marginal cost of shielding does not exceed the marginal benefit, understood as the amount shielded after deducting shielding expenses. But this too is erroneous: It assumes the costs are borne by the borrower, but they are in fact taken from what is owed to the lender.

With this in mind, the first contribution of this paper is in explaining that the choice of value to shield depends on debtor's wealth and the size of the debt—but not on shielding costs. More specifically, *the lowest value that a debtor will find rational to spend on shielding is given by the*

difference between debtor's wealth and debt.[1] To illustrate the intuition underlying this result, suppose the borrower owes $10,000 and has $25,000. Spending only $12,000 on shielding, for example, would leave more than $10,000 exposed, so the lender would be able to collect in full despite shielding effort. It follows that if the borrower spends on shielding any positive amount, it must be greater than $15,000 for else shielding effort would be moot—and this minimal value that must be shielded holds regardless of shielding costs.

Understanding how much would be shielded helps to determine whether shielding will take place at all. When deciding whether to shield, the borrower compares the costs involved in shielding sufficient value to the cost of debt repayment. If shielding costs exceed the debt, the borrower would be better off repaying the debt than shielding. Now, since a wealthier borrower would have to shield more, he would face higher shielding costs. From this follows the second contribution of this paper: *the wealthier the borrower is, the less rational shielding becomes.*[2]

Anticipating the ex-post shielding decisions has important effects on project finance. On the one hand, shielding risk can lead to outright credit denial even for profitable investments. While normally the lender can be compensated for default risk by charging a higher interest, this is not necessarily the case here. This is because charging higher interest would result in greater shielding incentives may thus *reduce* lender's payoff. This will result in credit rationing for certain profitable investments even in the absence of the conventional reasons of adverse selection and moral hazard in effort (Stiglitz and Weiss, 1981).

On the other hand, the analysis also implies a strong limit on the incentive to shield. If borrower's ex-post wealth is high, shielding will be too costly. And if the investment has high expected returns, the lender need not worry about default due to shielding. As a result, high yield investments, even if risky in terms of variability of returns (e.g., start-ups), can enjoy easy access to credit even without collateral. Stated differently, a lender might perversely prefer a risky investment to a safer one with the same expected value. This is because the upside in the risky investment is more likely to surpass the wealth threshold.

Given the problems asset shielding creates, both the lender and the borrower will have an incentive to limit shielding opportunities and the analysis compares two alternatives. In the one, the borrower "ties his hands" and commits not to shield. Such a commitment is of limited credibility, because contractual sanctions are pecuniary and so will not be effective in exactly those circumstances when the borrower breaches the contract. Still, it may be possible for the borrower to limit future shielding by permitting the creditor to repossess assets soon after default or by placing future revenues in a hard-to-access account. In the other alternative, the parties opt for an equity agreement instead of a debt contract. I show that the first approach mitigates the problem of

[1] In the body of the analysis I develop a stronger version of this conclusion, showing that it would pay the borrower to shield *all* assets conditional on deciding to shield.

[2] The intuition underlying this result can be easily illustrated. If a borrower who owes $10,000 has $15,000 in assets, then the minimum he would have to spend on shielding is $5,000. If he has $80,000, he would have to spend at least $70,000. The greater spending implies a greater cost and lesser incentive to shield.

shielding but will not solve it, whereas the second approach may indeed solve the problem of asset shielding but may not always be practical.

Section 4 analyzes a few extensions of the basic model. I explain the role of collateral—possessory and nonpossessory, explicit and implicit—in mitigating shielding risk and how equity cushions may be useful. I suggest another motive for debt relief agreements—avoiding shielding behavior—and suggest the structure of such agreements. I then consider how collection costs could affect shielding behavior and show that there is both substitution and complementarity between collection costs and shielding behavior. Finally I discuss ex-ante shielding and consumer lending.

I close with a brief analysis of a few regulatory implications. To ward off shielding, the legal system could attack the problem directly—by making it more expensive to shield through sanctions on shielding and closing shielding loopholes—or it can do so indirectly, by requiring minimal asset requirements for actors engaged in potentially dangerous activities or by limiting the fines and judgments imposed on asset-constrained individuals. Section 5 concludes.

There is rich work dating back to Shavell (1986) that studies the effect of insolvency on injurers' incentives to take care (the 'judgment proof problem'). For example, Ganuza and Gomez (2008) advocate the use of 'soft' liability standards for insolvent injurers. For the most part, work in this area takes wealth levels as exogenously set (Summers 1983, Dari-Mattiacci and De Geest 2002, Ganuza and Gomez, 2008, Dari-Mattiacci and Mangan 2008, Wickelgren 2011) although some important work considers the possibility that firm capitalization may be the result of strategic behavior (Shavell 2005, Che and Spier 2008, Veld and Hutchinson 2009, Ganuza and Gomez 2011). However, even the latter strain in the literature only studies ex-ante moral hazard.[3] This paper complements this body of work by considering the ex-post moral hazard inherent in asset shielding, which is of relevance regardless of ex-ante capitalization.

Other related work comes from the literature on credit. However, this scholarship too has largely abstracted away from shielding decisions and focused instead on the costs and choice of default (e.g., Leff 1970, Schwartz 1983, Gross and Souleles 2002, White 2007). In the recent contribution of Ellingsen and Kristiansen, they allow borrowers to "divert" assets, but this is different from shielding as it is assumed to come at no cost besides the risk of enforcement (Ellingsen and Kristiansen 2011). In practice, however, shielding is quite costly and generally goes unpunished.[4]

The part of the literature that relates most closely to asset shielding is the theory of costly state falsification (owing to Lacker and Weinberg 1989). This work studies contracting in the face of an ex-post moral hazard of asset hiding, similar to the inquiry at hand. However, this literature focuses on sophisticated contracts and does not consider simpler contracts which are common in practice (as noted by Lacker himself 1991). Moreover in many settings where shielding opportunities are present—e.g., torts, civil judgments, fines, and taxes—contracting is impossible, so that the study of shielding behavior with incomplete contracts becomes important.

[3] Shavell (2005) adumbrates this possibility of ex-post moral hazard but does not analyze it.
[4] See discussion in section 2.

The primary contributions of this paper relative to existing literature stem from the analysis of optimal asset shielding decisions and the identification of the relationship between these decisions and borrower's wealth. The implications of this analysis on the credit market and on rich and poor borrowers are likewise new. Similarly novel are the ideas that shielding is generally an all-or-nothing proposition,[5] that high wealth mutes the incentive to shield, and the interpretation of the incentive to enter into debt relief contracts.

2. SHIELDING ASSETS FROM ENFORCEMENT

The term asset shielding (or equivalently, asset protection) is used here expansively, to account for any action or omission by an individual that takes place after the creation of a specific debt and that is intended to limit the lender's ability to seize assets in case of default.[6] Thus defined, some examples are the case of Charles Kallestad, a borrower who was found to be shielding assets worth hundreds of thousands of dollars through multiple transfers to an accomplice (U.S. v. Kallestad 51 F.3d 1044 and trial documents); O.J. Simpson and Paul Bilzerian, who moved to multi-million mansions in Florida after accruing millions of dollars in debts; and Jimmy Jen, a debtor from California who was found to have shielded over $6 million using secret vaults, shell corporations, and a sham divorce (Elinson 2010).[7]

The primary forms of shielding are consumption (e.g., purchasing perishable goods or expensive dinners, giving to charity), concealment (e.g., hiding cash, mock transfers, failing to disclose income), legal asset protection (e.g., investing in bankruptcy exempt property, creating special trusts, and forming corporate structures), or obstruction of enforcement efforts (e.g., transferring assets to foreign havens or changing addresses). The literature abounds with techniques and cases (e.g., Che and Spier 2008, White 2007, Vandervort v. Vandervort, 134 P.3d 892, (Okla. Civ. App. 2005)). Many of these techniques—although by no means all—are simple and rapid to affect and do not require extensive advance planning, most notably asset concealment. This means that a debtor would often be in a position to shield assets before the creditor seeks repayment. This is especially true in loan agreements where the moment of realization of investment returns is not precisely known in advance.

Shielding is costly. Some costs are direct—such as setting a shelter or retaining a lawyer—but others are indirect—such as the opportunity cost of shielding and the cost involved in not being able to freely use one's assets. Whether the marginal cost of shielding increases or declines with the amount shielded is hard to tell a-priori, but it will clearly be positive in most cases.

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[5] Ellingsen and Kristiansen (2011) reach a similar result but for a different reason.

[6] Hence, I do not consider "preparatory" asset protection that takes place before the borrower has a specific debt.

[7] O.J. Simpson escaped a $33.5 million judgment while residing in a Florida mansion and receiving a $25K monthly pension, taking advantage of Florida's generous homestead protection laws and the federal retirement laws (Alper 2007); Bilzerian defaulted on $140 million debts while residing in an 11 bedroom home in Florida taking advantage of similar protections (Shenon, 2001); Jimmy Jen hid over $6 million dollars in vaults, shell corporations, and in his wife's possession following a sham divorce (Elinson 2010);

There are also two other types of costs: legality and reputation (Arbel, 2015). As a general matter, shielding assets with the intention of avoiding a specific debt exposes the debtor to both civil and criminal liability. Civil liability is seemingly somewhat effective,[8] although the bringing of such a lawsuit requires evidence of fraudulent transfer, which can be hard to obtain, and the successful implementation of the judgment depends on the assets still being in jurisdiction.[9] Moreover, even preliminary steps, such as locating the debtor, prove difficult in practice (Stephen, Avril, and Wrapson 2013). Criminal sanctions are seemingly much less effective (e.g., McCullough 1997). In 2011 there were 1.3 million bankruptcy filings (U.S. Courts 2012), but the Executive Office of the US Trustees (EOUST) referred only 1,968 cases to criminal proceedings (DOJ 2012)[10] and in only about 20 cases formal charges were filed.[11] This is despite evidence noted below by the EOUST itself that bankruptcy fraud is pervasive.

Another cost is reputation (e.g., loss of credit score or lending relationships). Reputation is likewise limited because it is often hard to observe whether the borrower defaulted strategically or due to real financial inability. The multiplicity of credit channels further dilutes reputational effects, as information, even if obtained, may not fully propagate to all other lenders.

Overall, shielding is somewhat prevalent and seemingly highly effective. While we do not have good data, one indication comes from reports of the EOUST, which is the agency in charge of investigating bankruptcy fraud. In a random sample of 102 cases, they found that 17% of the debtors "materially misstated" the true extent of their assets.[12] This evidence joins other studies that find strategic behavior in bankruptcy and in judgment enforcement (Fay, Hurst and White 2002 and Ning Zhu 2011, but see Sullivan, Westbrook and Warren 1989; Arbel, 2015), suggesting that some debtors use bankruptcy to protect assets.[13] The size of the debt collection industry is also indicative, as their main service is collection from reluctant debtors. This industry collects over 50 billion dollars annually (PWC 2008, EY 2012).[14]

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[8] Creditor's right to reverse fraudulent transfers stems, mainly, from either § 9 of the UFTA or §548 of the Bankruptcy Code. Both Westlaw and LexisNexis record only about 450 cases in 2011 that cite to § 548.

[9] In FTC v. Affordable Media, LLC 179 F. 3d 1228 (9th Cir. 1999), the debtors placed their assets in an offshore account. When ordered by a US judge to repatriate their assets, they faxed a request to the offshore trustee who refused to implement it, because the trust mandate gave him the power to refuse requests made under duress.

[10] The EOUST collects information from trustees who are required to inform the EOUST of all suspicions of criminal activity (Handbook 2012)

[11] Similarly, the database TracFed shows that over the last decade, there was a yearly average of about 60 cases prosecuted where the main charge was 8 USC §152 (the main section concerning asset fraud in bankruptcy). For the same criteria, Westlaw records 56 open dockets in 2012 and the IRS reports opening investigations in only 44 cases in 2014 (http://www.irs.gov/uac/Statistical-Data-Bankruptcy-Fraud).

[12] Of the cases referred, the causes for referral was: false oath or statement (33.2%), concealment of assets (24.8%), and other bankruptcy fraud schemes (21.5%) (each case may have more than one allegation).

[13] There are also reports of trillions of dollars hidden in offshore accounts, but it is unclear which part is motivated by asset protection and which by the desire to avoid taxes and other laws.

[14] Analysis of the Federal Reserve reports show that in the 10 years between 2003 to 2013, commercial banks have reported average charge-offs of 5.5% (credit cards) and 0.91% (residential real estate) (Federal Reserve Website, http://www.federalreserve.gov/releases/chargeoff/chgallnsa.htm) Similarly, in total, corporations write off an average

In sum, then, from the debtor's perspective, the shielding of assets is a viable strategy with low chance of criminal sanctions, but with some cost due to limited reputational effects and some risk of reversal of the shielding if it is not executed carefully.

3. MODEL AND ANALYSIS

The asset shielding model spans four dates (see Figure 1) and involves two risk-neutral parties. At Date 1, one of the parties ('borrower') has a positive-expected value investment that requires a fixed investment of b. The borrower has no wealth,[15] and seeks a loan from the other party ('lender'), in a competitive lending market with costs of capital normalized to zero. The parties negotiate the interest on the loan r, so that the amount due at Date 4 is $b + r$.[16] If the lender agrees to provide the loan at this price, the funds are invested.

If the investment is made, the earnings, e, are realized at Date 2 and are taken from the probability distribution function $f(e)$, and e is in $[\underline{e}, \bar{e}]$, with $0 \leq \underline{e} < \bar{e}$.

At date 3, the borrower decides whether to repay or shield. This is given by the amount t ($t \geq 0$) the borrower spends on shielding, with $t=0$ being no-shielding. There is a shielding 'technology', described by the function $s(.)$, which gives the amount shielded by spending t. It is assumed that s' is strictly increasing, continuous, and with $s'<1$.[17]

The borrower's choice at Date 3 of the amount to shield implicitly defines the amount he leaves exposed. At Date 4 the lender collects and by the recourse principle, the lender may collect from all exposed assets up to the amount owed, i.e., $Min(e-t, b+r)$. After that, the debt is discharged in bankruptcy or the creditor gives up on collecting.

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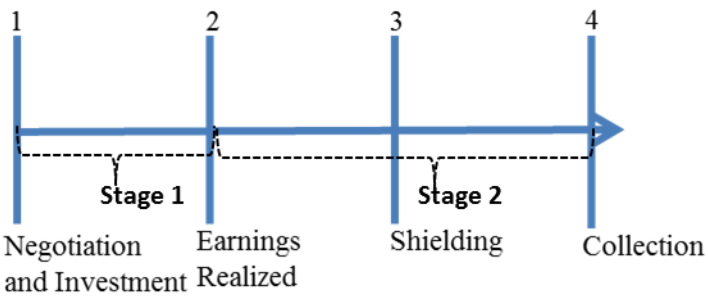
of 4.8% of their accounts receivable, which in 2009 totaled $253 billion (IRS Statistics, http://www.irs.gov/uac/Tax-Stats-2). Note that this figure includes loss from debtors who are genuinely unable to repay, so it should only be understood as a rough estimate on the upper limit of strategic debt avoidance.

[15] This assumption bars the use of collateral and it is relaxed in the extensions of the model.

[16] I restrict attention here to simple loan contracts, where the parties set a non-contingent payment schedule. I also abstract from criminal sanctions, as Section 2 suggests they are rare; civil sanctions that reverse shielding are more common and they can be conceptualized as part of the expected cost of shielding.

[17] This assumption captures the idea that there is always some cost to shielding, such as the opportunity cost involved in losing interest on one's savings, for otherwise the assets would be shielded in the baseline and the inquiry would be trivial. I further assume here that there are no fixed shielding costs. I relax this assumption below.

Figure 1: Timing of the Model



Finally, the measure of social welfare adopted is the total utility of the parties, which in light of the risk neutrality assumption, is simplified to their joint wealth. At the end of the Date 4, the social benefits from the investment, if made, are its earning *e*, and the social costs are the costs of making the investment *b* as well as shielding costs *c(s)*.

Timing, Information, and Order of Analysis: the game is solved by backwards induction. It is assumed that all information is common knowledge, although shielding may not be verifiable to a third party. The analysis starts with the shielding and collection stage (Dates 3 & 4), when the amount of earning *e* and the interest *r* are fixed. The analysis then goes backwards to analyze the parties' decisions in the first stage (Date 1) when the investment contract, and more specifically *r*, is negotiated. The results of the analysis will be compared to both the social optimum and to a situation where shielding is limited and costly—either by law, technology, or borrower's commitment.

3.1. Stage 2 Analysis: Shielding

At stage 2, the borrower's objective is to maximize profits by choosing *t*, the amount to spend on shielding. This makes borrower's payoff:

$$s(t) + \max(0,\ e - t - (b + r)) \qquad (1)$$

The first term here is the value to the borrower of shielded assets. By the recourse principle, all exposed assets are potential substitutes for the debt. This means that after shielding, the lender will collect the debt from exposed assets, leaving the borrower with what remains (with a lower bound of zero). We then have the following result.

Proposition 1

1.1. If the borrower chooses to shield any positive amount of wealth, the optimal shielding sum, t^*, will be equal to his entire wealth; $t^*=e$.
1.2. There exists a unique critical level of wealth e^* that if $e < e^*$, all of e is used in shielding, so no debt is collected, and if $e > e^*$, nothing is shielded. However, e^* is an increasing function of r and may exceed $\bar{e}$.

Proof: See Appendix.

The intuition behind this proposition is as follows. The borrower has at this stage a debt of $b+r$ and a fixed wealth of e. We are assuming the borrower decided to shield assets and we are looking to see how much value he would like to shield. This decision can be thought of as involving two steps. First, the borrower contemplates whether spending on shielding a small amount is desirable. If that amount is small indeed, the remaining assets would exceed the debt: i.e., $e-t>b+r$. On reflection, shielding such a small amount is undesirable, for it leaves exposed enough value so that despite shielding efforts, the debt will be collected in full. This is a direct implication of the recourse principal. Understanding that, the borrower might seek to shield some larger amount, but perhaps something that still falls short of his entire wealth (i.e, $e-(b+r)<t<e$). This would have the benefit of avoiding some of the debt, but it will also—by definition—leave some assets exposed. The lender will collect these assets which will satisfy only part of the debt. But with respect to these exposed assets, the borrower reasons that leaving them exposed would mean that they will be lost; if, instead, the borrower would shield them as well, he will retain some of their value, and however small that is, it is still better than losing them to the lender. Hence, shielding these assets too is in the borrower's interests. We conclude that *if shielding takes place, it would be rational to shield all of the borrower's assets*.

Example 1. The borrower owes \$6,000 and the project earned \$10,000. For every dollar spent on shielding, the borrower retains 20 cents. At first, the borrower contemplates spending \$3,000 on shielding (securing him a value of 0.20*3,000=\$600). But since that would leave exposed \$7,000, the lender will be able to collect the debt in full. Then the borrower considers spending \$7,000 on shielding (securing him a value of 0.2*7,000=\$1,400). This is preferable, but still leaves \$3,000 that will be collected. If the borrower shields these \$3,000 too, he can further increase his payoff by 0.2*3,000=\$600, which is clearly superior to leaving them exposed. As a result, if the borrower chooses to shield assets, he will spend the full \$10,000 on shielding.

It is important to note that this conclusion is general. Even if shielding is very costly, it will still be the case that *if* shielding takes place, the borrower's entire wealth would be spent on shielding, i.e., $t=e$. But of course, this does not mean that shielding will always take place. With this in mind we turn to the other part of Proposition 1.

At the beginning of Stage 2 the borrower may either shield or repay, depending on his payoff from each option. Repayment costs $b+r$ while shielding will cost, based on the previous analysis, $e-s(e)$. There is some positive marginal cost to shielding due, for example, to the loss of interest or asset mobility. This implies that when the amount spent on shielding is large enough, call it e^*, we will have $e^*-s^*(e)=b+r$; i.e., it will cost the same amount to shield one's assets as it would cost to repay the debt. In other words, e^* is a wealth threshold; having more wealth than e^* means that it would cost more to shield than to repay, so that it will no longer be rational to shield assets.

We note three implications of the wealth threshold: shielding assets can be irrational if borrower's wealth is sufficiently high, for then shielding costs may exceed the cost of repayment.[18] Addition-

[18] Of course, the project may not produce sufficient earnings to pass this threshold (i.e., $e^*<\bar{e}$), which can be very high if it easy to shield. In this case, we shall see, the project will not be financed.

ally, e^* is increasing in r –that is, a higher debt increases the incentive to shield assets. Lastly, if shielding technology is inefficient and costly, due to legal or market conditions, that would have the effect of increasing e-$s(e)$, implying a lower wealth threshold. Taken together, *the incentive to shield increases in debt but decreases in wealth and enforcement.*

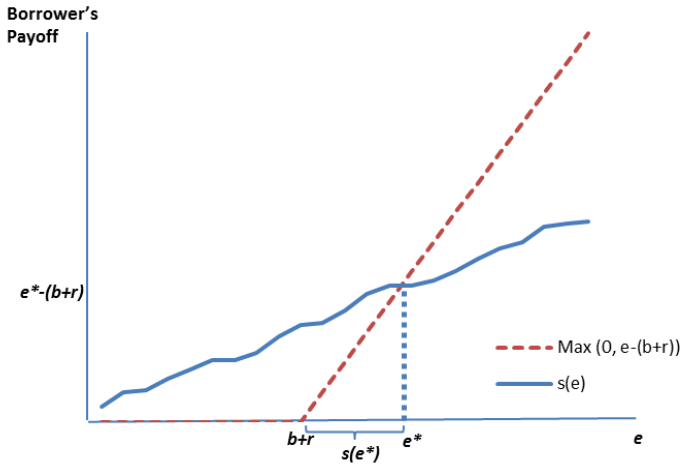
Example 2. Consider the same borrower as before. If the project earns $7,000, spending this entire amount on shielding would cost 0.8*7,000=$5,600, relative to a debt repayment cost of $6,000. Hence, shielding would be preferable. But if the project earns $10,000, shielding would cost $8,000, making it more costly than repaying $6,000. In fact, for every amount above $7,500, it would cost the borrower more to shield than to repay—making it the wealth threshold. In other words, if the return on the investment exceeds $7,500, the borrower would favor repayment to shielding. The wealth threshold would change if the shielding technology were to become less efficient, such that shielding would only leave 10 cents on the dollar (instead of 20). In that case, the wealth threshold would fall to only $6,666.

It is of interest to note the relationship between the wealth threshold and the concept of solvency. The borrower is technically solvent if $e>b+r$. However, this is not enough to surpass the wealth threshold; that will happen only if $e-s(e)>b+r$, or $e>b+r+s(e)$. Hence, borrower's wealth must be greater than the concept of solvency would imply by $s(e)$ for repayment to take place.[19] In other words, *solvency is a necessary but insufficient condition for debt repayment.* The flip side of this conclusion is that if the borrower chooses to repay, this will only happen when he can repay in full – so that the *lender can expect either no payment or full repayment*.

The following figure illustrates these points:

[19] This follows from Proposition 1.1: If borrower's wealth falls below b+r, his entire wealth will be taken by the creditor, so even if shielding is very wasteful, it is still better to shield and retain some value than lose all value.

Figure 2: Borrower's Payoff under Shielding or Repayment as a Function of Earnings



As the figure shows, as the investment earnings rise, the borrower finds shielding more and more costly. When earnings pass the e^* threshold, the shielding costs exceed the costs of repaying the debt and the borrower finds repayment optimal. As noted, having $b+r$ in earning is insufficient to warrant repayment, and the earnings must be greater than $b+r$ by $s(e^*)$ for the borrower to repay. Lastly, from the creditor's perspective, repayment is binary due to the cliff's edge nature of shielding: For every $e \leq e^*$, the lender is not paid at all, and for every $e > e^*$ the creditor is repaid in full.

Social Optimum. The social optimum is defined as the sum of the parties' joint wealth:

$$e - b - \big(t - s(t)\big) \qquad (2)$$

That is, the returns from the investment less the costs of making the investment and the costs involved in shielding.[20] Since (2) is strictly decreasing in t, it will be socially desirable that $t=0$, so that no assets will be shielded; the simple reason is that asset protection absorbs resources but creates no value aside from shifting wealth between the parties.

Private Decisions with Limits on Shielding. In some situations, shielding may be less effective and more costly—either because the legal system makes shielding difficult or because the borrower was able to "tie his hands" and make it more difficult to shield. To capture that, we will consider a competing shielding technology $s_c()$, such that $s_c'(t) < s(t)$ for all t, with full inability to shield being $s_c'(t)=0$ for all t. Under limited shielding, borrower's payoff is given by:

$$s_c(t) + \max(0,\ e - t - (b + r)) \qquad (3)$$

And since $s_c'(t) < s_c(t)$ for all t, it follows that the return on shielding will be lower, thus limiting the desirability of ex-post shielding. This is a reflection of the earlier point that if shielding tech-

[20] The interest r does not factor in the parties' joint wealth since it is a payment made between the parties.

nology is less effective, the wealth threshold decreases. In the extreme, when shielding is unavailable (i.e., $s'(t)=0$ for all t), the wealth threshold becomes zero, leading the borrower to never shield, thus aligning his behavior with what the social optimum.

From the lender's perspective, limits on shielding lower the wealth threshold implying a higher probability of repayment. In the extreme, when the wealth threshold is zero, the lender receives a payment of $min(e, b+r)$ (compared to $b+r$ only for $e>e^*$).

Equity Agreement. We compare now the simple debt contract with a simple equity agreement where the lender buys a stake in the borrower. Under this agreement, the borrower owes the lender a fraction f of all earnings. To simplify the discussion of equity agreements, we will make the fairly strong assumption that $t-s(t)=kt$ for all t¸ that is, that the marginal cost of shielding is fixed at k.

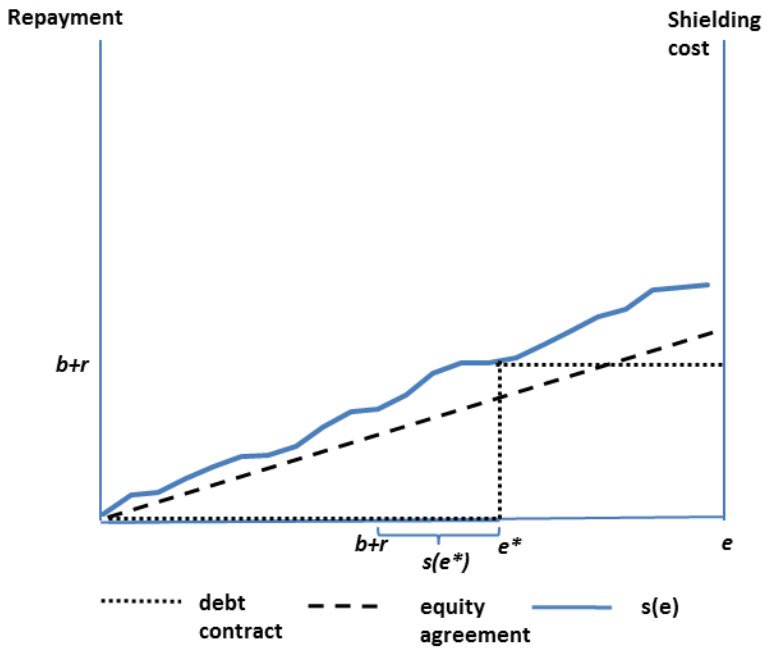
Proposition 2.

2. If the equity stake is small, i.e., if $f<k$, there will be no incentive to shield assets, but if it is higher, the borrower would always rather shield than pay.

Proof: The proof is straightforward and so is its underlying intuition. Because of 1.1., if the borrower decides to shield assets, he would attempt to shield all of them, which will come at a cost of ke. Under equity, the borrower can meet his obligations by paying fe. It follows then that the borrower would rather pay than shield if $f<k$. On the other side, if $k<f$, it will always be cheaper to shield than to repay. The intuition being that because all assets are shielded, shielding imposes a per-unit of wealth cost. Equity also imposes a per-unit of wealth cost. If the equity stake is small, the cost per-unit of repaying the debt is lower than the cost of shielding assets. We conclude that *a low equity interest can mitigate shielding incentives and, under the assumption of fixed marginal cost, may solve them completely.* QED.

The following figure illustrates this proposition. As can be seen, an equity agreement that requires a fraction of costs that lies below the marginal shielding cost would provide the borrower an incentive to repay even in bad states of the world. Unlike a debt contract, the lender is thus assured payment in all states.

Figure 3: Repayment and Shielding Costs as a Function of Earnings, Debt versus Equity



3.2. Stage 1 Analysis: Loan Negotiation

Let us examine now the parties' decision regarding lending and borrowing in the first stage. Based on the analysis just made, the parties negotiate with the expectation that the borrower would repay only if $e>e^*$. The parties negotiate over r and since the analysis implies that e^* depends on r, it will be useful to describe e^* as $e^*(r)$.

The lender thus expects full repayment if, and only if, $e>e^*(r)$, making his expected payoff:

$$\int_{e^*(r)}^{\overline{e}} (b+r)\, f(e)\mathrm{d}e \qquad (4)$$

The following proposition summarizes parties' decisions in this model.

Proposition 3.

If assets can be shielded, then:

3.1. If the returns on the investment are expected to be sufficiently high –i.e., $F(e*(r)) < 1 - \frac{b}{b+r}$, for some r, lending will take place despite the potential for asset shielding;

3.2. Asset shielding may result in denial of credit to net positive value investments through two channels:

3.2.1. **Value Reduction**. Shielding reduces the expected value of the investment to a potentially negative value due to shielding costs(=$\int_{\underline{e}}^{e^*(r)} t(e)\, f(e) de$); or,

3.2.2. **Feedback Effect**. Increasing interest may reduce expected payments, thus making interest adjustments insufficient to compensate the lender for shielding risk, making it so that there will not be an equilibrium interest rate.

Proof. See Appendix.

The first part of Proposition 2 reflects the notion that when wealth is high, shielding becomes irrational. The lender will only lend if his participation constraint is met, that is, if the lender can expect to recoup her investment *b*. This will happen when there is sufficient probability of the wealth threshold being met, because then the debt plus interest are paid in full. As is familiar, the potential for shielding in the other cases could be compensated through the higher interest rate. And if the investment returns are expected to be high in all states of the world, it may be that the interest charged would be at the risk-free rate, despite borrower's technical ability to shield assets.

This result—that lending is rational even in the presence of effective shielding technology—could partially explain credit markets in jurisdictions with poor enforcement and the practice of mostly unsecured loans to high-payoff investments, such as start-ups. The following example illustrates:

Example 3: The borrower seeks a loan of $6,000 and the investment is certain to earn at least $8,000. Since this earning amount is greater than the wealth threshold identified above of $7,500, the lender knows, with certainty, that the borrower will have an incentive to repay. Hence, even with an interest of *0*, the lender will be able to recover the full $6,000.

Example 3a: Now the investment is expected to earn an amount between $0-30,000 with a uniform distribution. If the interest is set at $6,000, the wealth threshold becomes $15,000 (for the cost of shielding that amount is $12,000, the same as the debt plus interest). Since there is 50% chance of exceeding the wealth threshold, this secures the lender an expected payment of 0.5*12,000=$6,000. So the lender should be willing to lend even if shielding is expected to take place in some states of the world. Borrower's payoff below the wealth threshold has an expected value of 0.2*7,500, and above the threshold of 22,500-12,000, for a total expected payoff of 0.5*0.2*7,500+0.5*(22,500-12,000)=$6,000.

The second part of the Proposition indicates two channels by which asset shielding destroys value ex-ante. The first is the fact that shielding assets consumes resources that would otherwise be available to the parties. If the expected surplus of the investment is $3,000, but the expected shielding cost is $5,000, then the investment no longer has a positive expected value.

The second channel is subtly different. As was just noted, the risk of shielding means that a higher interest must be charged. But recall that the incentive to shield rises with the debt (e^* is increasing in *r)*. Increasing *r* in (4) has the double effect of increasing payment conditional on repayment, but reducing the overall probability of repayment (by increasing the lower bound of the integral). To compensate for the higher incentive to shield, an even higher interest may be charged. But this can create a feedback effect, with higher interest increasing shielding incentives,

requiring higher interest, etc. And so, for various investments, there may not exist any equilibrium interest rate for which the lender will be willing to lend and the borrower willing to borrow.

An implication of this Proposition concerns the lender's preference between safe and risky projects of the same expected value. Safer projects are characterized by lower variability of returns, which also entails a lower probability of exceeding the wealth threshold. This would mean that a lender my have a perverse preference to risky projects in the presence of asset shielding risk.

Note that denial of credit through these channels operates through a different mechanism than that identified by Stiglitz and Weiss (1981). Instead of ex-ante moral hazard or adverse selection, here the problem is one of ex-post moral hazard.

Social Optimum. At the beginning of the Date 1, the revenue from the investment is uncertain and has an expected value of *E(e)*. The net value of the investment is *E(e) - b*, which is assumed to be positive. It was noted above that during the second stage, it is socially desirable for assets not to be shielded. Therefore, assuming *t=0*, it is socially desirable for the positive expected value investment to be undertaken. When assets may be shielded ex-post, the value of the investment becomes $E(e) - b - \int_{\underline{e}}^{e^*(r)} t(e)\, f(e) de$, that is, the expected value falls by the costs of shielding. Hence, an otherwise socially desirable investment may become undesirable if shielding is expected.

Private Decisions when Shielding is Limited. Lender's payoff in this akin to (4):

$$\int_{e^*(r)}^{\overline{e}} (b + r)\, f(e) \mathrm{d}e \qquad (5)$$

We have noted that *e** decreases for lower *s'()*, i.e., if shielding technology is limited, the wealth threshold will be lower. A lower threshold implies a higher probability of repayment, thus reducing interest rates and mitigating the problems just identified. Importantly, however, these problems may not be completely solved as long as *s'()*>0, for there could still be some incentive to shield. The following example illustrates

Example 4. Suppose the same circumstances as in 3a. only that now shielding technology is limited so that the borrower retains only 10 cents on each dollar shielded, instead of 20. With this change, if the interest is set at \$3,000, the wealth threshold is \$10,000 (for 0.9*10,000=6000+3000). There is 2/3 chance of exceeding this threshold, thus securing the lender an expected return of 2/3*9,000=6,000, so the lender would indeed be willing to lend at this rate. This also means that the borrower pays \$3,000 less in interest in this case, due to the limited ability to shield. Borrower's expected payoff under this example would be 1/3 * 0.1*5,000+ 2/3 * (20,000-9000)=\$7,500. This is an improvement of \$1,500 over example 3a, all due to the limited ability to shield assets.

The analysis changes when shielding is completely ineffective. In this case, the borrower is indifferent between repaying and shielding for low earnings, *e≤b+r*, and will strictly prefer repaying when earnings are high, *e>b+r*. This implies an expected return to the lender of *min(e, b+r)*, leading to a familiar prediction: while the interest rate may be positive, lending to a positive ex-

pected value investment will always take place. This is in contrast to the shielding model, where lending to such projects was not guaranteed.

We see then that a credible commitment not to shield, and likewise effective enforcement technology, would lead to lower interest and can solve credit denial problems. This is clearly in the borrower's self-interest, ex-ante, to be able to commit to not shielding thus securing finance when he otherwise would not and keeping a greater share of the investment surplus. The difficulty is that standard contractual mechanisms involve only pecuniary sanctions, and thus provide no teeth to a commitment not to shield

Equity Agreement. We turn now to examine the possibility of an equity agreement instead of a debt contract. At Stage 1, the parties set *f* or *r* endogenously. Based on Proposition 2, it is an equity agreement will dominate ex-ante a debt contract from both the borrower's and lender's perspective.

Suppose first that there exists $f<k$ that meets the lender's participation constraint (i.e., $\int_{\underline{e}}^{\bar{e}} fe\, f(e)de = b$, recalling that for $f<k$ there is no shielding). The lender would then find it rational to lend, and the borrower would enjoy from improved access to credit at lower rates.

If it is impossible to set such *f*, then it will also be impossible to find *r* that would permit lending. This is because for the debt contract to meet the lender's participation constraint, there must be some $e'\geq e^*(r)$ for which $ke'\geq b+r$. That is, there must be some of level of wealth for which the borrower prefers repayment to shielding. But if this is the case, it is possible to set $f=k$, and offer the lender a return that is at least as large as under debt. Hence, if the lender is willing to lend with debt, he should be willing to lend with equity as well.

This conclusion, that equity stakes dominate debt contracts is strong and so it is important to note its limits. The literature on costly-state falsification analyzes the optimality of such "shielding-proof" contracts (Lacker and Weinberg 1989). As this literature highlights, the optimality of equity agreements is limited. While they eliminate waste due to shielding, they force allocations that the parties may not find optimal ex-ante.

4. EXTENSIONS

I will now relax some of the assumptions made in the basic model, seeking to explore its relevance to the use of collateral, debt relief, imperfect shielding techniques, and the shielding of investment proceeds.

4.1. Secured Credit, Collateral, and Equity Cushions

Parties sometimes often secured credit as means of reducing lending risk. Using this technique, the lender receives a security interest in the borrower's assets. How would that affect shielding behavior?

Despite their name, security interests do not resolve the problem of asset shielding. While security interests are generally effective in affecting the priorities among creditors in bankruptcy, they

only have a limited effect on shielding behavior. If the borrower owns a consumer good with a lien on it, he may still sell it to a third party or hide it. The lien cannot prevent it and, in fact, a third party may retain ownership of the assets despite creditor's objection. This is not to say that a lien is of no value: liens may make shielding more complicated and costly. But, as we saw, a more expensive shielding technology does not necessarily solve the problem of asset shielding.

A much more effective mechanism is the use of possessory collateral. Suppose now that the borrower starts with some positive wealth w. If the lender is in possession of the collateral, the borrower will not be able to shield it. Hence, default will imply a cost of w on the borrower (loss of collateral). This has two consequences. First, the wealth threshold is now implicitly given by $e-s(e)-w=b+r$, which is lower than otherwise, meaning less shielding risk and, consequently, lower interest rates and less credit denial. Second, because shielding costs w, it means that if $w \geq b+r$, there will be no incentive to shield when the collateral is large, as the cost will always be higher than that of repayment. But possessory collateral is very costly to pledge and involves high and sometime debilitating operational costs, making it of limited use.

Interestingly, even nonpossessory collateral is valuable in mitigating shielding risk – despite borrower's ability to shield it. The reason it is useful is that shielding the collateral itself is costly, and this costs is added to the rest of the shielding costs. The wealth threshold is then implicitly given by $e+w-s(e+w)=b+r$ which is lower than otherwise (but higher than under possessory collateral).[21] This can be interpreted more broadly, as an advantage of equity cushions. Due to the recourse principle, all of borrower's equity cushion acts as implicit nonpossessory collateral, thus reducing the incentive to shield. This means that collateral need not be pledged explicitly to be effective.

Overall, this implies that high-wealth individuals pose a lesser lending risk, allowing them greater access to credit markets. Additionally, this analysis highlights the function of nonpossessory collateral, not only in the relationship between creditors but also between the debtor and the creditor.

4.2. Renegotiation and Debt Forgiveness

In situations where the borrower has a credible threat ex-post to shield assets, the parties may want to renegotiate the debt. The lender would find such a renegotiation desirable, as with asset shielding the lender is not repaid at all. This presents an opportunity for the lender to offer some 'debt relief' in exchange for partial payment.

From the borrower's perspective, debt relief is beneficial if the lender is willing to accept an amount that is equal or lower than borrower's cost of shielding assets. That is, if the lender is willing to forgo the debt claim in exchange for an amount no greater than $e-s(e)$. if the lender is

[21] An indirect effect is due to the somewhat lower marketability of secured assets, which will increase the marginal cost of shielding those assets.

willing to accept that amount, the borrower would avoid the original debt at a lower cost than by shielding assets. Hence, both parties can be made better off by ex-post debt relief.[22]

Is such an agreement realistic? If the borrower approaches the lender demanding debt relief, would not the lender, who knows the debtor can pay, try to enforce the debt at that moment? While plausible, we observe in practice many instances of debt relief where some debt is forgiven or "settled" (NY City Bar 2012). Such agreements are generally based on the implicit understanding that the debtor is not giving literally everything he has, and instead, the parties negotiate some lesser amount.[23] This lends realism to the asset-shielding avoiding motive.

Ex-ante, the prospect of debt relief will mitigate the problems caused by asset shielding, but will not solve them completely. First because of the transaction costs involved in ex-post renegotiation and second because the lender will not be able to receive more than the cost of shielding in bad states of the world (relative to project's full returns in the case of no shielding), so the return may still be insufficient to induce lending. Stated more abstractly, debt relief is akin to an equity agreement in bad states of the world and a debt contract in good states of the world.

4.3. Costly Collection, Uncertain Collection, and Collection of Shielded Assets

In the main analysis, collection of exposed assets was certain. Relaxing this assumption may affect the magnitude of assets that the borrower would seek to shield.[24]

Suppose first that collection has a fixed cost of c.[25] The lender will not find collection profitable unless $e-s(e)>c$. This will allow the borrower to leave c in asset value exposed without fear of collection. For the borrower, shielding costs are then reduced by $c-s(c)$, thus further exacerbating shielding incentives and their resultant negative effects.[26]

It may also be that collection costs depend on the amount collected. Let $l(m)$ be the cost function of collecting an amount m. Suppose that $l(m)$ is either everywhere increasing or decreasing. Let m^* be the value of m for which $l'(m^*)=1$. If collection costs are decreasing, the borrower could leave up to m^* in assets exposed and they will be essentially protected. This reduces the amount the borrower needs to shield by m^*, having a similar effect to that of a positive c.

If collection costs are increasing, collecting more than m^* would be unprofitable. This implies for the borrower that leaving assets exposed is akin to losing m^* in value. Now, if $m^*>b+r$, this will not change the analysis. However, if $m^*<e-s(e)$, the borrower will find it better to leave some as-

[22] The enforceability of debt relief agreement itself is not a problem, if debt relief is conditional on the payment being made. If the borrower breaches, then he will have to incur the higher costs of shielding.

[23] This is not intended to imply that the primary motivation for debt relief agreement is the avoidance of asset shielding. There are other motivations for such agreements, such as saving collection costs. Whichever of these motivations plays a more dominant role is an open empirical question.

[24] An option that I do not address here directly is that shielded assets will be "de-shielded" by creditor's efforts. This option could be simply conceptualized as a higher cost of shielding.

[25] Some fixed collection costs are court and sheriff fees, information requests, time spent on collection, and professional assistance fees.

[26] If $e<b+r+c$, the borrower may choose to repay only $e-c$.

sets exposed than to shield them. Note that in practice, lenders often pay a contingency fee to debt-collectors, so that lenders may have an incentive to pursue all debts, regardless of costs, although the debt collectors themselves may employ similar reasoning to this just noted.[27]

Let us examine now the situation where exposed assets are not always be collected due, for example, to legal limitations or the difficulty of locating them. Suppose that assets exposed are collected with a probability *p*. In this case, the borrower will compare his payoff conditional on complete shielding *s(e)* with the payoff from leaving assets exposed, *pe*.[28] If, for simplicity, marginal shielding cost is fixed at *k*, shielding will only be rational if $k<p$. From the lender's perspective, not shielding is better than shielding, as expected recovery becomes *(1-p)e* instead of *0*.

Finally, let us consider the case where assets can be 'de-shielded'. If there is some probability that assets that were shielded can be uncovered, then this risk can be conceptualized as part of the cost of shielding, making shielding costs *t-s'(t)* instead of *t-s(t)*. The implications of this were already discussed above.

4.4. Ex-Ante Shielding

It is possible that the borrower could also shield the loan proceeds *b*. However, this possibility will not change the analysis. A risk-neutral borrower would be better off investing the proceeds and then shielding the greater expected returns than shielding the lower proceeds of the loan.

5. CONCLUSION AND POLICY IMPLICATIONS

This paper emphasizes the point that shielding is not worthwhile unless the borrower leaves exposed fewer assets than his debt. A chief implication of this point is that shielding would not be worthwhile if a borrower has high wealth, either due to high returns or to initial endowment. On the other hand, a poorer borrower, even if solvent, may find shielding rational. Therefore, the social problems associated with asset shielding, wasted resources, and denial of credit, would be of greater relevance for either poor borrowers or investments that do not succeed.

The conclusions of the analysis are quite general and tend to hold even when collection is costly or uncertain and when the borrower has opportunity to shield prior to making the investment. Renegotiation mitigates some of the social problems of asset shielding, but still involves higher interest and some degree of credit denial. Collateral can be used to further ameliorate the problem, but it will not generally solve it. Equity agreements do provide a promising solution, although they may not always be feasible in practice.

In closing, I would like to briefly highlight a few regulatory implications of this analysis. As the analysis shows, asset shielding can lead to a social loss. The parties may not always be able to solve it directly. One reason can be transaction costs, but a more interesting problem is that con-

[27] The debt collection industry commission average is reported to be around 19% (Fedaseyeu 2013)

[28] The actual decision may be more complicated, as it may be rational to shield only some assets but leave others exposed. But this will not change the qualitative nature of the conclusion to follow.

tractual sanctions are mostly pecuniary. As a result, in exactly those circumstances when a party shields assets, these sanctions would be irrelevant.

Given those limitations, the most direct means of controlling the problem is making shielding more costly, by, for example, reversing suspicious transactions, extending clawback periods, using criminal sanctions more extensively, or limiting bankruptcy exemptions.[29] More generally, the recourse principle limits shielding and so exceptions to this rule (as in non-recourse loans) should be carefully considered.

Another possible mechanism is insurance requirements and use of vicarious liability (as in Pitchford 1995 and Mattiacci and Parisi 2003). Having a third-party involved, such as an insurance company, would reduce lender's risk, but will not necessarily solve the problem, as the borrower may still be able to shield assets. It is only if third parties have an advantage over creditors in monitoring borrowers—which they might have as in the case of multiple lenders—that third party involvement may be a solution to this problem. Future work may develop the conditions under which such a system can be useful.

The legal system may also control the problems of asset shielding more indirectly, by manipulating the wealth threshold. This can be done by requiring actors engaged in dangerous activities to meet a minimal capital requirement. Such an equity cushion, we have noted, reduces shielding incentives by reducing the wealth threshold. The legal system may also reduce shielding incentives by imposing lower fines on under-capitalized debtors (in the spirit of Ganuza and Gomez 2008), or, similarly, order the payment of fines in installments over a long period of time. We noted that the wealth threshold is lower if the debt is lower, so that such solutions may mitigate the problem.

This outline of policy interventions suggest that there is much that can be done to control shielding risk. Understanding the problem of ex-post asset shielding and the underlying incentives could inform work in these areas.

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APPENDIX

Proof of Proposition 1.

1.1. I will now show that it is optimal to set t^* at either 0 or e (i.e., there are no intermediate values of t). To see the first case, suppose that a low t is considered such that $t < e - (b + r)$, i.e., t is less than borrower's ex-post wealth less the debt obligation. This means that the second term in (1) is positive (i.e., $max(0, e-t-(b+r))>0$). We can therefore simplify (1) to $s(t) + e - t - b - r$. And because $s(t)-t<0$,it would be best to set $t=0$. If, instead, a higher t is considered, such that $t > e - (b$

[29] When shielding leads to suboptimal care, the legal system may seek to directly

+ r), that would make borrower's payoff in (1) =*s(t)*, which is clearly optimal to set at its highest value, i.e., *e*.[30] QED.

Note: the proof is relatively general and it holds regardless of the marginal cost of shielding (as long as it is positive), so that it applies even if the marginal cost of shielding exceeds the marginal amount shielded.

1.2. By 1.1., the optimal level of *t*, conditional on shielding, is *e.*. Hence, shielding costs can be expressed as *e-s(e)*. As *s'(e)<1*, Shielding costs are increasing in *e*. This implies that for some level of *e*, we will have *e-s(e)=b+r*. let *e** denote this level. The benefit of shielding is avoiding up to *b+r* in costs, so when *e>e**, the costs of shielding exceed the benefit. It is straightforward to see from this formulation that for higher *r* the level of *e** also increases.

1.3. Because the cost of shielding for any e>e* is greater than *b+r*, the borrower will be better off paying *b+r* and retaining *e-(b+r)* than shielding. QED.

Proof of Proposition 2.

2.1. Let us look at the case where, for simplicity, *r=0* and $\underline{e}>e^*(0)$. In all states of the world borrower's wealth exceeds the threshold identified in 1.2., so shielding will not take place, and the expected return in (5) becomes simply *b+0*. Hence, the loan is guaranteed to be repaid in full and the interest would be indeed set at zero.

If, however, $\underline{e}<e^*(0)$, it is still possible that the loan will be provided. This will be the case if there exists *r* for which:

$$\int_{e^*(r)}^{\bar{e}} (b+r)\, f(e)\mathrm{d}e \geq b$$

But it must be that *r* >0 in this case, because there will not be any payment in the states of the world when $\underline{e}<e^*(0)$.[31]

Note. For lending to take place despite shielding risk, the expected investment earnings have to be higher than they would be under no asset shielding by $\int_{\underline{e}}^{e^*(r)} \mathrm{e}\, f(e)de$, which reflects the reduction in repayments due to asset shielding. This provides one measure of assessing the social cost of shielding.

2.2.1. The value of the investment is reduced in all cases where *e<e*(r)* because the borrower spends *e-s(e)* on shielding. This reduces the (joint) value of the investment by $\int_0^{e^*(r)}(e - s(e))\, f(e)\mathrm{d}e$; hence, if the net value of the investment, $E(e) - b$, is lower than this expected reduction, the investment will have a negative expected value and there will not exist a level of interest for which the lender would be willing to lend.

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[30] The same result of full shielding applies, and for the same reason, when borrower's wealth is low, i.e., *e<b+r*.

[31] For example, suppose *c(p)* is a constant *$0.5* per dollar, *b = $10,000*, and there is a 20% chance that $\underline{e}$*=$1,000* will be realized and a 80% chance that $\bar{e}$*=$40,000* will be realized. If *r=$2,500*, then *e*=$37,500* and there is 80% chance that $12,500 will be repaid, meaning an expected payment of *0.8*12,500=$10,000* – enough to induce the lender to lend.

2.2.2. Suppose first that the parties contemplate setting $r=0$ and that $\underline{e}<e^*(0)$. The amount repaid is given by (3) as $\int_{e^*(0)}^{\bar{e}}(b)\,f(e)\mathrm{d}e$. Since this will be lower than b due to shielding, the interest must be increased to some higher level, denoted as $r^1>0$. By slightly increasing the interest, the lender increases his expected payoff by the probability of repayment times the higher payment, i.e., $(1-F(e^*(r^1))(b+r^1)$. At the same time, however, the higher debt would reduce the probability of repayment, so that the expected repayment falls by the lost revenues, i.e., $F(e^*(r^1)-F(e^*(0)))b$. Now, if under the new schedule the net amount received (the gain from the higher interest less the loss from the lower probability of repayment) falls below b, r^1 would have to be set even higher. It is plain to see now that further increasing the interest may repeat this dynamic, so that r would need to be further and further increased. At the extreme, r could be set any arbitrarily high level, $r\geq\bar{e}$, but then surely no payments will be made, because if the debt is greater than borrower's wealth it always pays to shield (by 1.1.). Hence, it may be that no interest rate would exist such that the necessary amount will be repaid, and the loan will be denied (even if, after deducting the costs of shielding, it has a positive value).[32] QED.

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[32] For example, suppose shielding cost is a constant *$0.5* per dollar, the loan is *$10,000* and that there is equal probability of returns being either $10,000 or $30,000—i.e., expected return is $20,000. If *r=0*, the critical level is $30,000, so there is %50 chance of the borrower repaying, implying an expected return to the lender of $5,000. To adjust, the interest must be set to some positive amount, but this will only increase the critical level to be above $30,000, implying *0* overall returns to the lender.

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