August,2019

Life Insurance Settlement and Information Asymmetry

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I. Introduction

Life settlement

- ►Life settlement : a transaction which allows policyholders to sell their insurance policies to a investor (settlement provider)

- ►Alternative Option to surrender

- ►Surrender value is lower than actuarial value and settlement price is higher than surrender value.

I. Introduction

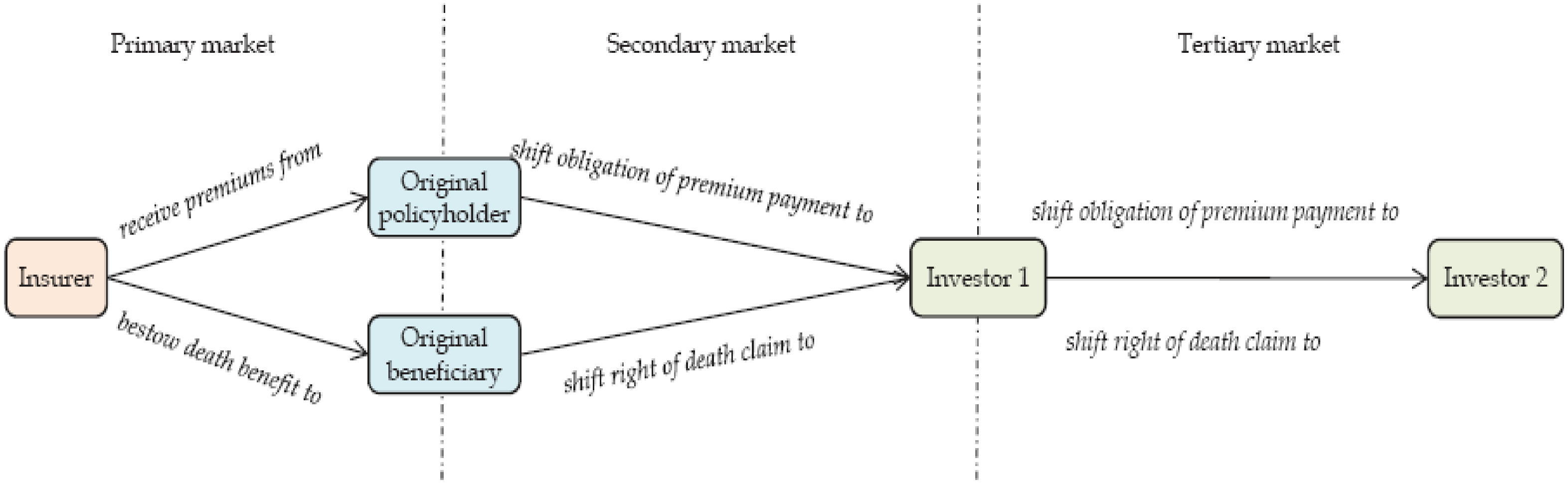
Life settlement

►Illiquid insurance policy(not tradable)→life settlement securitization opens up the secondary market for insurance

► Investors can get an opportunity to invest an asset which is not correlated to their portfolio.

I. Introduction

Submarket of life insurance



► **Source: Harvard Business School Background Note 2018-127**

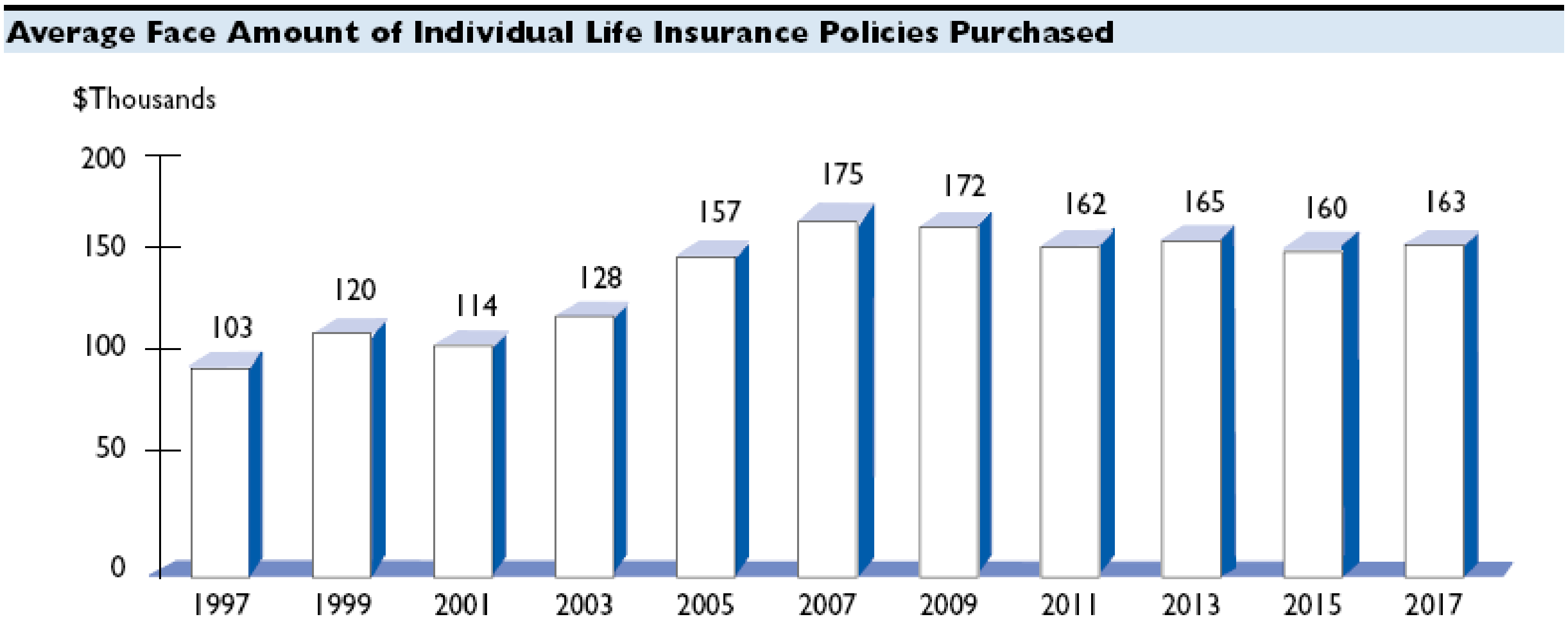
II. Life insurance market overview

- Life insurance is owned by 61% of American adults.
  - Home ownership :64%
  - 401 (k) retirement account ownership: 53%

- Of policies (face value)
  - 60%(31%) of individuals in 2016: whole life & endowment
  - 40%(69%) of individuals in 2017: term insurance

II. Life insurance market overview

Life Insurance Market Overview



자료: American Council of Life Insurers (2018)

Life Insurance Market Overview

► Termination Rate

	2008	2009	2010	2011	2012
face value	7.6	7.3	6.8	6.1	5.9
# of policy	7.9	6.9	6.1	6.1	5.8

	2013	2014	2015	2016	2017
face value	5.7	5.3	5.4	5.2	5.7
# of policy	5.0	6.2	5.6	6.0	6.4

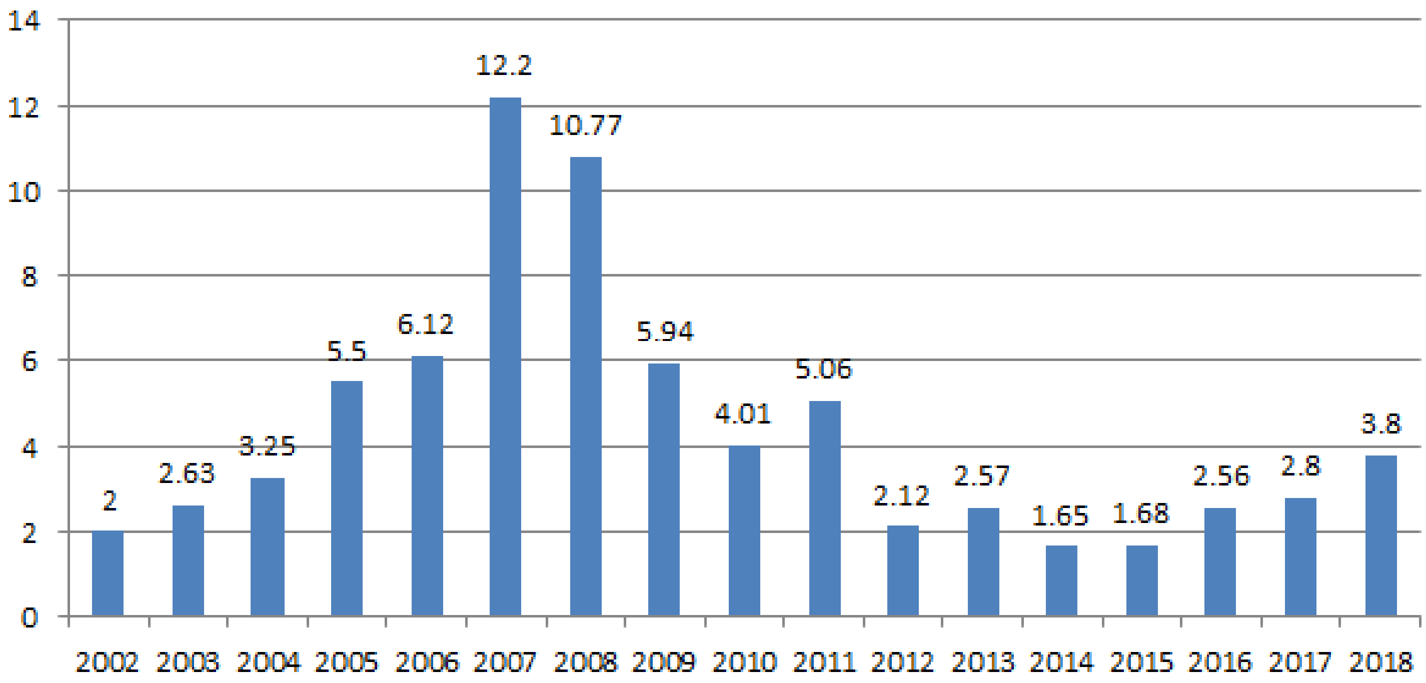
자료: American Council of Life Insurers (2018)

II. Life insurance market overview

- Gatzert (2010)
  - Settlement is allowed in Germany, the U.K. & the U.S.
- China Insurance Regulatory Commission (CIRC)
  - It will run 2-year trial program allowing viatical settlement
- The Deal (2015), Magna (2017)
  - The market size was 1.65 billion dollars (2015)
  - In 2018, the size is projected at 3.4 billion dollars.

III. Life settlement market overview

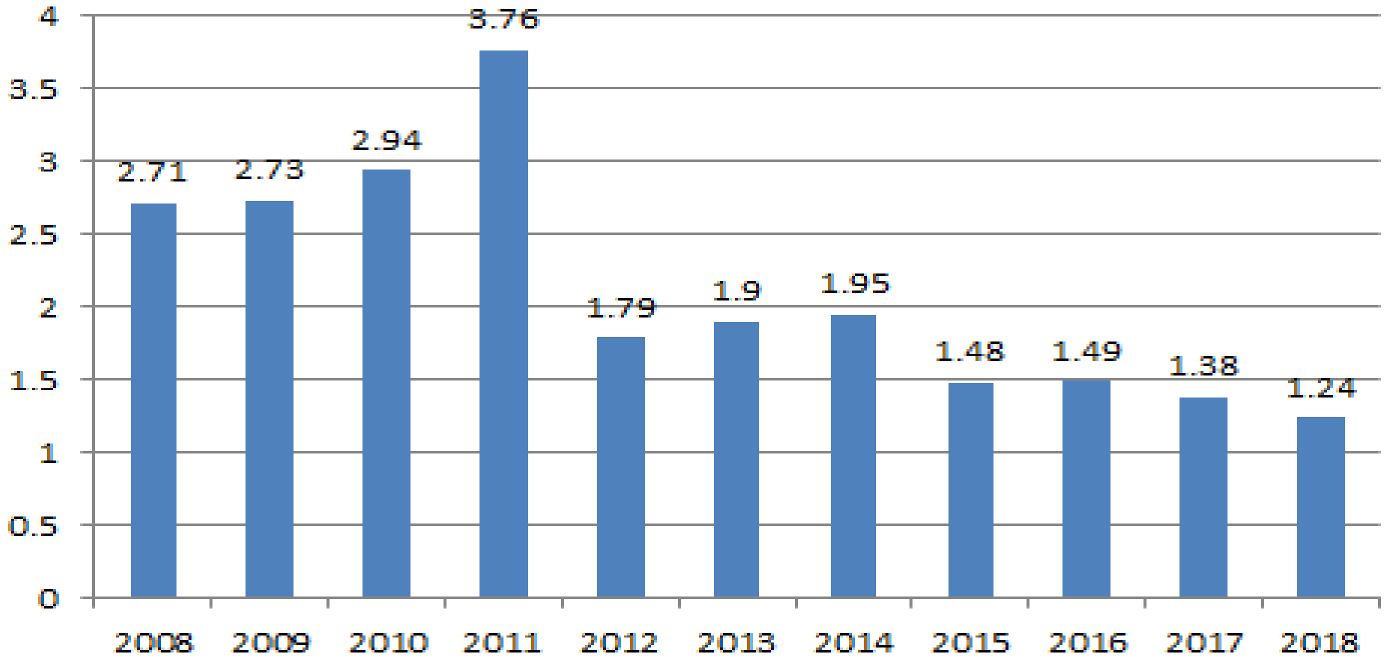
Size of Life settlement market (Face value, billion dollars)



Source: conning (2008), The Deal (2013), Magna report (2018)

III. Life settlement market overview

Size of Life settlement market (Avg Face Value, million dollars)



Source: The Deal (2013), Magna report (2018)

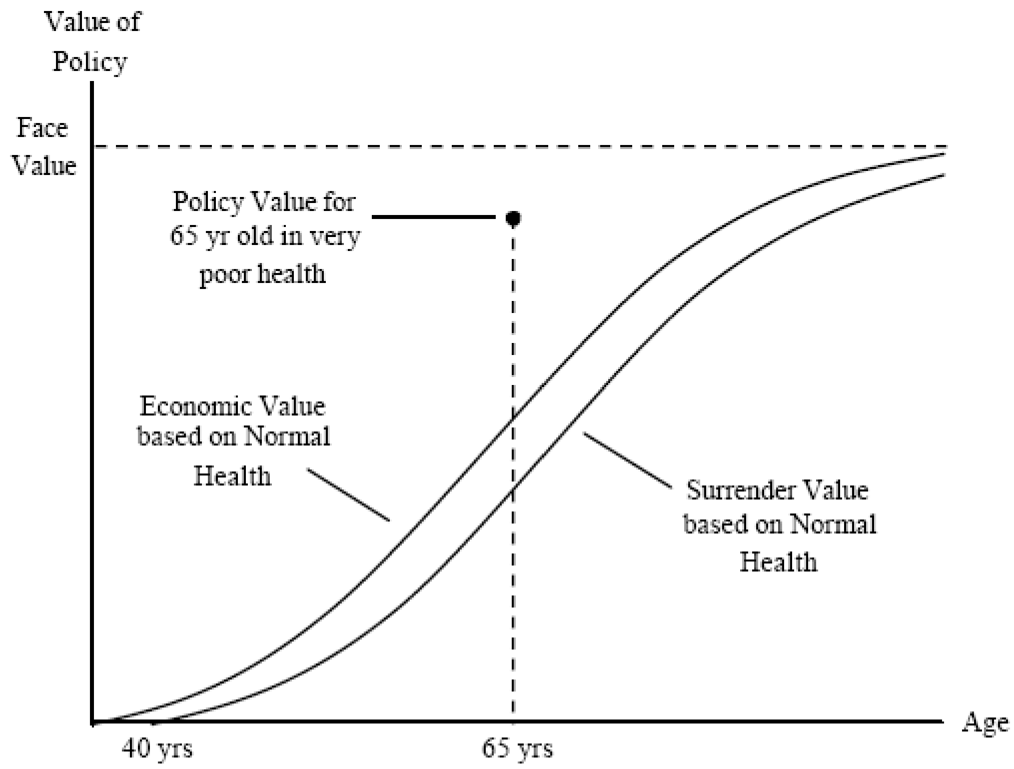
III. Life settlement market overview

Factors For Growths of Life Settlement

- Retirement of Baby boomers
  - $ 143 billion in life insurance owned by people 65 and over was lapsed in 2015.
- Lengthening lifespans
  - innovations in medicine & health care
- Increasing accuracy of Medical underwrting

IV. Literature Review

- **Doherty and Singer (2002)**
  - Settlement market may enhance consumer welfare
  - Reduce the monopsony power of the insurer
  - Lapse supported pricing



IV. Literature Review

- **Hong and Seog (2018)**
  - Monopolistic insurance market and focusing on the liquidity risk
  - Settlement market may or may not enhance consumer welfare.

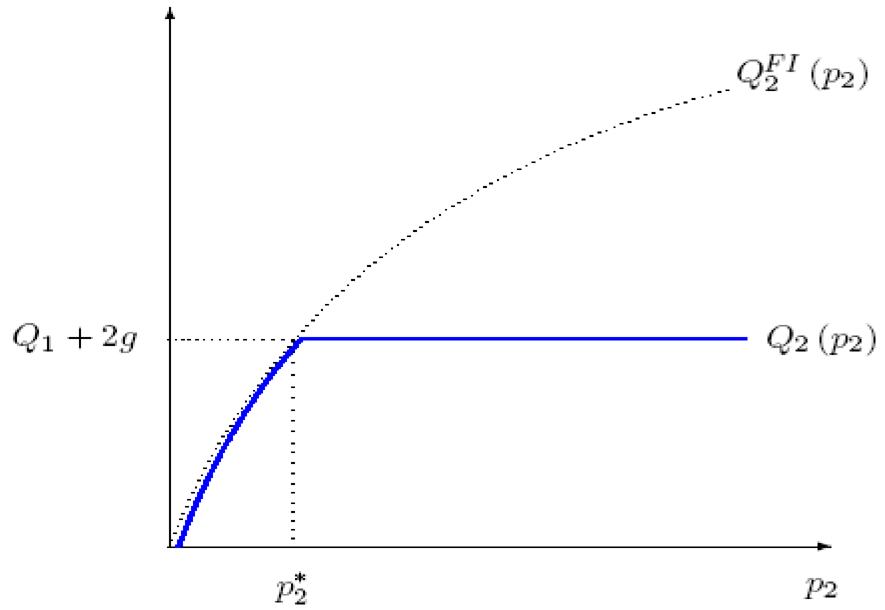
- **Seog and Hong (2019)**
  - Monopolistic insurance market and focusing on the liquidity costs of the insurer and policyholders
  - Settlement may help to increase insurance demand and the profit of insurer by saving the liquidity costs.

IV. Literature Review

- **Fang and Wu (2017)**
  - Overconfidence over bequest motives or mortality risks.
  - Settlement market corrects the beliefs and welfare can be improved.
- **Gottlieb and Smetters (2014)**
  - Policyholders exhibit overconfidence over liquidity risks.
  - Settlement market increases consumer welfare, if surrender should occur due to the negative income shock.

IV. Literature Review

- **Daily, Hendel and Lizzeri (2008, henceforth DHL), Fang and Kung (2008, henceforth FK)**
  - 2-period model in the competitive insurance market
  - "front-loaded" contracts→hedge the "reclassification risk"
  - Settlement market lowers consumer welfare since the premium will increase & policyholders cannot hedge the reclassification risk



IV. Literature Review

- **Gatzert et al. (2008)**
  - Settlement market may worsen the insurer's profit by a simulation based on the actuarial assumptions.
  - The profit reduction also leads to the rise of premiums.

- **Braun et al (2012)**
  - Open-end life settlement funds show attractive return as 4.85% of the annualized return. (2003.12~2010.06, AA-Partners dataset) (S&P 500: 0.07%, US Government Bond Index: 0.41%)
  - The volatility is low (2.28%) / Correlation with other asset classes is also low
  - Liquidity, longevity, valuation risk are not captured.

- **Zhu and Bauer (2013)**
  - Realized return of settlement investors is markedly low compared to the expected return(8~12%) due to the information asymmetry regarding mortality risk.
  - The return difference is 5.72%

IV. Motivation

Main Focus

- **Two – dimensional asymmetric information (mortality risk & liquidity risk)**
- **Liquidity risk of policyholders (following HS 2018, HS 2019)**
  - ► Risks to need urgent cash for medical treatment, etc.
  - ► Policyholders face heterogeneous mortality & liquidity risks & insurers offer menu contract (Q,S)
  - ► Rothschild and Stiglitz & Wilson condition

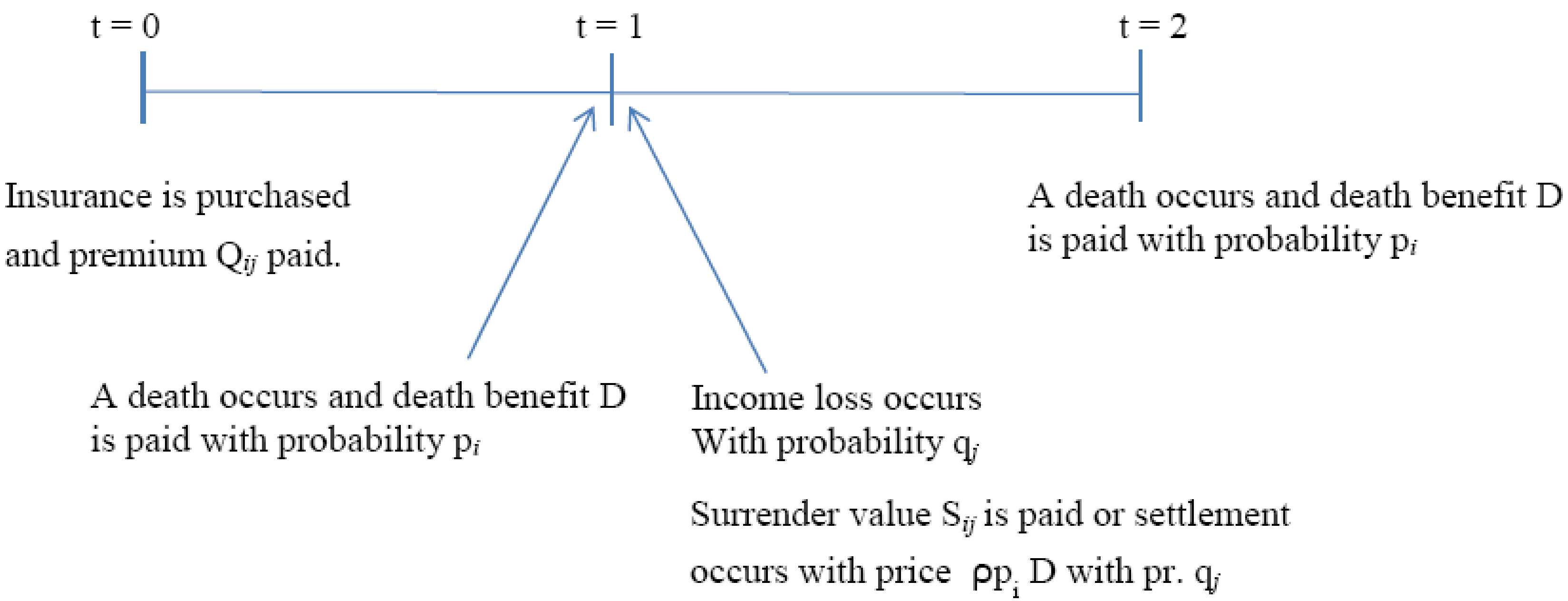
V. Model Description

Assumption

- Competitive insurance market
- 2 sources of risk : Mortality risk *i* – H,L & liquidity risk *j* – H, L →4 types of insureds (*ij* = HH,HL,LH, LL)
- 2 periods model: t = 0, 1, 2 & Income: W_t or zero
- Discount factor : ρ
- Insured's utility: u & u(0)=0, dependent's utility: v, v(0)=0
- Mortality risk at t=1 and t=2: p_i
- Income loss y with probability q_j occurs at t = 1
- Premium: Q_{ij} & death benefit of insurance : D
- Cash surrender value : S_{ij}, $S_{ij} \leq D$
- Perfect and competitive settlement market, risk neutral investors: settlement price = $\rho p_i D$
- Contract C_{ij}: (Q_{ij} ,S_{ij})
- Expected utility of insured *ij* given contract C_{ij} : V_{ij} (C_{ij})
- The proportion of each risk type : λ_{ij}

V. Model Description

Time Line of Model



VI. The Basic model: benchmark case

- <u>No adverse selection</u>
  Without settlement

- Insurance premium for each type.

$$Q_{ij} = \rho p_i D + \rho(1-p_i)q_j S_{ij} + \rho^2 p_i(1-p_i)(1-q_j)D \qquad (2.1)$$

- The expected utility of insured *ij* without settlement :

$$V_{ij}(C_{ij}) = u(W_0 - Q_{ij}) + \rho p_i v(D) + \rho(1-p_i)q_j u(W_1 - y + S_{ij}) + \rho(1-p_i)(1-q_j)u(W_1)$$
$$+\rho^2 p_i(1-p_i)(1-q_j)v(D) + \rho^2(1-p_i)^2(1-q_j)u(W_2) \qquad (2.2)$$

- The slope of the indifference curve on the (Q,S) plane :

$$\frac{dQ_{ij}}{dS_{ij}} = \rho(1-p_i)q_j \frac{u'(W_1 - y + S_{ij})}{u'(W_0 - Q_{ij})} > 0 \qquad (2.3)^3$$

- Assumption : $\rho p_H D[1+\rho(1-q_H)(1-p_H)] - \rho p_L D[1+\rho(1-q_L)(1-p_L)]$ is positive

VI. The Basic model: benchmark case

- The problem of insurers :

$$\underset{Q_{ij},S_{ij}}{Max}\; V_{ij}(C_{ij}) = u(W_0 - Q_{ij}) + \rho p_i v(D) + \rho(1-p_i)q_j u(W_1 - y + S_{ij}) + \rho(1-p_i)(1-q_j)u(W_1)$$
$$+\rho^2 p_i(1-p_i)(1-q_j)v(D) + \rho^2(1-p_i)^2(1-q_j)u(W_2)$$

$$s.t.\quad Q_{ij} = \rho p_i D + \rho(1-p_i)q_j S_{ij} + \rho^2 p_i(1-p_i)(1-q_j)D$$

- The FOCs :

$$L_{S_{ij}} = \rho(1-p_i)q_j u'(W_1 - y + S_{ij}) - \lambda_{ij}\rho(1-p_i)q_j = 0 \qquad (2.6)$$
$$L_{Q_{ij}} = -u'(W_0 - Q_{ij}) + \lambda_{ij} = 0 \qquad (2.7)$$

- Lemma 1. (No adverse selection). Suppose that settlement is not allowed. The optimal insurance contract is satisfied following conditions.

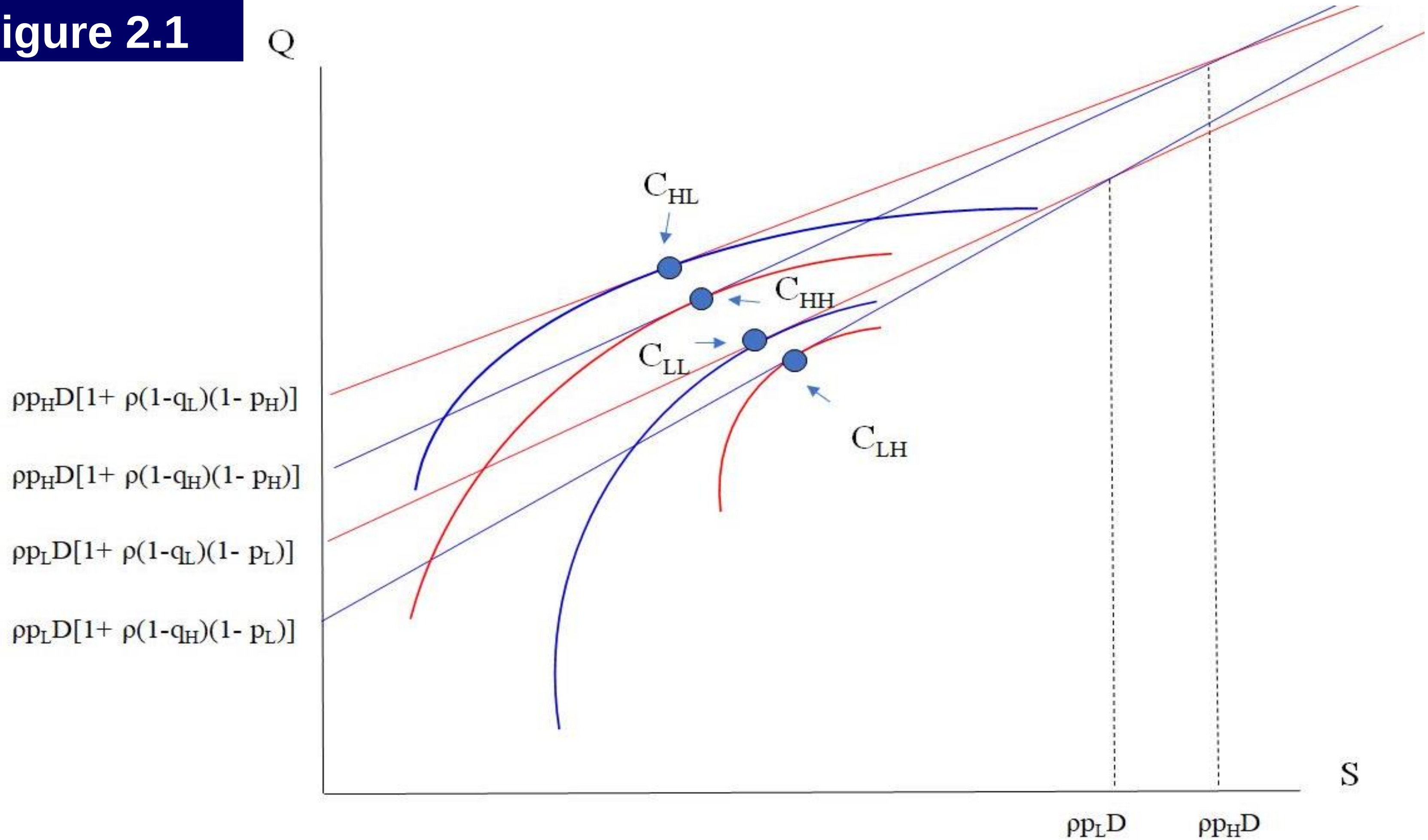
(1) $u'(W_0 - Q_{ij}) = u'(W_1 - y + S_{ij}),\ i = H, L\ ,\ j = H, L$

(2) For i, $(S_{iH} > S_{iL}, Q_{iH} < Q_{iL})$

(3) For j, $(S_{Hj} < S_{Lj}, Q_{Hj} > Q_{Lj})$

VI. The Basic model: benchmark case

Figure 2.1



VI. The Basic model: settlement is allowed

- No adverse selection
  With settlement

- The investors offer the contracts C_H and C_L

  $(Q_i = \rho p_i D + \rho^2 p_i (1 - p_i) D, S_i = \rho p_i D)$

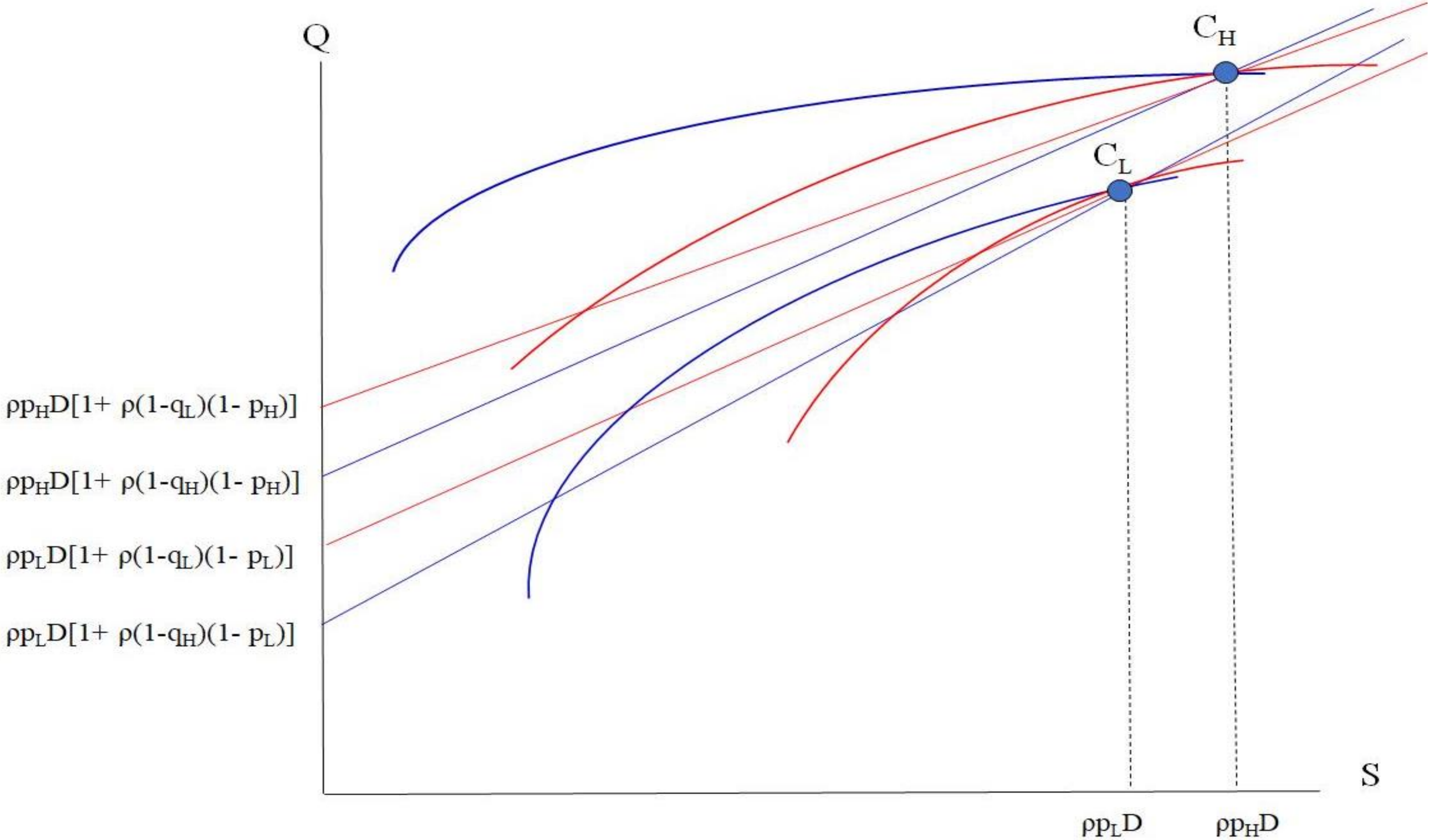
- Lemma 2. (No adverse selection). Suppose that settlement is allowed. Then the following results hold.

(1) Optimal contract C_i for ij is $(Q_{ij} = \rho p_i D + \rho^2 p_i (1 - p_i) D, S_{ij} = \rho p_i D)$.

(2) The utilities of all insureds decrease.

VI. The Basic model: settlement is allowed

Figure 2.2



VII. The model: settlement is not allowed (RS)

- Information Asymmetry
  Without settlement
  Under RS condition

- The zero profit Pooling line :

$$Q = P + \{\rho(1-p_H)[q_H\lambda_{HH} + q_L\lambda_{HL}] + \rho(1-p_L)[q_H\lambda_{LH} + q_L\lambda_{LL}]\} S$$

Where $P = \rho[(\lambda_{HH} + \lambda_{HL})p_H + (\lambda_{LH} + \lambda_{LL})p_L]D$

$$+\rho^2 \{p_H(1-p_H)[\lambda_{HH}(1-q_H) + \lambda_{HL}(1-q_L)] + p_L(1-p_L)[\lambda_{LH}(1-q_H) + \lambda_{LL}(1-q_L)]\} D \quad (3.3)$$

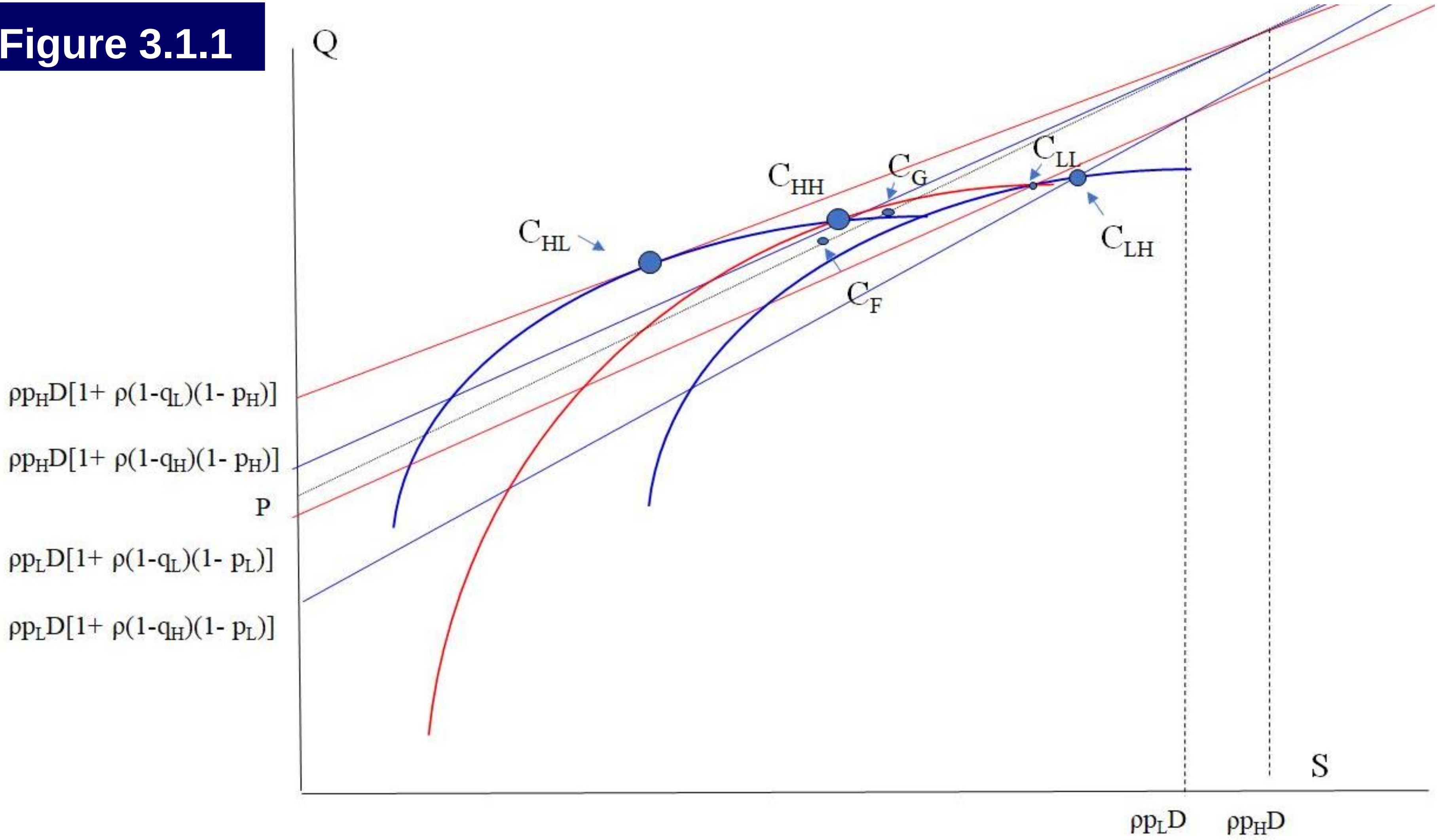
- The zero profit Pooling line for low mortality risks (i = L):

$$Q = \rho p_L kD + \rho(1-p_L)\frac{\lambda_{LL}q_L + \lambda_{LH}q_H}{\lambda_{LL} + \lambda_{LH}} S \quad \text{Where} \quad k = 1 + \rho(1 - \frac{\lambda_{LL}q_L + \lambda_{LH}q_H}{\lambda_{LL} + \lambda_{LH}})(1-p_L) \quad (3.4)$$

- Separating of Semi-pooling equilibrium

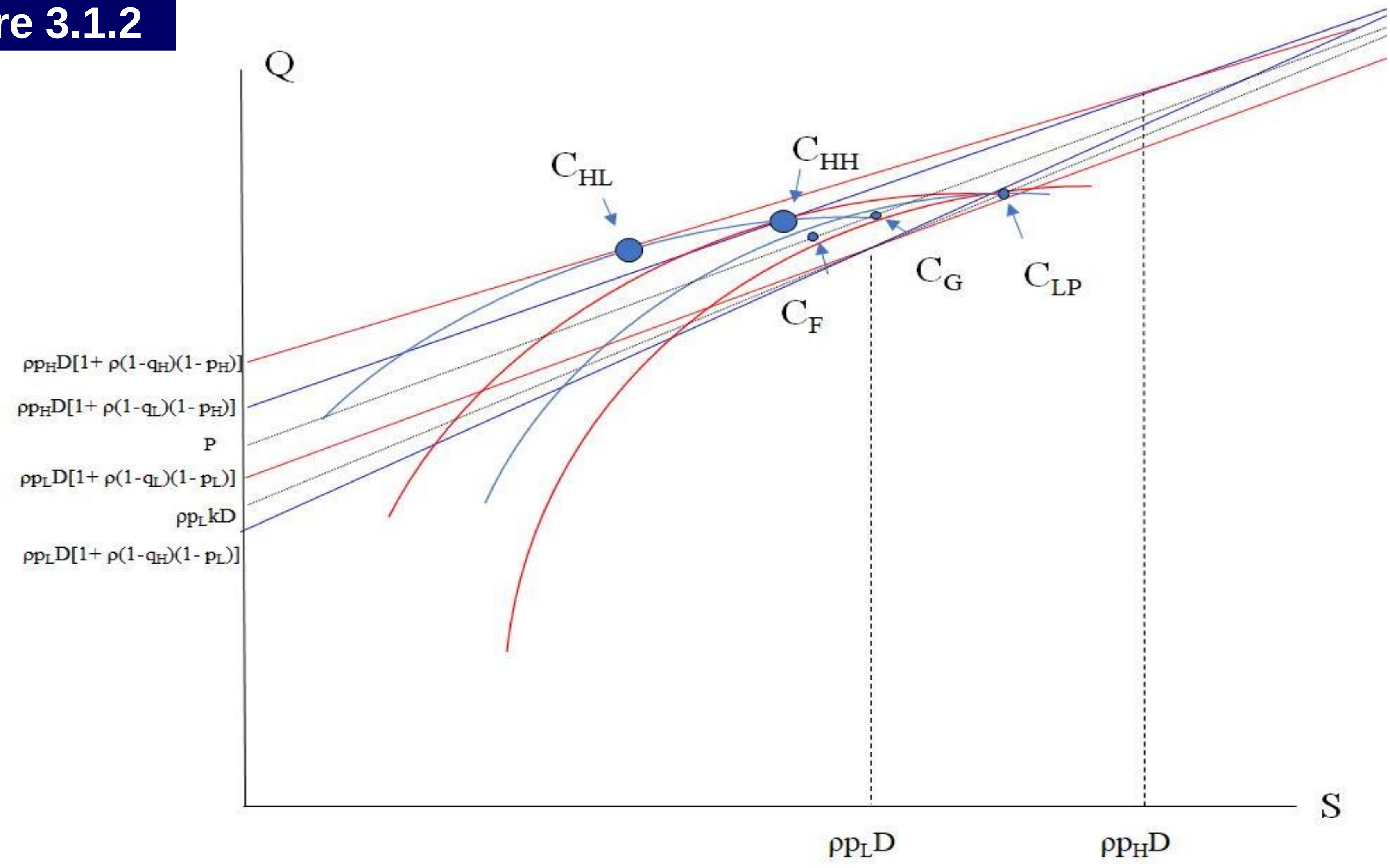
VII. The model: settlement is not allowed (RS)

Figure 3.1.1



VII. The model: settlement is not allowed(RS)

Figure 3.1.2



VII. The model: settlement is not allowed (RS)

- Information Asymmetry
  Without settlement
  Under RS condition

- Proposition 1. (Rothschild and Stiglitz) Suppose that settlement is not allowed. Then the following results hold.

(1) For HL type, $u'(W_0 - Q_{HL}*) = u'(W_1 - y + S_{HL}*)$ while other types ij, $u'(W_0 - Q_{ij}*) > u'(W_1 - y + S_{ij}*)$ at the equilibrium.

(2) The condition for equilibrium depends on the relative proportion of insureds. When equilibrium exists, the condition for RS separating equilibrium is $S < \rho p_L D$, while the condition for semi-pooling equilibrium at which the types with the low mortality risks are pooled while the others are separated is $S \geq \rho p_L D$. S satisfies the following condition (3.2).

$$u(W_0 - Q_{HH}*) + \rho(1-p_H)q_H u(W_1 - y + S_{HH}*)$$
$$= u(W_0 - \rho p_L D - \rho(1-p_L)q_L S - \rho^2 p_L(1-p_L)(1-q_L)D) + \rho(1-p_H)q_H u(W_1 - y + S)$$

Where $C_{HH}*$ composed of $(Q_{HH}*, S_{HH}*)$ is satisfying $V_{HL}(C_{HL}*) = V_{HL}(C_{HH}*)$. (3.2)

VII. The model: settlement is allowed (RS)

- <u>Information Asymmetry</u>
  With settlement
  Under RS condition

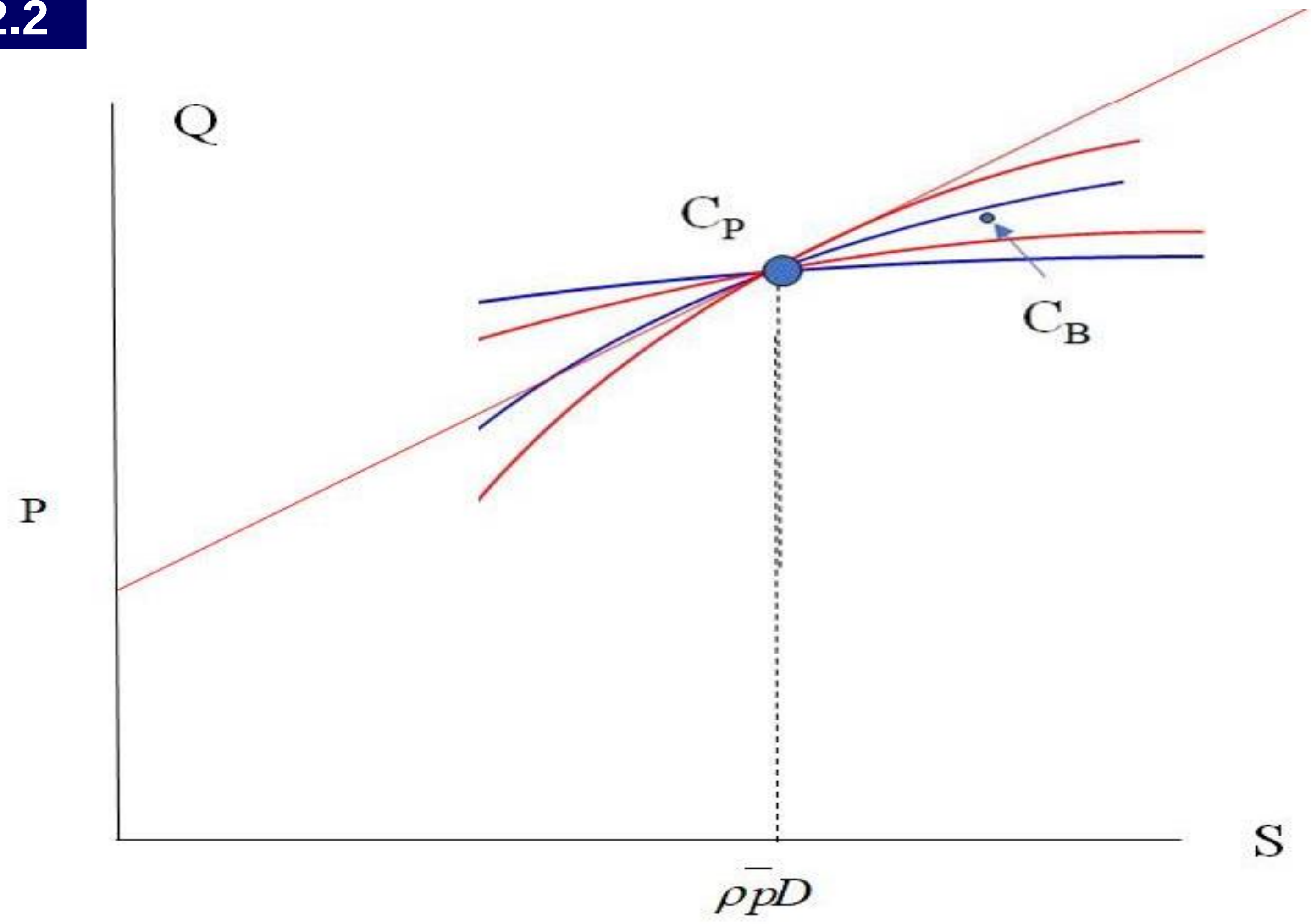
- Insurers cannot offer a pooling contract with $S < \rho \bar{p} D, where\, \bar{p} = \lambda_H p_H + \lambda_L p_L$
  Insurers offer C_P (Q_P, S_P) where

$$Q_P = \rho \bar{p} D + \rho^2 D \{ \lambda_H p_H (1 - p_H) + \lambda_L p_L (1 - p_L) \}$$
$$+ \rho^2 D \left\{ (\bar{p} - p_H)(1 - p_H)[q_H \lambda_{HH} + q_L \lambda_{HL}] + (\bar{p} - p_L)(1 - p_L)[q_H \lambda_{LH} + q_L \lambda_{LL}] \right\},\ S_P = \rho \bar{p} D.$$

→ C_P cannot be an equilibrium.

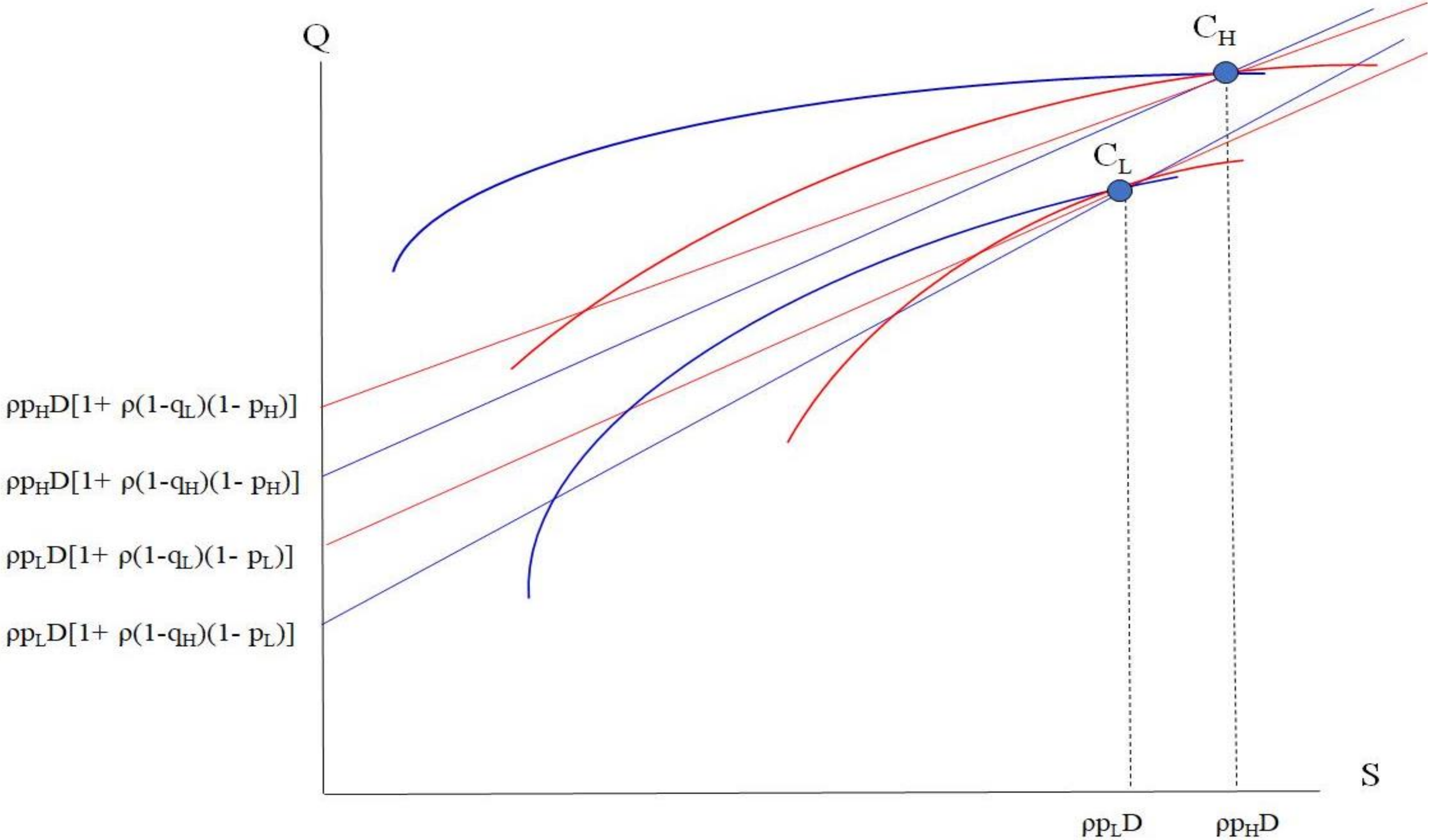
VII. The model: settlement is allowed (RS)

Figure 3.2.2



VII. The Basic model: settlement is allowed

Figure 2.2



VII. The model: settlement is allowed (RS)

- <u>Information Asymmetry</u>
  With settlement
  Under RS condition

- Insurers may offer a semi-pooling contracts C_{HS} , $C_{LS.}$
- If the proportion of LH is sufficiently low, then the semi-pooling equilibrium can exist.

Proposition 2. (Rothschild and Stiglitz) Suppose that settlement is allowed. Then the following results hold.

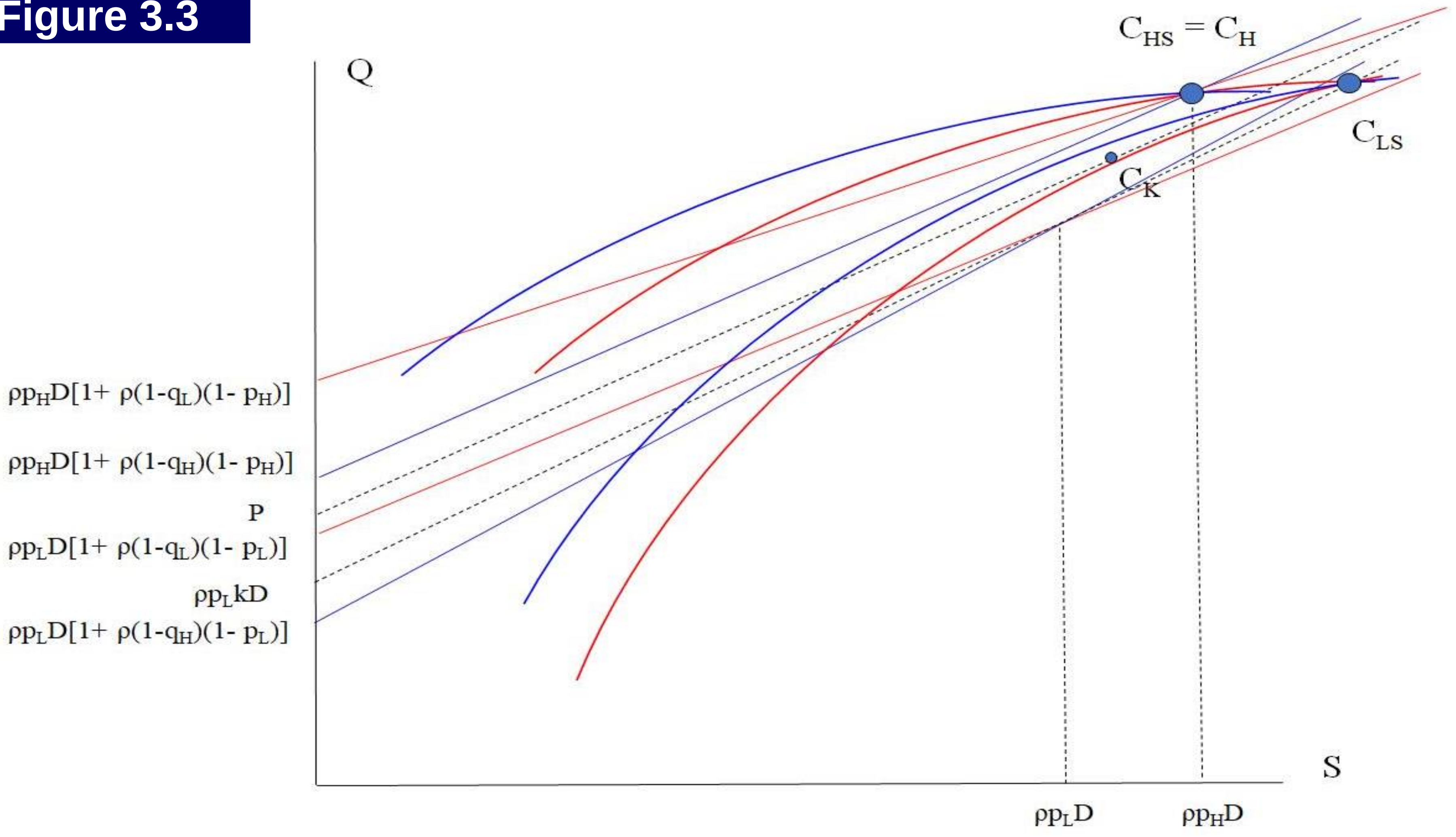
(1) When equilibrium exists, then the equilibrium is semi pooling at which the same mortality risks are pooled while different mortality risks are separated.
(2) At the semi-pooling equilibrium, the settlement investors only target the high mortality risks.

Proposition 3. (Rothschild and Stiglitz) Suppose that settlement is allowed. Then the following results hold.

(1) Insurance premium for all insureds increases.
(2) The utilities of all insureds decrease.

VII. The model: settlement is allowed (RS)

Figure 3.3



VIII. The model: settlement is not allowed (Wilson)

- <u>Information Asymmetry</u>
  Without settlement
  Under Wilson condition
- RS separating (or semi-pooling) equilibrium constitutes Wilson equilibrium. Potential Wilson pooling equilibrium is C_{NP}

Proposition 4. (Wilson) Suppose that settlement is not allowed. Then the following results hold.

(1) If RS separating (or semi-pooling) equilibrium exists, then the equilibrium is Wilson separating (or semi-pooling) equilibrium.

(2) Pooling equilibrium constitutes Wilson equilibrium. At this equilibrium, following condition holds.

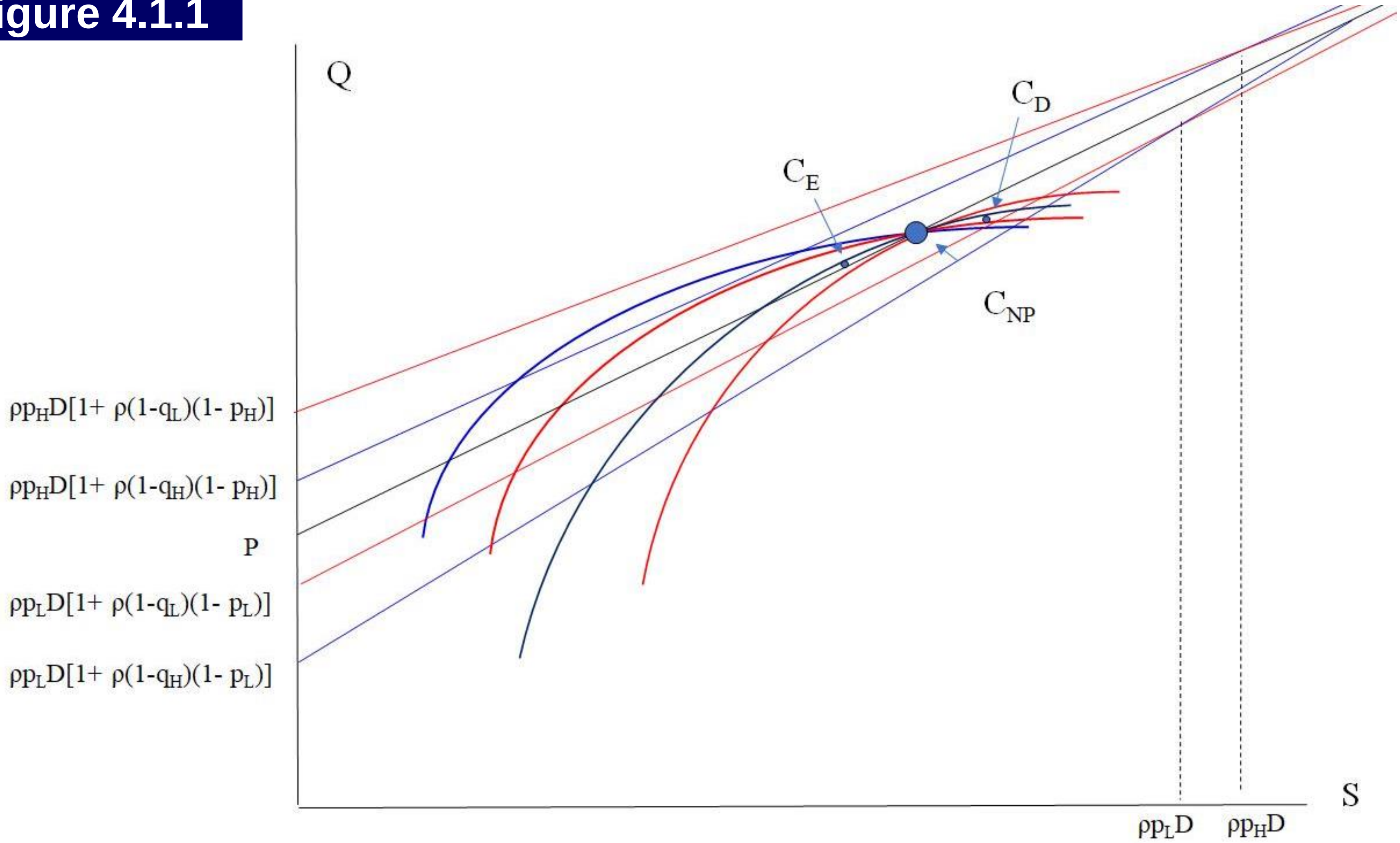
$$(1-p_H)[q_H\lambda_{HH}+q_L\lambda_{HL}]+(1-p_L)[q_H\lambda_{LH}+q_L\lambda_{LL}]=(1-p_L)q_H\frac{u'(W_1-y+S_{LH})}{u'(W_0-Q_{LH})} \quad (4.1)$$

(3) The surrender value at pooling equilibrium is greater than $\rho p_L D$ when the following condition holds.

$$(1-p_H)[q_H\lambda_{HH}+q_L\lambda_{HL}]+(1-p_L)[q_H\lambda_{LH}+q_L\lambda_{LL}] < (1-p_L)q_H\frac{u'(W_1-y+\rho p_L D)}{u'(W_0-\rho p_L D-\rho^2(1-p_L)D)} \quad (4.2)$$

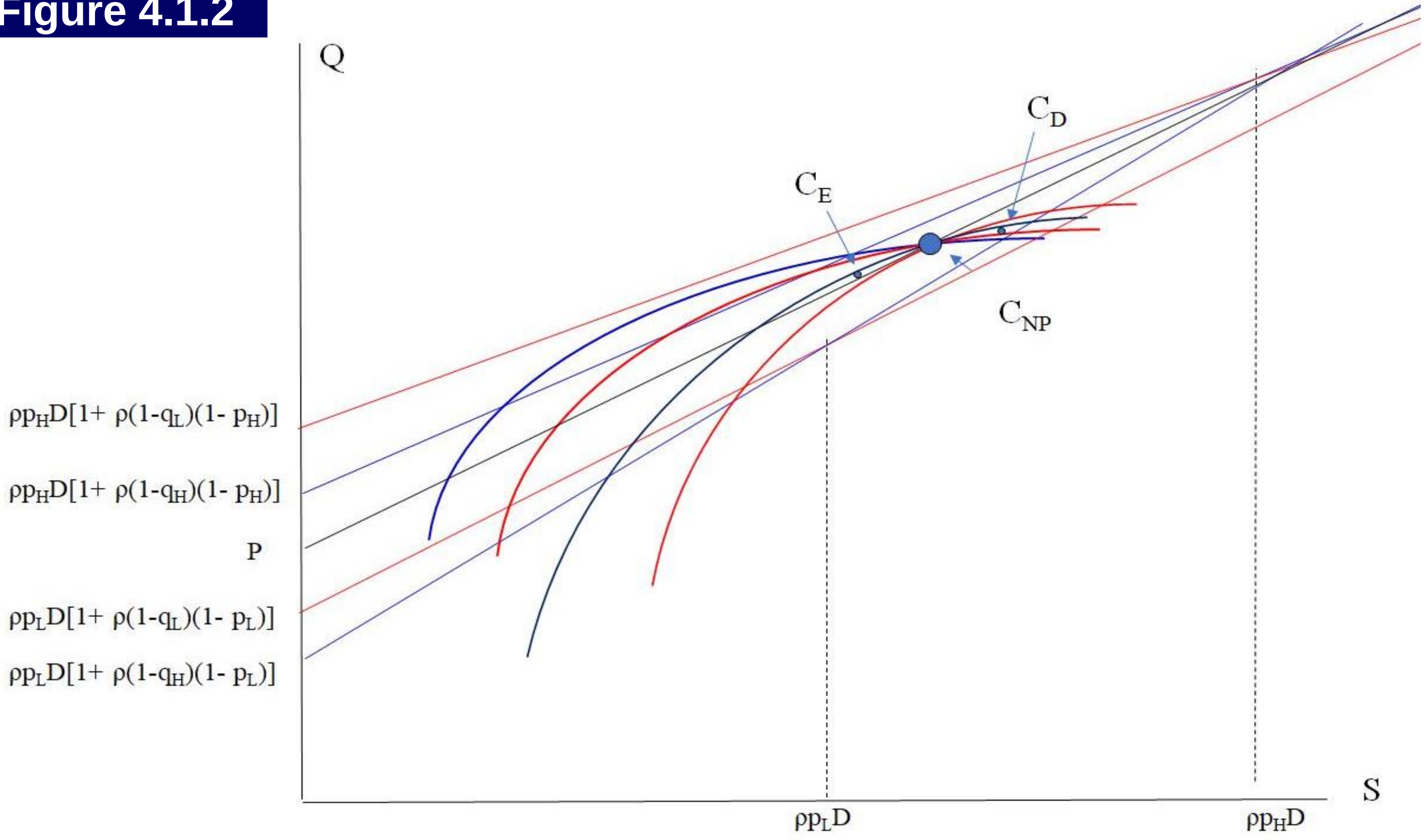
VIII. The model: settlement is not allowed (Wilson)

Figure 4.1.1



VIII. The model: settlement is not allowed (Wilson)

Figure 4.1.2



VIII. The model: settlement is allowed (Wilson)

- Information Asymmetry
  With settlement
  Under Wilson condition

- RS separating (or semi-pooling) equilibrium constitutes Wilson equilibrium. Potential Wilson pooling equilibrium is C_P
- In figure 3.2.2, if C_B is below the zero profit pooling line, then insurers do not offer C_B.

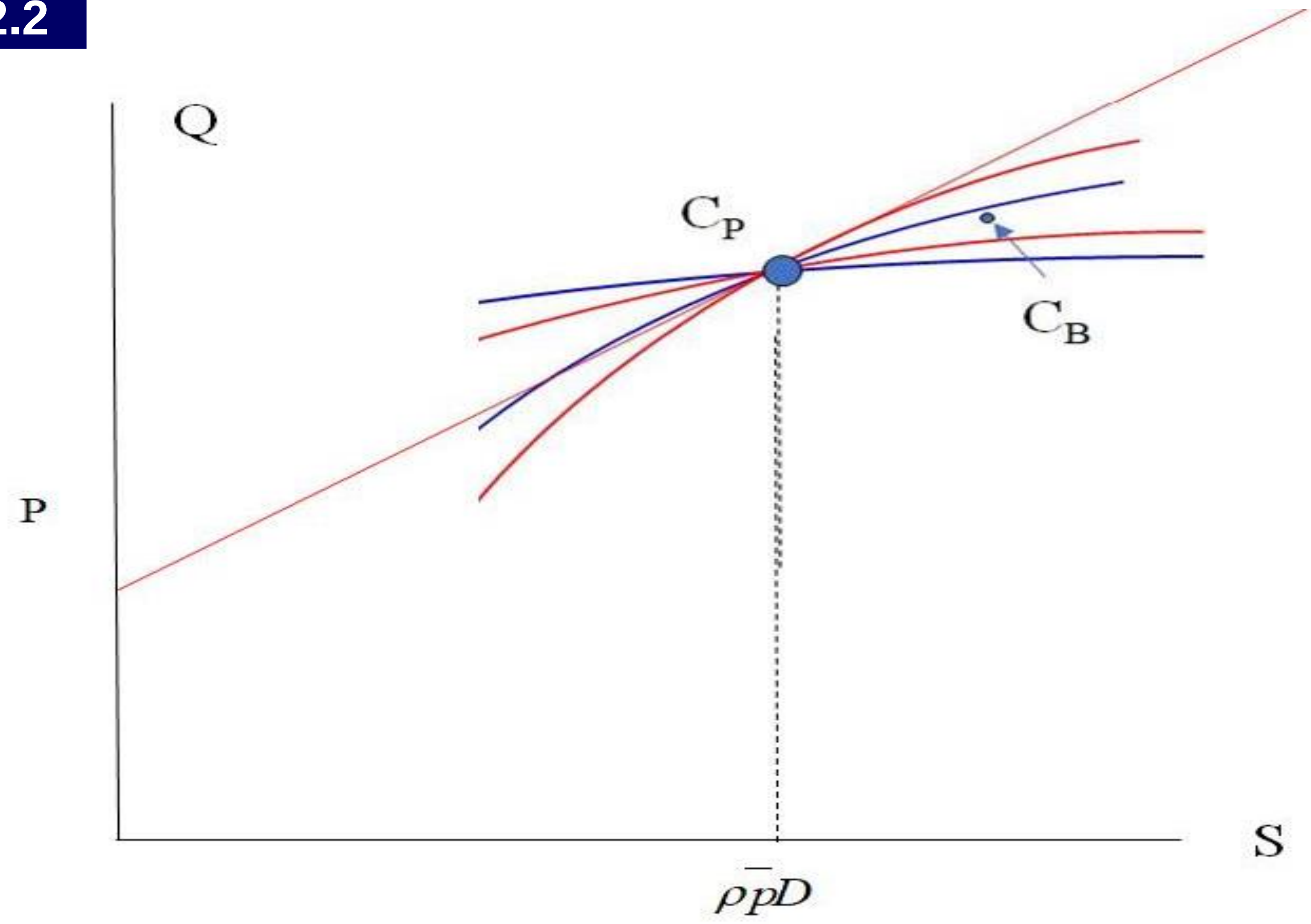
$$(1-p_H)[q_H\lambda_{HH}+q_L\lambda_{HL}]+(1-p_L)[q_H\lambda_{LH}+q_L\lambda_{LL}] \geq (1-p_L)q_H \frac{u'(W_1-y+\rho\bar{p}D)}{u'(W_0-Q_P)}$$

$$\text{where } Q_P = \rho\bar{p}D+\rho^2 D\{\lambda_H p_H(1-p_H)+\lambda_L p_L(1-p_L)\}$$
$$+\rho^2 D\{(\bar{p}-p_H)(1-p_H)[q_H\lambda_{HH}+q_L\lambda_{HL}]+(\bar{p}-p_L)(1-p_L)[q_H\lambda_{LH}+q_L\lambda_{LL}]\} \quad (4.3)$$

- The expected utility of LH may or may not be maximized at C_P.

VIII. The model: settlement is allowed (RS)

Figure 3.2.2



VIII. The model: settlement is allowed (Wilson)

Proposition 5. (Wilson) Suppose that settlement is allowed. Then the following results hold.

(1) If (4.3) hold, RS semi-pooling contract with settlement or pooling contract can be Wilson equilibrium contract. The pooling contract is C_P denoted as $(Q_P, \ \rho \bar{p} D)$ where

$$Q_P = \rho \bar{p} D + \rho^2 D \{\lambda_H p_H (1-p_H) + \lambda_L p_L (1-p_L)\}$$
$$+\rho^2 D \{(\bar{p} - p_H)(1-p_H)[q_H \lambda_{HH} + q_L \lambda_{HL}] + (\bar{p} - p_L)(1-p_L)[q_H \lambda_{LH} + q_L \lambda_{LL}]\}$$

(2) If (4.3) does not hold, the following cases hold.

a. If the equilibrium contract without settlement is RS separating (or semi-pooling), then the RS semi-pooling contract with settlement or pooling contract C_P can be an equilibrium.

b. If the equilibrium contract without settlement is pooling contract, then the equilibrium contract does not change.

(3) Settlement market does not exist when the following conditions hold.

a. (4.3) does not hold and the equilibrium contracts with and without settlement are separating (or semi-pooling) and pooling, respectively.

b. (4.3) does not hold and the equilibrium contract without settlement is pooling.

VIII. The model: settlement is allowed (Wilson)

Proposition 6. (Wilson) The effects of settlement are as follows.

(1) Insurance premium for some insureds may increase. There exists the case in which the premium for all insureds decrease.

(2) The utilities of some insureds may increase. There does not exist the case in which the utilities for all insureds increase.

VII. Conclusions

<Under RS condition>

- Without settlement , risk types are fully separated or semi-pooled where liquidity risks with low mortality risk are pooled if an equilibrium exists.
- With settlement, a semi-pooling equilibrium may exist in which liquidity risks are pooled while mortality risks are separated.
- The utilities of all insureds decrease.

<Under Wilson condition>

- Without settlement ,a pooling equilibrium exists.
- With settlement, a pooling equilibrium may exist.
- There exists the case that settlement market does not exist.
- The utilities of some insureds may increase.

Thank you!