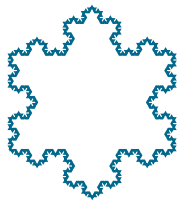
Do Bond Covenants Prevent Asset Substitution?

Johann Reindl
BI Norwegian Business School

joint with Alex Schandlbauer
University of Southern Denmark



DO BOND COVENANTS PREVENT ASSET SUBSTITUTION?

The Asset Substitution Problem

- Levered equity is a *call option* on a firm's underlying assets.

$\Rightarrow$ Equityholders gain from increasing the riskiness of the firm at the expense of debtholders as first noted by Jensen and Meckling (1976).

- Underlying reason: Limited liability makes equity a *convex function* of the unlevered firm value.

DO BOND COVENANTS PREVENT ASSET SUBSTITUTION?

The Asset Substitution Problem

- Levered equity is a *call option* on a firm's underlying assets.

$\Rightarrow$ Equityholders gain from increasing the riskiness of the firm at the expense of debtholders as first noted by Jensen and Meckling (1976).

- Underlying reason: Limited liability makes equity a *convex function* of the unlevered firm value.

Potential Solutions:

- Special financial structure: Hybrid debt (convertibles), short-term debt,...
- Bond covenants prohibiting certain actions

DO BOND COVENANTS PREVENT ASSET SUBSTITUTION?

The Asset Substitution Problem

- Levered equity is a *call option* on a firm's underlying assets.

$\Rightarrow$ Equityholders gain from increasing the riskiness of the firm at the expense of debtholders as first noted by Jensen and Meckling (1976).

- Underlying reason: Limited liability makes equity a *convex function* of the unlevered firm value.

Potential Solutions:

- Special financial structure: Hybrid debt (convertibles), short-term debt,...
- Bond covenants ~~prohibiting certain actions~~
- New Mechanism: Bond covenants **changing the curvature of equity**

HOW CAN WE MEASURE ASSET SUBSTITUTION?

Where to look?

- Asset substitution is most likely to have happened with firms that went bankrupt.
- We track firms that have defaulted for the last **84** months before their default.

Empirical Difficulties

- **Endogeneity** of covenant and risk-shifting decision:
  1. The riskiness we observe depends on whether covenants are in place or not.
  2. The decision to include covenants in bond contracts depends on the expected gains from risk-shifting.
- **Identification problem** because the standard *leverage effect* leads to an automatic increase in a firm's volatility as it approaches default.
- Standard econometric techniques do not work because of the **conditional** sample.

HOW CAN WE MEASURE ASSET SUBSTITUTION?

Our Approach

- Structural corporate finance model that links the leverage and the characteristics of the firm to observable equity prices (**identification ~~problem~~**).
- Defaulted firms are grouped into two sub-samples
  1. firms having issued bonds **with covenants** attached
  2. firms having issued bonds **without covenants** attached.

  and the structural model is estimated separately for each group (**endogeneity ~~problem~~**).
- New estimation approach: conditional simulated methods of moments that is able to deal with our sample of defaulted firms (**selection ~~bias~~**).

RESULTS: DO COVENANTS PREVENT ASSET SUBSTITUTION?

Firms with bond covenants...

- ... have strong risk-shifting incentives (risk-shifting is not costly for equityholders),
- ... and seem to use bond covenants to commit to a more prudent conduct of business. The equity value function is less convex because of the covenant,
- ... engage in risk-shifting very early but not any further in periods of financial distress.

Firms without bond covenants...

- ... have low risk-shifting incentives (risk-shifting is very costly), $\Rightarrow$ agency costs imposed on debtholders are relatively small.
- ... exhibit risk-shifting and default strategies that are very close to the optimal behavior as predicted by theory,
- ... have optimally chosen to not use covenants because the inefficiencies created through covenants exceed their benefits (agency cost savings).

RELATED LITERATURE

Theory on Risk Shifting

- Special financial structure, e.g., hybrid debt in the form of a convertible bond as in Green (1984): The concavity induced by the thread of conversion exactly offsets the convexity induced by limited liability.
  - Problem: works only in a one period model.
- Short-term debt (Djembissi, 2011): Risk-shifting increases the cost of future debt which affects future dividends.
  - Problem: Very costly due to suboptimal leverage and too early default.
  - Empirical evidence: few executives feel that short borrowing reduces risk-shifting incentives, Graham and Harvey (2007).

Empirics on Covenant Use

- Smith and Warner (1979): Costly contracting hypothesis.
- Bradley and Roberts (2003), Wei (2005): Covenants reduce the cost the debt.
- Chava et al. (2010), Billett et al (2007): Firms actively use covenants to reduce the agency costs of debt financing (focus on investment).

MODEL - THE FIRM

Capital Structure

- Outstanding debt represented by consol bond with coupon C.
- *Bankruptcy costs*: a fraction α of the unlevered firm value.
- Default happens when X_t hits a predetermined threshold X_D.
  The threshold is either determined optimally by equityholders or through bond covenants.

Earnings and Assets

- Operating income under the risk-neutral measure:

$$dX_t = \mu_i X_t dt + \sigma_i X_t dW_t$$

- Value of the unlevered assets (if no risk-shifting occurs):

$$A(X_t) = E^{\mathbb{Q}}\left[\int_t^{\infty} (1 - T_C) e^{-r(s-t)} X_s ds\right] = \frac{(1 - T_C)X_t}{r - \mu}$$

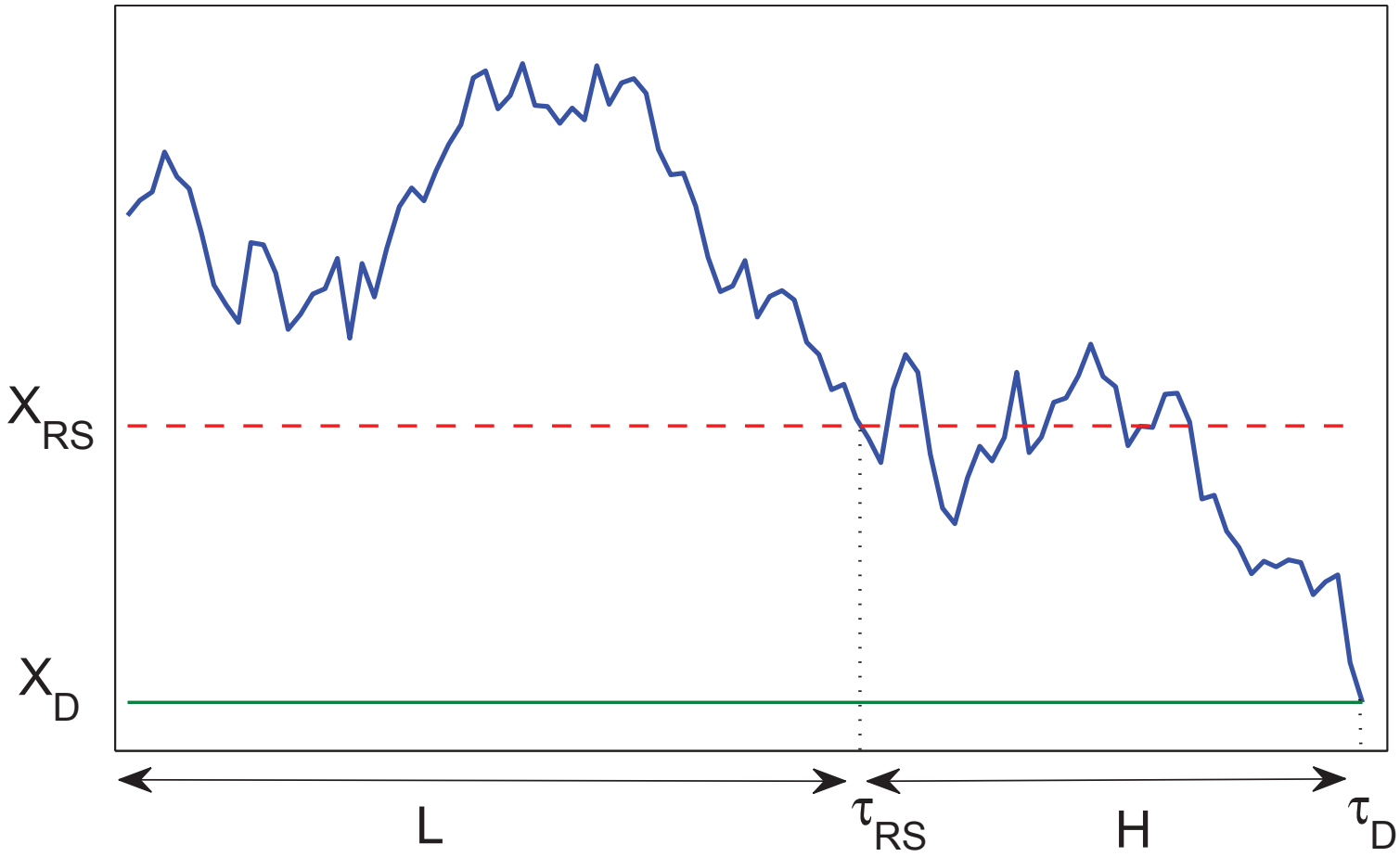
ASSET SUBSTITUTION

- Equityholders have the **option to increase the riskiness** of the firm's cashflow:
$$\sigma_i \in \{\sigma_L, \sigma_H\} \quad \text{where } 0 < \sigma_L < \sigma_H < \infty$$
- Increasing the risk of the cashflow can be **costly**:
$$\mu_i \in \{\mu_L, \mu_H\} \quad \text{where } \mu_H \leq \mu_L < \infty$$
  - expenses necessary for establishing and upholding the riskier use of the assets and/or
  - increase in the discount rate

  $\Rightarrow$ **Risk-shifting can destroy value**:
$$A_H(X_t) = \frac{(1 - T_C)X_t}{r - \mu_H} \leq \frac{(1 - T_C)X_t}{r - \mu_L} = A_L(X_t)$$
- Equityholders choose an optimal **risk-shifting threshold** X_{RS}.

ASSET SUBSTITUTION: OPTIMAL STRATEGIES

EQUITYHOLDERS CHOOSE AN OPTIMAL RISK-SHIFTING (X_{RS}) AND DEFAULT THRESHOLD (X_D).



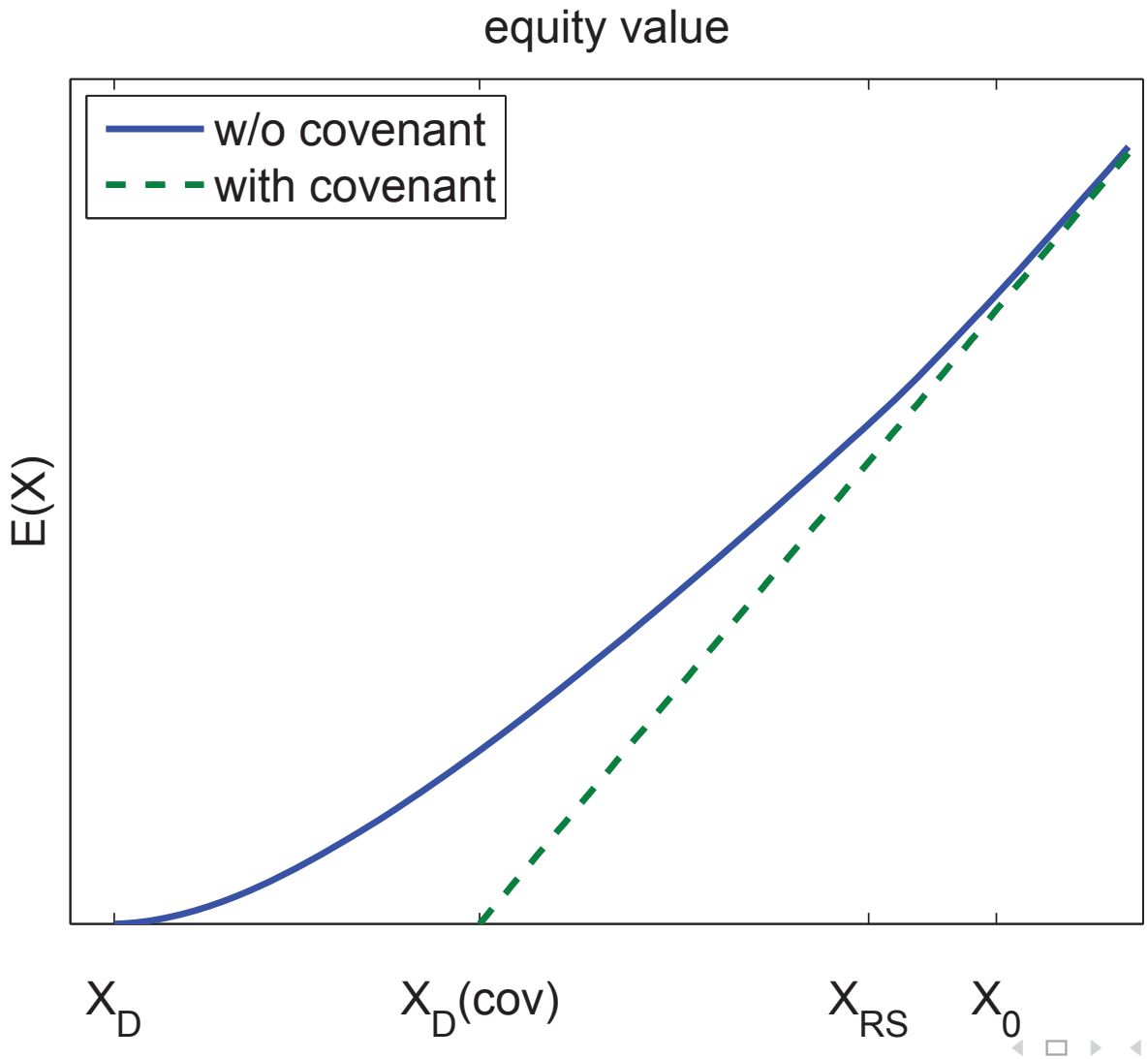
ASSET SUBSTITUTION

- Equityholders have the **option to increase the riskiness** of the firm's cashflow:
$$\sigma_i \in \{\sigma_L, \sigma_H\} \quad \text{where} \quad 0 < \sigma_L < \sigma_H < \infty$$
- Increasing the risk of the cashflow can be **costly**:
$$\mu_i \in \{\mu_L, \mu_H\} \quad \text{where} \quad \mu_H \leq \mu_L < \infty$$
  - expenses necessary for establishing and upholding the riskier use of the assets and/or
  - increase in the discount rate

  $\Rightarrow$ **Risk-shifting can destroy value**:
$$A_H(X_t) = \frac{(1 - T_C)X_t}{r - \mu_H} \leq \frac{(1 - T_C)X_t}{r - \mu_L} = A_L(X_t)$$
- Equityholders choose an optimal **risk-shifting threshold** X_{RS}.
- The **convexity** of equity value function induces the risk-taking behavior.

ASSET SUBSTITUTION: CONVEXITY

THE CONVEXITY OF THE EQUITY VALUE FUNCTION INCREASES THE MORE FINANCIALLY DISTRESSED THE FIRM BECOMES (LOW VALUES OF X_t)



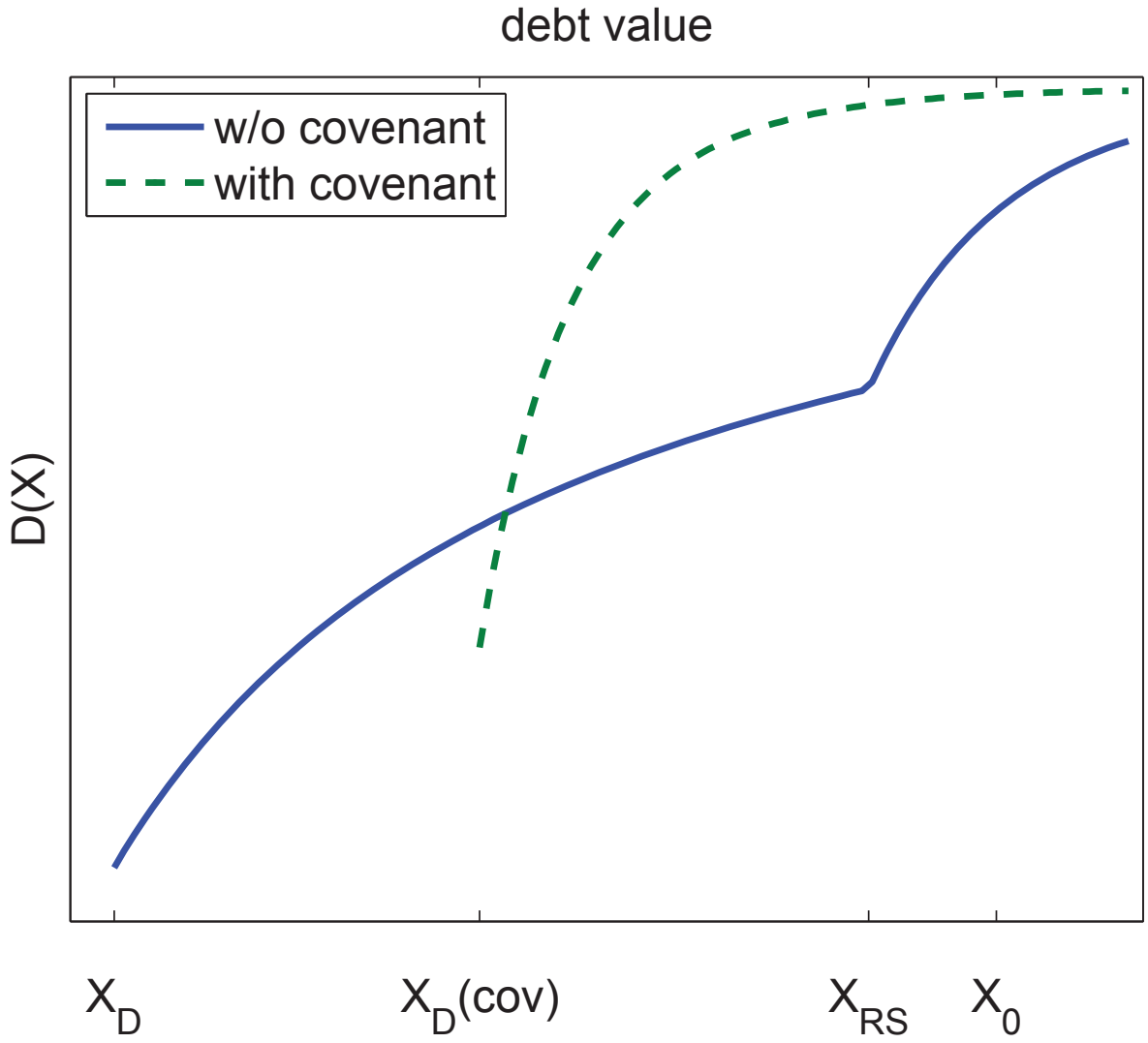
ASSET SUBSTITUTION

- Equityholders have the **option to increase the riskiness** of the firm's cashflow:
$$\sigma_i \in \{\sigma_L, \sigma_H\} \quad \text{where } 0 < \sigma_L < \sigma_H < \infty$$
- Increasing the risk of the cashflow can be **costly**:
$$\mu_i \in \{\mu_L, \mu_H\} \quad \text{where } \mu_H \leq \mu_L < \infty$$
  - expenses necessary for establishing and upholding the riskier use of the assets and/or
  - increase in the discount rate

  $\Rightarrow$ **Risk-shifting can destroy value**:
$$A_H(X_t) = \frac{(1 - T_C)X_t}{r - \mu_H} \leq \frac{(1 - T_C)X_t}{r - \mu_L} = A_L(X_t)$$
- Equityholders choose an optimal **risk-shifting threshold** X_{RS}.
- The **convexity** of equity value function induces the risk-taking behavior.
- The Dilemma:
  - Risk-shifting transfers value from debtholders to equityholders.

ASSET SUBSTITUTION: VALUE TRANSFER

RISK-SHIFTING TRANSFERS VALUE FROM THE DEBTHOLDERS TO EQUITYHOLDERS.



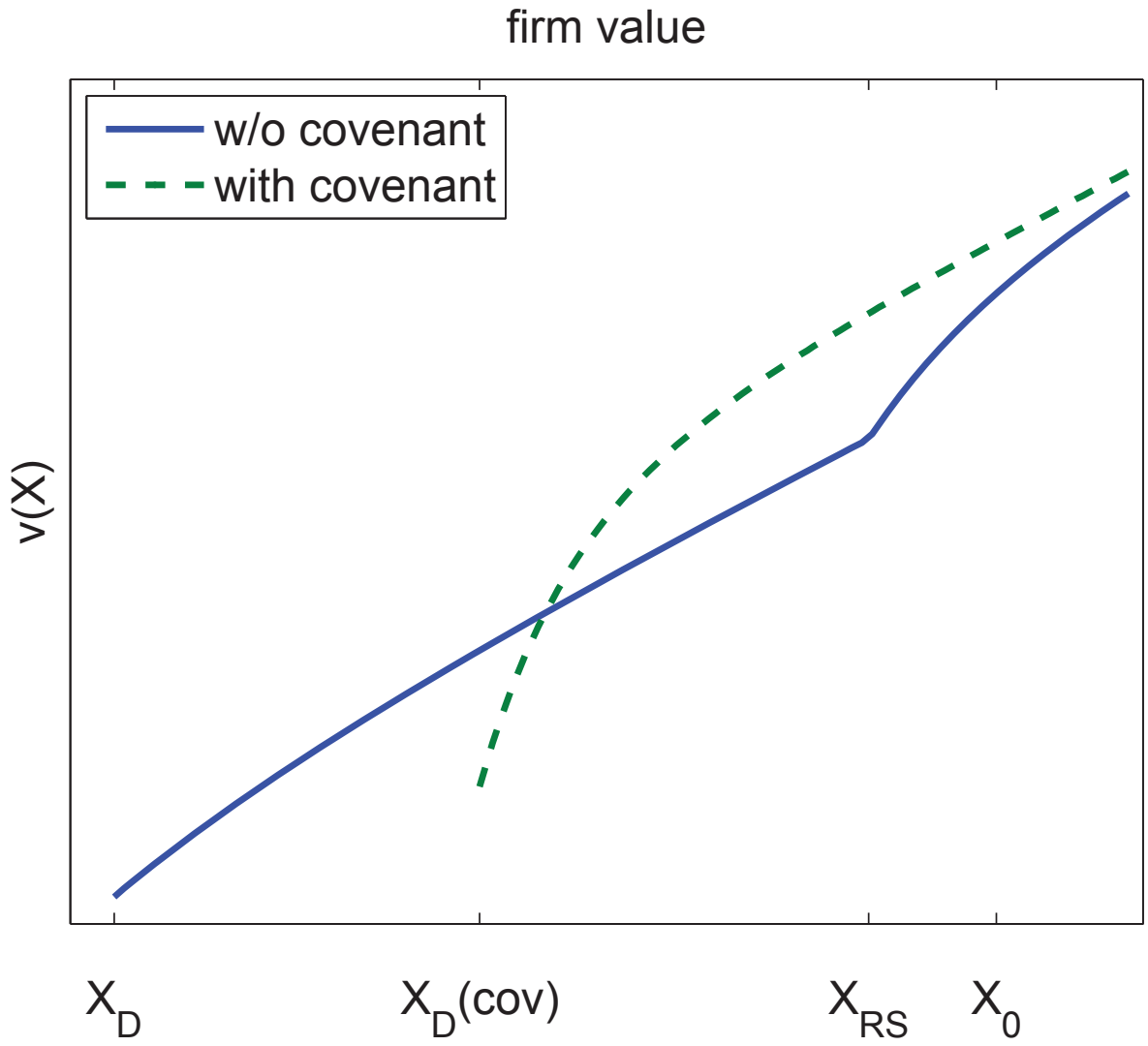
ASSET SUBSTITUTION

- Equityholders have the **option to increase the riskiness** of the firm's cashflow:
$$\sigma_i \in \{\sigma_L, \sigma_H\} \quad \text{where} \quad 0 < \sigma_L < \sigma_H < \infty$$
- Increasing the risk of the cashflow can be **costly**:
$$\mu_i \in \{\mu_L, \mu_H\} \quad \text{where} \quad \mu_H \leq \mu_L < \infty$$
  - expenses necessary for establishing and upholding the riskier use of the assets and/or
  - increase in the discount rate

  $\Rightarrow$ **Risk-shifting can destroy value**:
$$A_H(X_t) = \frac{(1 - T_C)X_t}{r - \mu_H} \leq \frac{(1 - T_C)X_t}{r - \mu_L} = A_L(X_t)$$
- Equityholders choose an optimal **risk-shifting threshold** X_{RS}.
- The **convexity** of equity value function induces the risk-taking behavior.
- The Dilemma:
  - Risk-shifting transfers value from debtholders to equityholders.
  - When issuing debt, equityholders would like to commit to not engage in asset substitution but this is not time consistent.

ASSET SUBSTITUTION: LOWER DEBT CAPACITY

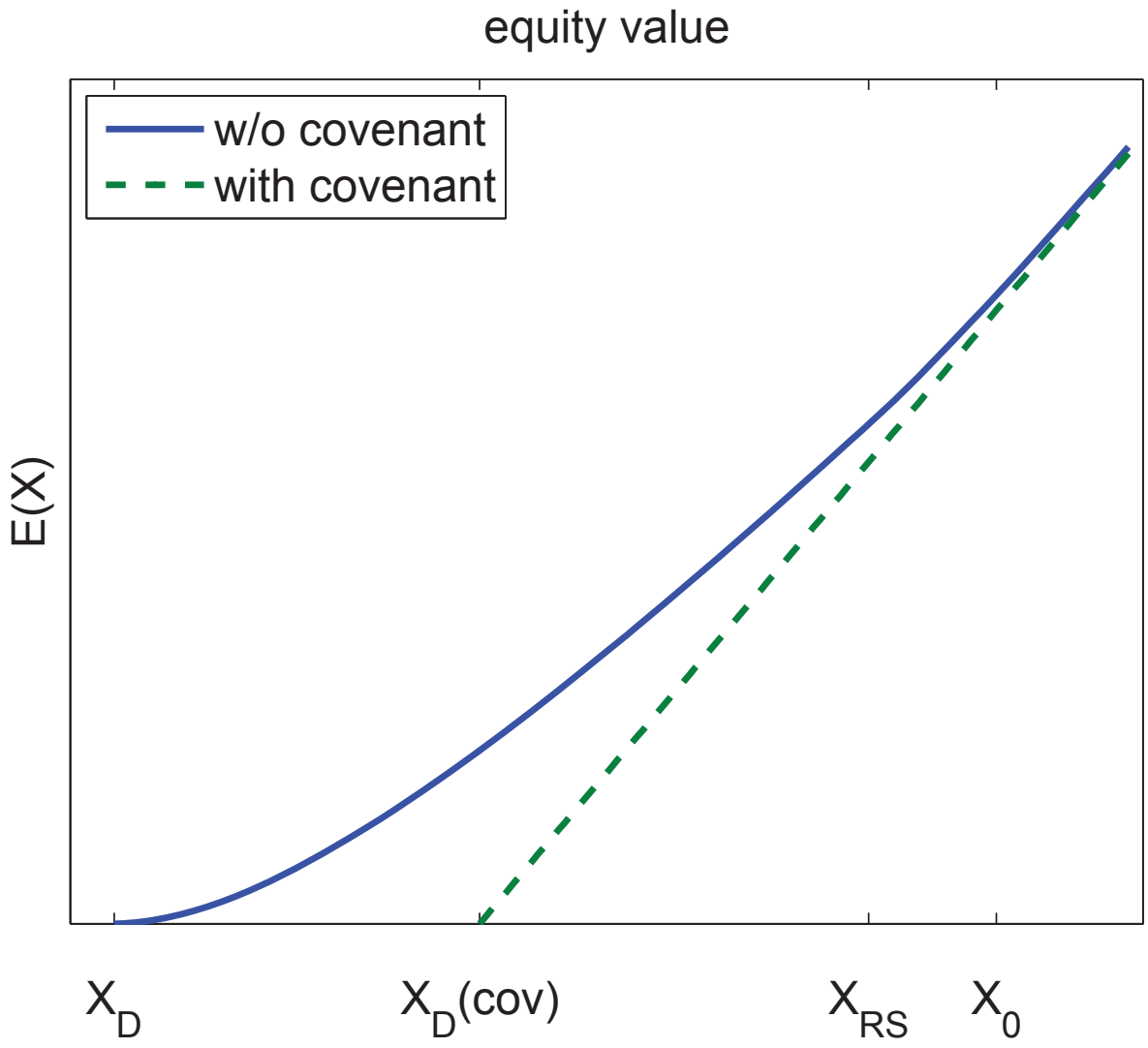
DEBT CAPACITY IS LOWER DUE TO RISK-SHIFTING.



CASHFLOW BASED COVENANTS AND RISK-TAKING INCENTIVES

- As risk-shifting is not contractible upon, bond covenants cannot directly prohibit risk-shifting.
- A cashflow based covenant that specifies a threshold for technical default, e.g., $X_D = C$ (debt-service ratio covenant), will make the **equity value a concave function**.

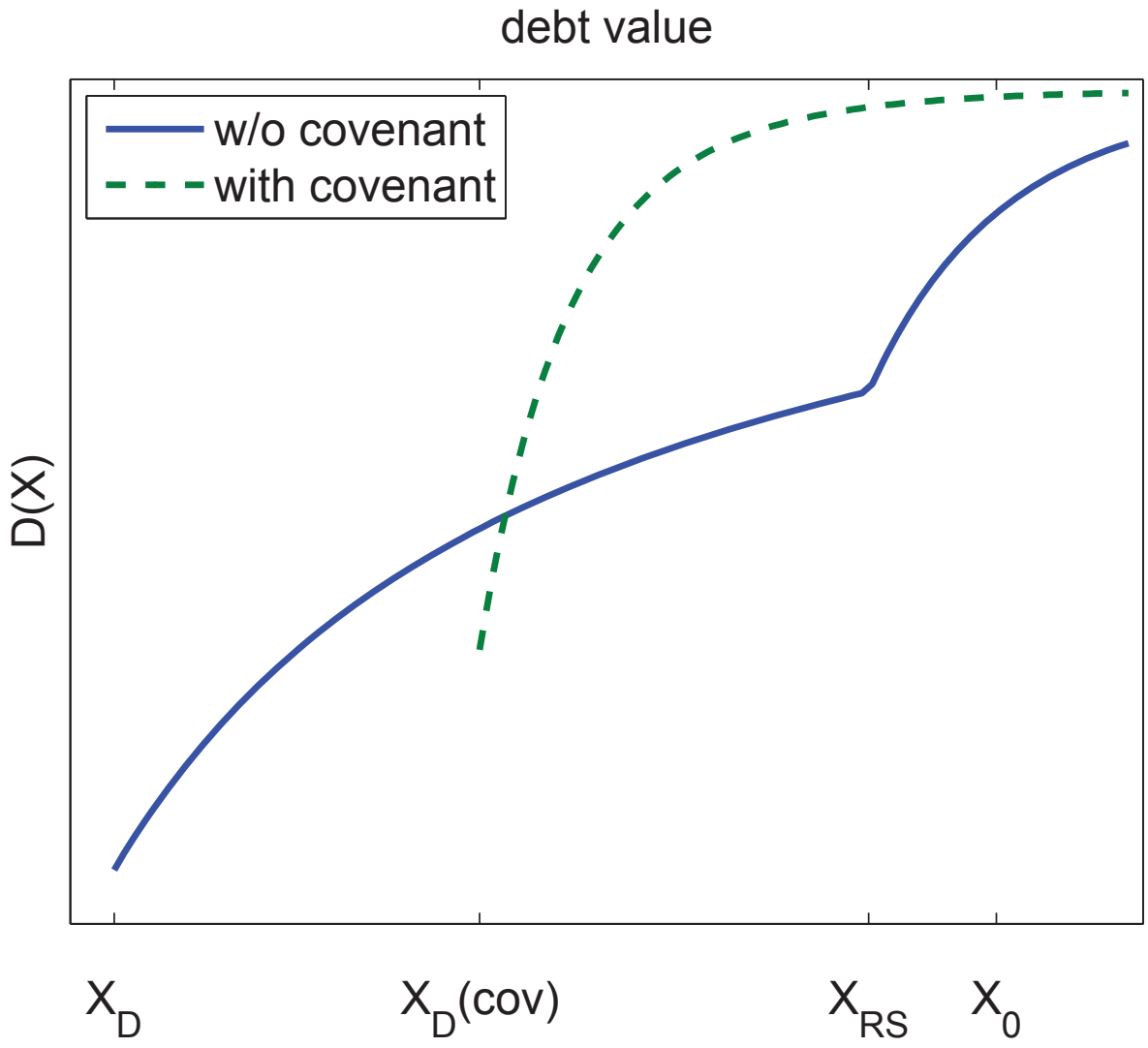
CASHFLOW BASED COVENANTS: CONCAVE EQUITY



CASHFLOW BASED COVENANTS AND RISK-TAKING INCENTIVES

- As risk-shifting is not contractible upon, bond covenants cannot directly prohibit risk-shifting.
- A cashflow based covenant that specifies a threshold for technical default, e.g., $X_D = C$ (debt-service ratio covenant), will make the **equity value a concave function**.
  - No risk-shifting means **no wealth transfer** from debtholders to equityholders...

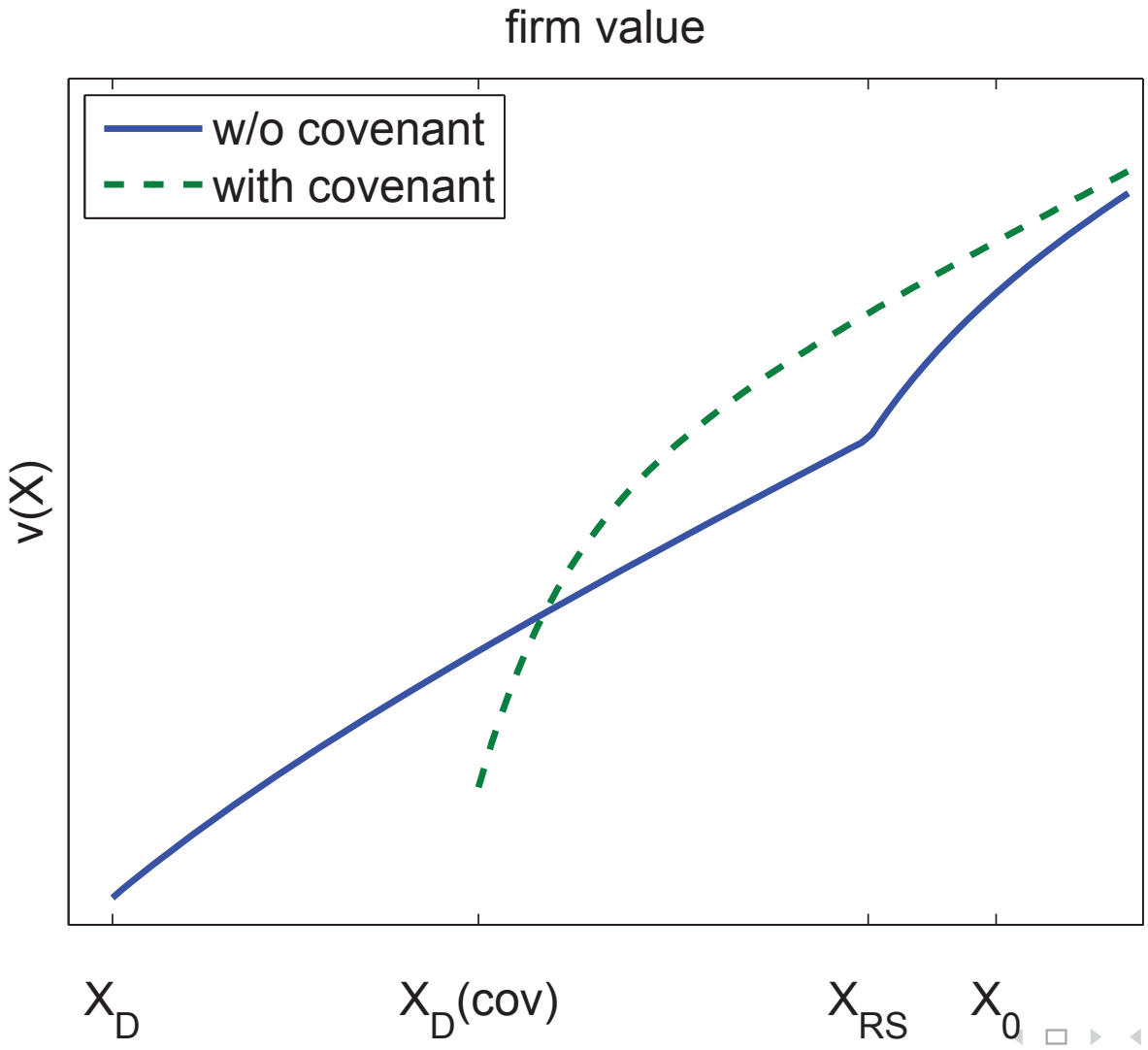
CASHFLOW BASED COVENANTS: NO TRANSFER



CASHFLOW BASED COVENANTS AND RISK-TAKING INCENTIVES

- As risk-shifting is not contractible upon, bond covenants cannot directly prohibit risk-shifting.
- A cashflow based covenant that specifies a threshold for technical default, e.g., $X_D = C$ (debt-service ratio covenant), will make the **equity value a concave function**.
  - No risk-shifting means **no wealth transfer** from debtholders to equityholders...
  - ... and **higher debt capacity**, i.e., gains from larger tax shield.

CASHFLOW BASED COVENANTS: HIGHER DEBT CAPACITY



CASHFLOW BASED COVENANTS AND RISK-TAKING INCENTIVES

- As risk-shifting is not contractible upon, bond covenants cannot directly prohibit risk-shifting.
- A cashflow based covenant that specifies a threshold for technical default, e.g., $X_D = C$ (debt-service ratio covenant), will make the **equity value a concave function**.
  - No risk-shifting means **no wealth transfer** from debtholders to equityholders...
  - ... and **higher debt capacity**, i.e., gains from larger tax shield.
- Cashflow covenants based on e.g., the debt-service ratio, **are tighter than would be necessary** and lead to inefficiently early default which destroys value.

CASHFLOW BASED COVENANTS AND RISK-TAKING INCENTIVES

- As risk-shifting is not contractible upon, bond covenants cannot directly prohibit risk-shifting.
- A cashflow based covenant that specifies a threshold for technical default, e.g., $X_D = C$ (debt-service ratio covenant), will make the **equity value a concave function**.
  - No risk-shifting means **no wealth transfer** from debtholders to equityholders...
  - ... and **higher debt capacity**, i.e., gains from larger tax shield.
- Cashflow covenants based on e.g., the debt-service ratio, **are tighter than would be necessary** and lead to inefficiently early default which destroys value.
  - There exists a lower technical default threshold just high enough to destroy equityholders risk-shifting incentives but is not contractible upon.

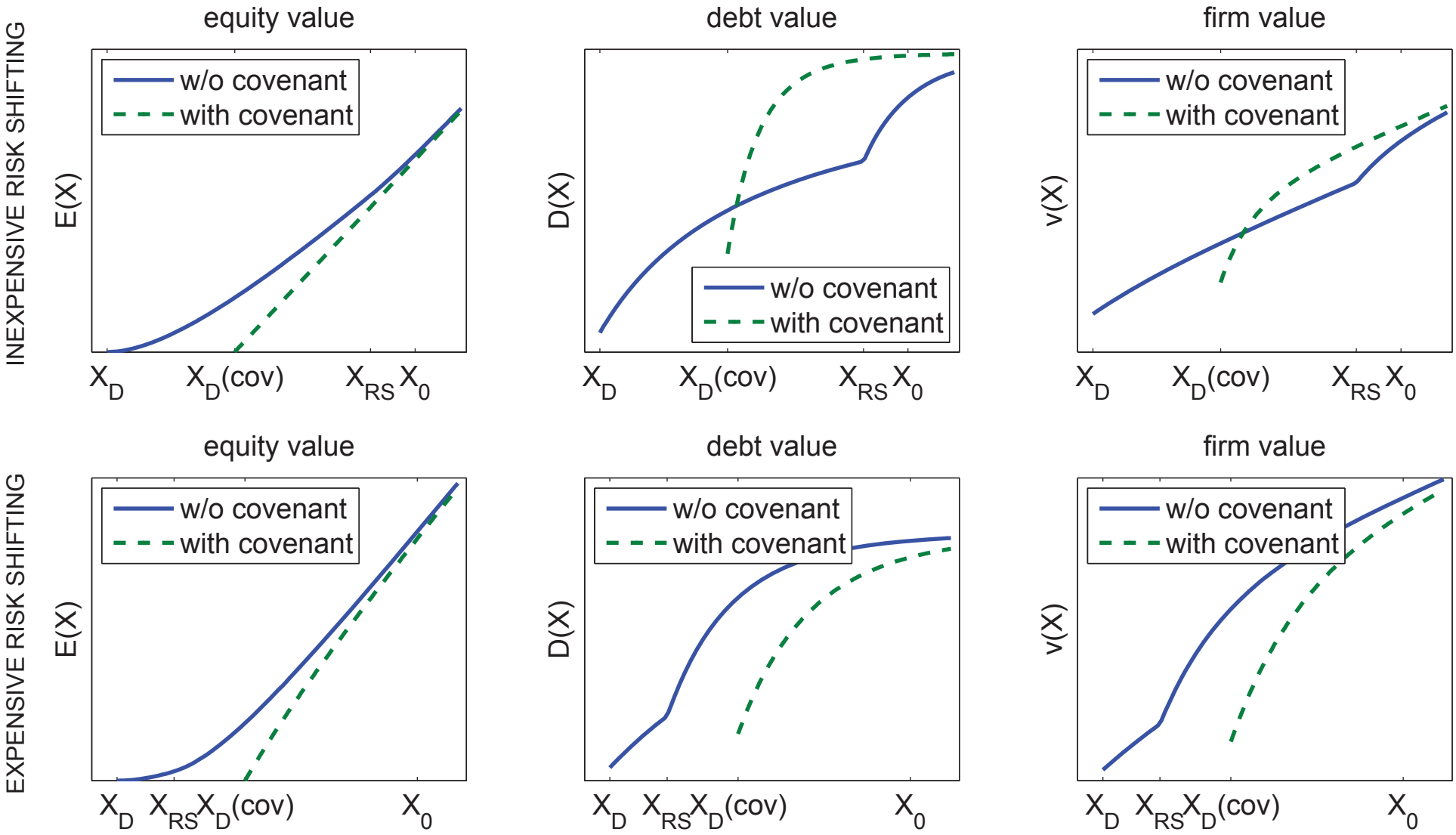
CASHFLOW BASED COVENANTS AND RISK-TAKING INCENTIVES

- As risk-shifting is not contractible upon, bond covenants cannot directly prohibit risk-shifting.
- A cashflow based covenant that specifies a threshold for technical default, e.g., $X_D = C$ (debt-service ratio covenant), will make the **equity value a concave function**.
  - No risk-shifting means **no wealth transfer** from debtholders to equityholders...
  - ... and **higher debt capacity**, i.e., gains from larger tax shield.
- Cashflow covenants based on e.g., the debt-service ratio, **are tighter than would be necessary** and lead to inefficiently early default which destroys value.
  - There exists a lower technical default threshold just high enough to destroy equityholders risk-shifting incentives but is not contractible upon.
  - Real world solution: **Renegotiate** cashflow covenants such that default does not happen too early.

THE OPTIMAL DEBT CONTRACT

- A covenant is not costless (costly contracting hypothesis, Smith and Warner, 1979) but creates inefficiencies through limiting the choice set of management.
- A cashflow covenant creates **inefficiencies through too early default**.
- If the valuation consequences of asset substitution are high, equityholders will engage in risk-shifting only in very bad times which is a low probability event.
- Thus, the expected value of the agency costs that are priced into debt is relatively low.
- In that case, the value loss due to the inefficiencies created by the covenant might outweigh the agency costs induced by asset substitution.

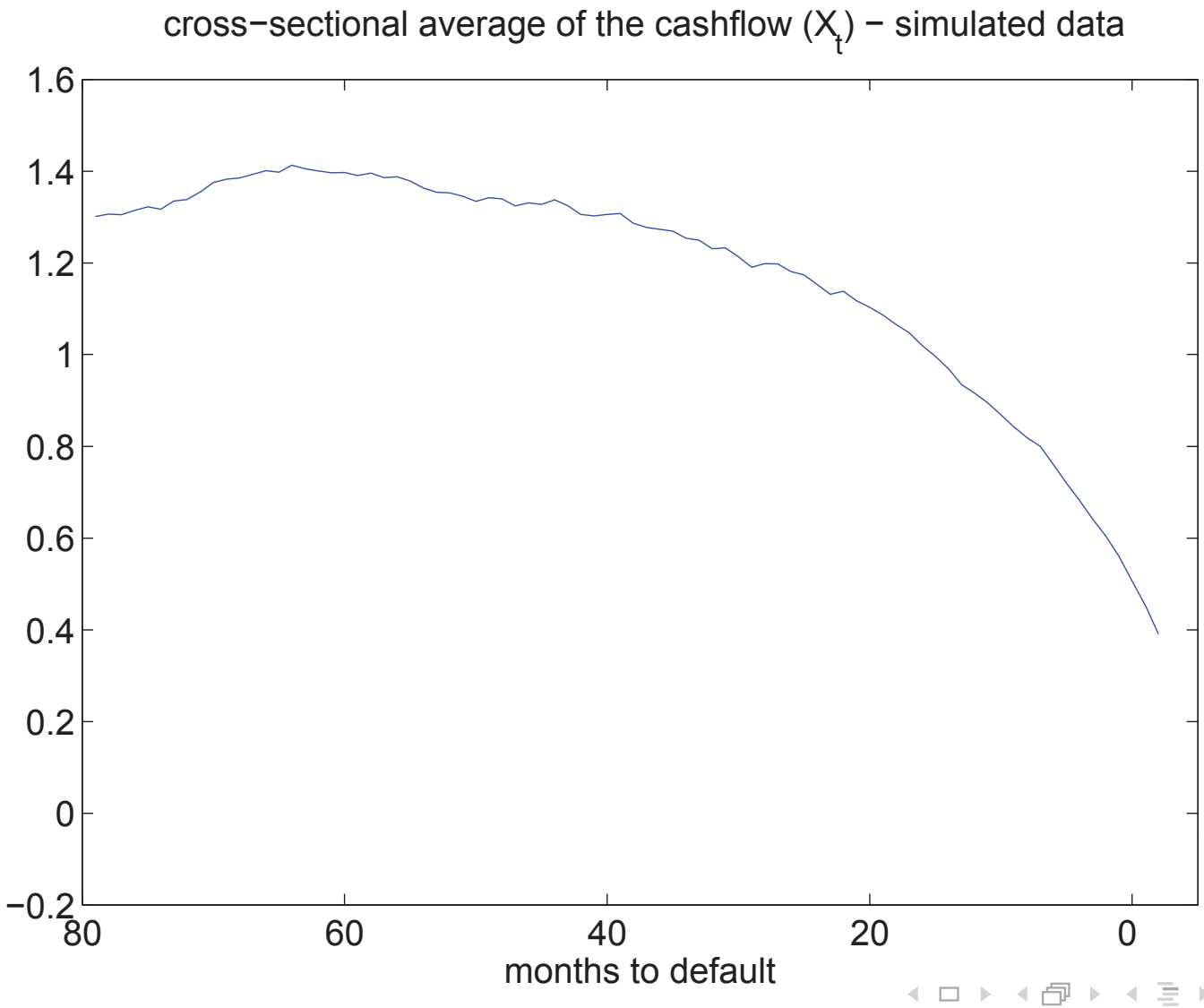
INEXPENSIVE (*1st row*) AND EXPENSIVE RISK-SHIFTING (*2nd row*)



OUR ESTIMATION APPROACH

- The structural model links observable equity prices to leverage and unobservable firm characteristics which are estimated.
- **No optimizing behavior is imposed:**
  - The optimal risk-taking (and default) behavior is not hard-wired in our econometric model.
  - The data determines the risk-shifting threshold X_{RS} and the default threshold X_D.
- Parameters to be estimated: $b = [\sigma_L, \sigma_H, \mu_L, \mu_H, \alpha_L, \alpha_H, \zeta_{RS}, \zeta_D]$
  - cashflow volatilities $[\sigma_L, \sigma_H]$;
  - cashflow growth rate under the Q-measure $[\mu_L, \mu_H]$;
  - cashflow growth rate under the P-measure $[\alpha_L, \alpha_H]$;
  - risk-shifting and default threshold ($[X_{RS}, X_D]$), defined as a multiple ($[\zeta_{RS}, \zeta_D]$) of outstanding debt;

Problem: SAMPLING CONDITIONAL ON DEFAULT CREATES DEPENDENCE



Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

Standard Simulated Methods of Moments

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

Standard Simulated Methods of Moments

1. Simulate a large sample of companies.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

Standard Simulated Methods of Moments

1. Simulate a large sample of companies.
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

Standard Simulated Methods of Moments

1. Simulate a large sample of companies.
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

Standard Simulated Methods of Moments

1. Simulate a large sample of companies.
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.
4. Minimize the weighted distance between the simulated and empirical moments by altering the parameters of the model.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

Standard Simulated Methods of Moments

1. Simulate a large sample of **defaulted** companies
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.
4. Minimize the weighted distance between the simulated and empirical moments by altering the parameters of the model.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

~~Standard~~ Conditional Simulated Methods of Moments

1. Simulate a large sample of **defaulted** companies
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.
4. Minimize the weighted distance between the simulated and empirical moments by altering the parameters of the model.

Modification

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

~~Standard~~ Conditional Simulated Methods of Moments

1. Simulate a large sample of **defaulted** companies
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.
4. Minimize the weighted distance between the simulated and empirical moments by altering the parameters of the model.

Modification

- Instead of simulating forward we **simulate back in time**.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

~~Standard~~ Conditional Simulated Methods of Moments

1. Simulate a large sample of **defaulted** companies
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.
4. Minimize the weighted distance between the simulated and empirical moments by altering the parameters of the model.

Modification

- Instead of simulating forward we **simulate back in time**.
- Instead of a starting point to begin with we have an **end-point (default threshold, X_D)** to end at.

Solution: CONDITIONAL SIMULATED METHODS OF MOMENTS

~~Standard~~ Conditional Simulated Methods of Moments

1. Simulate a large sample of **defaulted** companies
2. Choose different moments which describe the simulated sample, e.g. mean and variance of the equity and implied cash-flow returns.
3. Calculate the same moments for the real-world sample.
4. Minimize the weighted distance between the simulated and empirical moments by altering the parameters of the model.

Modification

- Instead of simulating forward we **simulate back in time**.
- Instead of a starting point to begin with we have an **end-point (default threshold, X_D)** to end at.
- Instead of iid draws we employ the appropriate **conditional joint distribution** for the observations prior to default.

DATA

- Sample of 176 firms that have defaulted between 2000 and 2013 (from Capital IQ).
- Stock price and accounting data from 1993 to 2013 (from Capital IQ).
- Bond covenant information (from Mergent FISD).

We follow Chava et al. (2010) and classify covenants into four groups:

1. Investment restrictions (89% of bonds)
2. Subsequent financing restrictions (86%)
3. Event related restrictions (83%)
4. Dividend and other payment restrictions (66% vs 14% in the sample of non-defaulted firms in Chava et al. (2010))

DESCRIPTIVE STATISTICS FOR BONDS OUTSTANDING

COVENANTS REDUCE THE CREDIT SPREAD

	mean	p25	median	p75
Bonds with covenants (59%)				
Offering amount (mil)	256.05	100	175	300
Treasury spread (b.p.)	137.84	0	81	222
Maturity (in months)	128.74	84	117	121
Issuance time before default (in months)	100.64	45	84	147
Security level	3.77	3	4	4
Bonds without covenants (41%)				
Offering amount (mil)	200.63	90	150	275
Treasury spread (b.p.)	345.55	0	388	556
Maturity (in months)	124.40	84	120	121
Issuance time before default (in months)	120.21	52	81	162
Security level	3.88	3	4	4

FINDINGS: FIRMS WITH BOND COVENANTS...

- ... can considerably increase the cashflow risk and risk-shifting is not costly.

$\Rightarrow$ ... have a high risk-shifting incentive.

parameter	low risk	high risk
cashflow volatility	$\sigma_L = 0.20$	$\sigma_H = 0.51$
cashflow growth under $\mathbb{Q}$	$\mu_L = -0.06$	$\mu_H = -0.0622$

threshold	estimated	if no covenants were in place
default (X_D)	0.96	0.37
risk shifting (X_{RS})	23.96	9.19

FINDINGS: FIRMS WITH BOND COVENANTS...

- ... can considerably increase the cashflow risk and risk-shifting is not costly.

$\Rightarrow$ ... have a high risk-shifting incentive.

- ... have a default threshold that is very close to the cashflow covenant $X_D = C = 1$, as expected which considerably reduces the convexity of the equity function.

parameter	low risk	high risk
cashflow volatility	$\sigma_L = 0.20$	$\sigma_H = 0.51$
cashflow growth under $\mathbb{Q}$	$\mu_L = -0.06$	$\mu_H = -0.0622$

threshold	estimated	if no covenants were in place
default (X_D)	0.96	0.37
risk shifting (X_{RS})	23.96	9.19

FINDINGS: FIRMS WITH BOND COVENANTS...

- ... can considerably increase the cashflow risk and risk-shifting is not costly.

$\Rightarrow$ ... have a high risk-shifting incentive.

- ... have a default threshold that is very close to the cashflow covenant $X_D = C = 1$, as expected which considerably reduces the convexity of the equity function.
- ... have a very high risk-shifting threshold. Many firms are already in the high risk-regime at the beginning of our sample period.
  Our interpretation: They don't increase riskiness of the firm any further in financial distress (close to X_D)

parameter	low risk	high risk
cashflow volatility	$\sigma_L = 0.20$	$\sigma_H = 0.51$
cashflow growth under $\mathbb{Q}$	$\mu_L = -0.06$	$\mu_H = -0.0622$

threshold	estimated	if no covenants were in place
default (X_D)	0.96	0.37
risk shifting (X_{RS})	23.96	9.19

FINDINGS: FIRMS WITHOUT BOND COVENANTS...

- ... can considerably increase the cashflow risk but risk-shifting is very costly ($\mu_L - \mu_H = 3\%$ vs 0.2% for firms with covenants).

$\Rightarrow$ ... have low risk-shifting incentives. Risk-shifting takes place just prior to default.

	without covenants		**with covenants**	
parameter	low risk	high risk	low risk	high risk
cashflow volatility	$\sigma_L = 0.37$	$\sigma_H = 0.86$	0.20	0.51
cashflow growth under $\mathbb{Q}$	$\mu_L = 0.02$	$\mu_H = -0.01$	-0.06	-0.0622

	without covenants		**with covenants**	
threshold	estimated	optimal	estimated	optimal
default (X_D)	0.10	0.196	0.96	0.37
risk shifting (X_{RS})	0.35	0.204	23.96	9.19

FINDINGS: FIRMS WITHOUT BOND COVENANTS...

- ... can considerably increase the cashflow risk but risk-shifting is very costly ($\mu_L - \mu_H = 3\%$ vs 0.2% for firms with covenants).

$\Rightarrow$ ... have low risk-shifting incentives. Risk-shifting takes place just prior to default.

- ... shift the risk and declare default very closely to the optimal threshold.

	without covenants		**with covenants**	
parameter	low risk	high risk	low risk	high risk
cashflow volatility	$\sigma_L = 0.37$	$\sigma_H = 0.86$	0.20	0.51
cashflow growth under $\mathbb{Q}$	$\mu_L = 0.02$	$\mu_H = -0.01$	-0.06	-0.0622

	without covenants		**with covenants**	
threshold	estimated	optimal	estimated	optimal
default (X_D)	0.10	0.196	0.96	0.37
risk shifting (X_{RS})	0.35	0.204	23.96	9.19

FINDINGS: FIRMS WITHOUT BOND COVENANTS...

- ... can considerably increase the cashflow risk but risk-shifting is very costly ($\mu_L - \mu_H = 3\%$ vs 0.2% for firms with covenants).

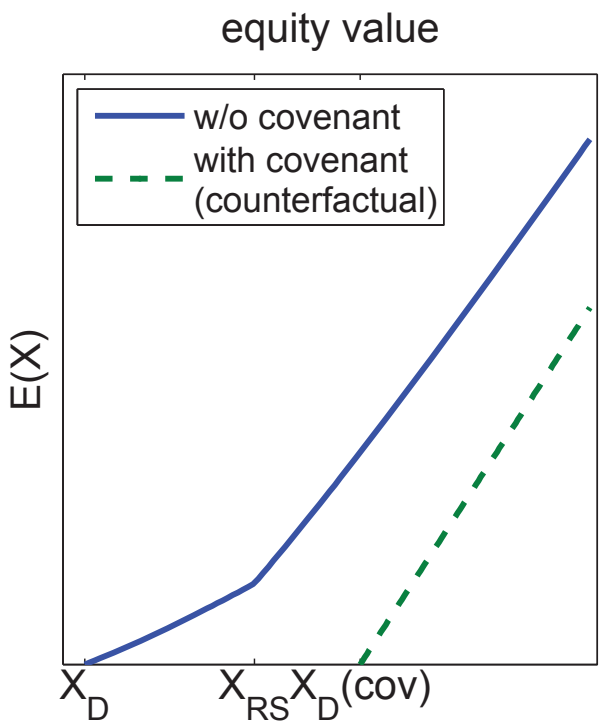
$\Rightarrow$ ... have low risk-shifting incentives. Risk-shifting takes place just prior to default.

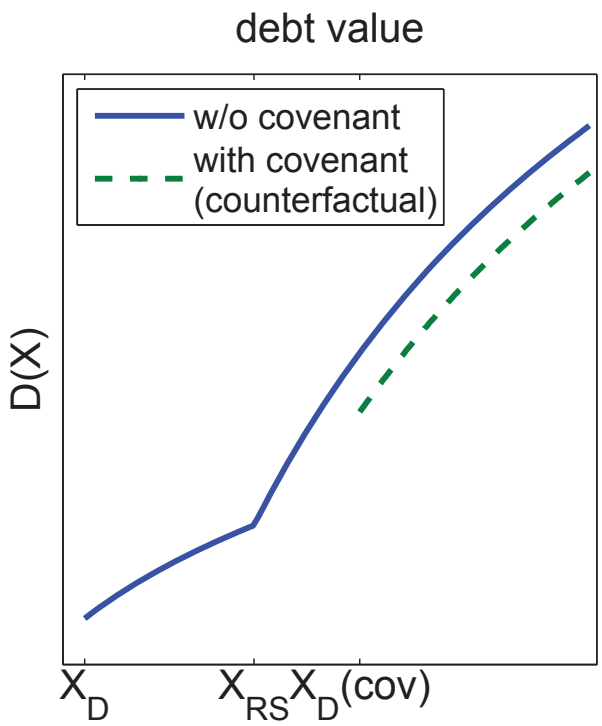
- ... shift the risk and declare default very closely to the optimal threshold.
- ... have optimally chosen to not use bond covenants.

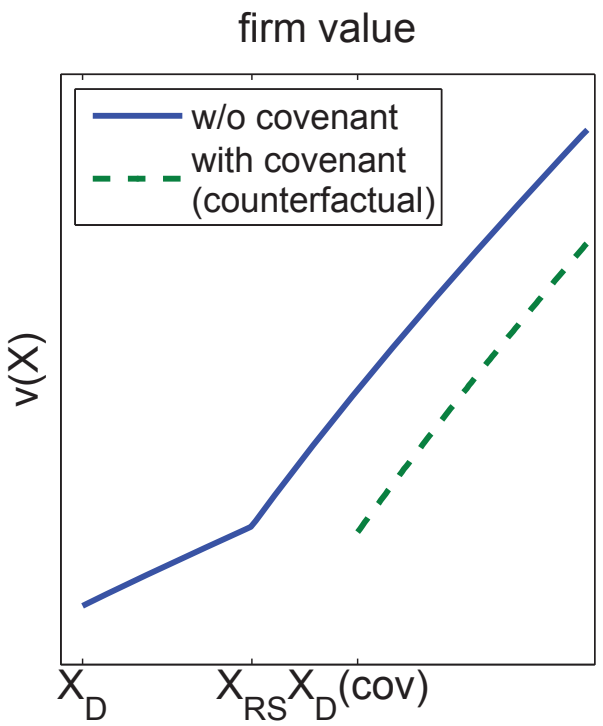
	without covenants		**with covenants**	
parameter	low risk	high risk	low risk	high risk
cashflow volatility	$\sigma_L = 0.37$	$\sigma_H = 0.86$	0.20	0.51
cashflow growth under $\mathbb{Q}$	$\mu_L = 0.02$	$\mu_H = -0.01$	-0.06	-0.0622

	without covenants		**with covenants**	
threshold	estimated	optimal	estimated	optimal
default (X_D)	0.10	0.196	0.96	0.37
risk shifting (X_{RS})	0.35	0.204	23.96	9.19

FIRMS WITHOUT BOND COVENANTS HAVE ISSUED THE OPTIMAL CONTRACT







CONCLUSION

- We use a structural corporate finance model and a new estimation technique to answer whether bond covenants prevent asset substitution.

We find that

- Firms with strong risk-shifting incentives employ covenants to reduce risk-shifting incentives.
- Covenants prevent that these firms engage in risk-shifting during periods of financial distress.
- The mechanism at work is that covenants decrease the convexity of the equity value function.
- Firms without covenants have low risk-shifting incentives
- and optimally chosen not to use covenants.