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**Abstract**

In this paper, we present a model in which agents choose voice, exit, or stay options when their marital condition becomes bad. The "voice" option can be interpreted as a spouse's effort or "investment" in the household to resolve his/her dissatisfaction and improve the marital condition. If a spouse hopes to divorce, he/she chooses "exit" option. If a spouse does not hopes to express his/her opinion and to divorce, he/she chooses "stay" option. We focus on the role of "exit" and "voice" in a marriage and investigate the effects of divorce law which is based on fault or no-fault on divorce rates. Our paper shows that divorce rates tend to be too higher under unilateral divorce law in the non-transferable utility case. On the other hand, mutual-consent divorce law generates multiple equilibria and then divorce rates are inefficient even in the transferable utility case. In this multiple equilibria case, divorce rates are determined by social factors as culture, norm, and religion, etc.

*JEL classification:* D1; K0; R2
*Key words:* Divorce; Exit; Voice; Divorce law

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# 1 Introduction

In their seminal paper, Becker (1993) and Becker, Landes and Michael (1977) insist that the Coase theorem applies to marital bargaining. To be more precise, the change in divorce law does not affect divorce rate, if bargaining can be done without costs within marriage. However, in the real world, the divorce law matters. In most U.S. states, the transition from "fault" to "no-fault" divorce law is spread through the 1970s and simultaneously, U.S. divorce rate rises dramatically. Whether these two trends are linked or not has been argued at length.[1] In recent years, empirical studies show that the change to no-fault unilateral divorce laws raise the divorce rate in U.S. However this effect does not continue for long term. For instance, Wolfer (2006) shows the divorce rate is affected largely in the first few years, and is not affected in the following years by the transition to unilateral divorce laws. On the other hand, some recent theoretical analysis show that the change of divorce law affects the divorce rate. For example, Rasul (2005) shows that the change to unilateral divorce law reduced marriage rate through the rise in the divorce rate. Clark (1999) and Fella, Mariotti and Manzini (2004) show that the inefficient divorce may occur even under fault mutual-consent divorce law. Moreover, Chiappori, Iyigun and Weiss (2007) shows that the change in divorce laws can rise or lower the divorce rate. Those literatures commonly show that to study the effects of divorce laws on divorce rates and welfare is still important.

In this paper, we investigates the effect of divorce laws on the divorce rates and welfare with the "exit-voice framework," initiated by Hirschman (1970). Hirschman points out that "voice" and "exit" are alternative means of dealing with problems that arises within an ongoing relationship or organization. "Voice" is an option to state his/her dissatisfaction, negotiate with the partners, and try to restore the condition of the organization. If most members cooperate, "voice" option can indeed improve the condition of the organization. On the other hand, "exit" is an option to depart from the organization itself.

A marital couple is also an organization that a wife and a husband are engaged in. Indeed, in the Palgrave Dictionary of Economics, Hirschman (1987) points out that "[m]odern marriage is one of the simplest illustrations of exit-voice alternative. When a marriage is in difficulty, the partners can either make an attempt, usually through a great deal of voicing, to reconstruct their relationship or they can divorce." In this paper, we formalize an exit-voice framework of the marriage market. To do so, we employ a simplified version of Mortensen and Pissarides (1994)'s labor search model as our basic model.

In Mortensen and Pissarides (1994), workers search for their job and firms search for workers, and when they are matched with each other, they from a production unit. However, there is a possibility that job condition switch from good to bad. Following their setting, we assume that both female and male search for their marriage partner in a marriage market. Each agent is randomly matched with another and marry with him/her. A marriage always starts with good

[1]For example, Peters (1986) shows that the change to no-fault unilateral divorce does not affect the divorce rate in her empirical work. Given this, Allen (1992) points out that the change to no-fault divorce causes a rise in the divorce rate. Then, Peter (1992) replied to Allen (1992). Friedberg (1998) suggest that the adoption of unilateral divorce laws raises the divorce rate since the late 1960s.

state (happy marriage). However, a marriage with good state goes to marriage with bad state (unhappy marriage) with constant positive probability per time. Therefore, in our model, there are three states of any agent: single, the marriage with good state, the marriage with bad state. When spouses are in an unhappy marriage, each spouse chooses one of the three options: voice, exit, or stay. Exit means a divorce. On the other hand, we regard voice as an option which both a wife and a husband cooperate to restore bad marital condition. To be more precise, the voice is an effort or "(post-marital) investment" within the household, and it costs. For example, a spouse can costly express his/her opinions to another in order to resolve his/her dissatisfaction. These opinions may be requests or claims for housework, expressions of affection, the disciplining of children, money matters etc. If both spouses express their voice, they may lead to a quarrel or arguments. A quarrel is, more or less, costly though it may serve the improvement the marital condition. If a spouse does not hope to divorce nor to express his/her opinion, stay option.

We can consider the two cases: the case of transferable utility and of non-transferable utility. In transferable utility case, all possible costs are also transferable. Then, the voice cost is equal among spouses. On the other hand, in non-transferable utility case, the voice cost may be asymmetry among spouses. We focus on the non-transferable utility case in this paper, since it is generally assumed that utility is non-transferable among a couple (see, Zelder (1993), Fella, Manzini, Mariotti (2007)). Analysis of the transferable utility case is relegated to Appendix C.

The main findings are as follows. The change in divorce law influences the divorce rates and welfare. First, suppose that divorce law is unilateral divorce law, i.e., a husband (wife) can divorce without wife(husband)'s agreement. If the voice cost is higher for husband (wife) than for wife (husband), then a husband (wife) may reject the voice although the voice maximizes the sum of spouse's payoff. Therefore, the voice under unilateral divorce are often inefficient relative to the optimal. In this case, equilibrium divorce rates are higher than optimal divorce rates. Thus, our results point out that divorce rates tend to be too higher under unilateral divorce law. Under unilateral divorce law, the factor which brings the economy about inefficient divorce is asymmetry of voice cost between a husband and a wife.[2]

Second, suppose that divorce law is mutual-consent law. Under the mutual-consent law, multiple equilibria may occur. In other words, the inefficient divorce or the inefficient voice may occur according to the social norms, cultures or religion. Under mutual-consent divorce law, both voice option and divorce (exit) option need the agreements of both a husband and a wife for realization. If both agents do not agree with each other, the couple continues to stay at the bad marital condition, which lowers utility of both agents. Then, if both agents agree with one of two option, both agents don't have incentive to deviate to other options. In this multiple equilibria case, divorce rates are determined by social factors as culture, norm, and religion, etc. In a society in which divorce is a bad behavior from a view point of ethics, agents in bad marital condition may hesitate to choose a divorce option, and choose a voice option. In such type of society, divorce rates tend to be low when there are multiple equilibria. However, when there are multiple equilibria, there may be too much couples which select a voice option: divorce rates are too low relative to the optimal condition, while asymmetry of voice cost induces the too

[2] If the divorce cost is symmetric in couples, the equilibrium under unilateral divorce law is consistent with optimal. See Appendix C.

much amount of divorce. If the economy is in this condition, the change of divorce law from mutual-consent to unilateral improves welfare of the economy.[3]

Organization of the paper is as follow. In Section 2, we present a basic set up of the model. In Section 3, we analyze the stationary distributions at equilibrium and compare their welfare levels. In Section 4, we show the situation when a marital sate becomes bad. In Section 5, we study the non-transferable utility case and analyze the effect of unilateral divorce law and mutual-consent divorce law on divorce rates and welfare of the economy. Section 6 concludes the paper.

# 2 The Model

## 2.1 Environment

Time is continuous. There are a continuum of males (M) with measure 1 and that of females (F) with measure 1. Each agent is at either of three states: single, marriage with good state (state $g$), and marriage with bad state (state $b$). At the single stage, both male and female get a flow payoff 0 and search for their marriage partners in a marriage market. On the equilibrium path, each agent randomly meets another agent on the other side with Poisson rate $a$ per time, and marry with him/her. When a marriage is formed, both agents enter into the marriage with good state. At the marriage with good state, both agents get the flow payoff $y_g$. However, a marriage with good state goes to marriage with bad state with Poisson process with $\lambda_g$ per time. At the marriage with bad state, both agents receive the flow payoff $y_b$ where $y_g > y_b > 0$. A marriage with bad state goes to divorce with Poisson process with $\lambda_b$. When a marriage goes to divorce, both female and male becomes single and search for their partners in marriage market again. Every agent maximize his/her lifetime expected discounted utility with the discount rate $r$.

Here, we define that $u$ is the measure of single M or F, and $e_j$ is the measure of marriages with state $j$. Thus, it must be hold that $u + e_g + e_b = 1$.

In our model, we assume that agents at the marriage with bad state can do effort to restore marital condition. We call this effort as "voice." We can think that voice is a communication ways such as a quarrel between husband and wife. When a marital condition turns to be bad, a couple chooses either of a voice option, a stay option or an exit option (divorce). Choosing a voice option, it costs $v_i = \theta_i v$ for $i = M, F$, and a bad condition goes to a good condition with

[3] The transferable utility case is an important benchmark, where it is confirmed that the Coase theorem holds and that the optimal options are chosen at the equilibrium if a husband and a wife coordinate on Pareto superior action profile. The equilibrium is consistent with optimal under unilateral divorce law when utility is transferable. However, when a husband and a wife cannot coordinate, multiple equilibria occur under mutual-consent divorce law. Then, in the transferable utility case without coordination, the change in divorce law influences on the divorce rates and welfare.

Therefore, the inefficient results are always caused by mutual-consent divorce law if a couple cannot coordinate on Pareto superior action profile. In both the transferable and the non-transferable utility case, mutual-consent divorce law always generates multiple equilibria, and then the divorce rate and the voice are inefficient. This comes from the fact that not only "voice" but also "exit" need the agreements of both a husband and a wife under mutual-consent divorce law.

Poisson rate $\tau$ per time where $\theta_M + \theta_F = 1$ and $\theta = \theta_M > \frac{1}{2}$.[4] Voice is effective only if both members of a couple choose it.

In addition, we assume that utility is non-transferable in the main text. The analysis of transferable utility case is in the Appendix C.

### 2.2 Stationary Equilibria and Divorce Laws

In this environment, we restrict our attention to the class of stationary equilibria. The candidates for stationary equilibrium are as follows:

- Voice equilibrium; voice option is exercised at every marriage in bad marital state.
- Exit equilibrium; exit option is exercised at every marriage in bad marital state.
- Stay equilibrium; stay option is exercised at every marriage in bad marital state.

Generally, which option is effective depends not only on spouses' actions, but also on which divorce law is applied. In this paper, we consider the following divorce laws:

- Unilateral divorce law.
- Mutual-consent divorce law.

Unilateral divorce law is the law that a husband (wife) can divorce without the agreement of his wife (her husband). On the other hand, under mutual-consent divorce law, it is necessary to divorce that both of agents agree with each other.

In this paper, we analyzes the effects of divorce law on the condition under which the three types of equilibrium is reached and the welfare at the equilibrium.

## 3 Stationary Distribution and Welfare

In this paper, we restrict our attention to the steady state. In this section, we derive stationary distributions at equilibrium and compare their measures of the agents in each state, divorce rates, and welfare levels. In a steady state, measure of agents in each state, denoted by $u$, $e_g$ and $e_b$, becomes constant throughout all times.

First, the stationary conditions of the voice equilibrium are

$$u^V a + e_b^V \tau = e_g^V \lambda_g,$$
$$e_g^V \lambda_g = e_b^V (\lambda_b + \tau),$$

[4] When we assume that $\theta_F > \frac{1}{2}$, results in our model keep.

where upperscript $V$ represents that the variables are at the voice equilibrium. Since $u^V + e_g^V + e_b^V = 1$, we obtain

$$\begin{aligned} u^V &= \frac{\lambda_g \lambda_b}{a(\lambda_g + \lambda_b + \tau) + \lambda_g \lambda_b}, \\ e_g^V &= \frac{a(\lambda_b + \tau)}{a(\lambda_g + \lambda_b + \tau) + \lambda_g \lambda_b}, \\ e_b^V &= \frac{a\lambda_g}{a(\lambda_g + \lambda_b + \tau) + \lambda_g \lambda_b}. \end{aligned}$$

Second, the stationary conditions of the exit equilibrium are

$$\begin{aligned} u^E a &= e_u^E \lambda_g, \\ 0 &= e_b^E \lambda_b. \end{aligned}$$

Then, we obtain

$$\begin{aligned} u^E &= \frac{\lambda_g}{a + \lambda_g}, \\ e_g^E &= \frac{a}{a + \lambda_g}, \\ e_b^E &= 0. \end{aligned}$$

Third, the stationary conditions of the stay equilibrium are

$$\begin{aligned} u^S a &= e_g^S \lambda_g, \\ e_g^S \lambda_g &= e_b^S \lambda_b. \end{aligned}$$

Then, we obtain

$$\begin{aligned} u^S &= \frac{\lambda_g \lambda_b}{a(\lambda_g + \lambda_b) + \lambda_g \lambda_b}, \\ e_g^S &= \frac{a\lambda_b}{a(\lambda_g + \lambda_b) + \lambda_g \lambda_b}, \\ e_b^S &= \frac{a\lambda_g}{a(\lambda_g + \lambda_b) + \lambda_g \lambda_b}. \end{aligned}$$

Now, we are in a position to compare these stationary equilibria. First, the comparison of measures of the agents in single, state $g$, and state $b$ among stationary states is as follows:

$$\begin{aligned} & u^E > u^S > u^V, \\ & \begin{cases} e_g^E > e_g^V > e_g^S, & \text{if } a > \tau, \\ e_g^V > e_g^E > e_g^S, & \text{if } a < \tau, \end{cases} \\ & e_b^S > e_b^V > e_b^E. \end{aligned}$$

We can also define the divorce rate $\delta^j$ in $j$ equilibrium as follows:

$$\delta^V = \lambda_b e_b^V,$$
$$\delta^E = \lambda_g e_g^E,$$
$$\delta^S = \lambda_b e_b^S.$$

Then we obtain

$$\delta^E > \delta^S > \delta^V.$$

This result is fairly intuitive. In exit equilibrium, any couple chooses to divorce as soon as their marital condition turns out to be bad, and therefore the divorce rate is the highest. On the other hand, in voice equilibrium, any couple efforts to restore their marital condition, and the effort decreases the divorce rate since no couple does not divorce in marriage in good state. Thus, the divorce rate is the lowest in voice equilibrium.

Next, we derive the welfare at each equilibrium. The welfare is defined as the average value. At voice equilibrium and stay equilibrium, there are three type of agents, single, marriage with good state, marriage with bad state. On the other hand, at the exit equilibrium, there do not exist any marriage with bad state agents. This is because at this equilibrium, agents select to divorce when marriage states switch from good to bad.

Welfare in each equilibrium is

$$W^V = 2y_g e_v^V + (2y_b - v)e_b^V,$$
$$W^E = 2y_g e_g^E,$$
$$W^S = 2y_g e_g^S + 2y_b e_b^S.$$

Then, the comparison of each equilibrium is as follows:

$$[\mathbf{w-VE}] \quad W^V \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} W^E \Leftrightarrow \frac{1}{2}v \left\{ \begin{array}{c} < \\ = \\ > \end{array} \right\} \frac{\tau - a}{\lambda_g + a} y_g + y_b,$$

$$[\mathbf{w-ES}] \quad W^E \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} W^S \Leftrightarrow y_b \left\{ \begin{array}{c} < \\ = \\ > \end{array} \right\} \frac{a}{\lambda_g + a} y_g,$$

$$[\mathbf{w-SV}] \quad W^S \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} W^V \Leftrightarrow \frac{1}{2}v \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} \frac{\tau \left\{ (a + \lambda_b) y_g - a y_b \right\}}{a(\lambda_g + \lambda_b) + \lambda_g \lambda_b}.$$

The optimal option is illustrated by Figure 1 and 2. Note that Line w-VE is upward, while Line w-SV is downward.[5] We distinguish the two cases: $a > \tau$ and $a < \tau$.

[5] Throughout this paper, we adopt a convention that a cutoff line of a condition, say, [w-VE] is called Line w-VE.

## 4 Couple's Game in Bad Marital State

The situation in which a couple is facing when their marital state becomes bad is a kind of game played by both spouses. Before investigating the stationary equilibria at full length, we clarify the equilibrium conditions of the couple's game in bad marital state under each divorce law.

The point is that spouses may need to coordinate in order to exercise some option. The voice option always needs to be coordinated. The exit option needs to be coordinated only under the mutual-consent divorce law. This brings about different equilibrium conditions between two divorce laws.

In the present paper, we use iteratively (weakly) undominated equilibrium as equilibrium concept. Iteratively undominated equilibrium is a Nash equilibrium which survives against iterative elimination of weakly dominated strategies. Generally, a result of iterative elimination of weakly dominated strategies is dependent upon the order of eliminations, and therefore iteratively undominated equilibrium is often thought to be problematic. However, it is verified that, in the games we consider in the present paper, an order of iteration does not matter. For example, Marx and Swinkels (1997) shows that an order of iteration does not matter in the class of the games satisfying "TDI condition." It is verified that any version of the couple's game in the present paper satisfies TDI condition.

Let $\pi_i^j$ be $i$'s payoff when $j$ option is exercised by the couple. These payoffs are endogenously derived in later analysis. Throughout this section, we put the following two assumptions:

**Assumption 1** For each $i = M, F$, $\pi_i^V$, $\pi_i^E$, and $\pi_i^S$ are all distinct.

**Assumption 2**

$$\begin{aligned}
\pi_M^V - \pi_M^E &\leq \pi_F^V - \pi_F^E, \\
\pi_M^V - \pi_M^S &\leq \pi_F^V - \pi_F^S, \\
\pi_M^E - \pi_M^S &= \pi_F^E - \pi_F^S.
\end{aligned}$$

These assumptions hold in a later analysis of the matching model. Assumption 1 is made for circumventing a complicated characterization of equilibria. Since we employ iteratively undominated equilibrium, the equilibrium conditions are much complicated when any two distinctive strategy give the same payoff. Assumption 2 refers to the situation in which M feels the voice option less desirable, compared to the other options, than F does, but the difference between the payoffs received in the exit option and the stay option is common among M and F. This assumption is relevant for the later analysis because we assume there is no difference between M and F except for the instantaneous voice cost and M's instantenous voice cost is larger than F's.

### 4.1 Unilateral Divorce Law

We first consider unilateral divorce law. The couple's game in bad marital state is illustrated by the matrix in Table 1. Each entry is an effective option of the couple.

| M / F | $V$ | $E$ | $S$ |
|---|---|---|---|
| $V$ | $V$ | $E$ | $S$ |
| $E$ | $E$ | $E$ | $E$ |
| $S$ | $S$ | $E$ | $S$ |

Table 1: The game under unilateral divorce law

**Proposition 1** Suppose Assumptions 1 and 2 hold. Then, the equilibrium conditions for each type of equilibria under the unilateral divorce law are as follows:

1. Voice equilibrium: $\pi_M^V > \pi_M^E$ and $\pi_M^V > \pi_M^S$.
2. Exit equilibrium: $\pi_M^E > \pi_M^V$ and $\pi_M^E > \pi_M^S$.
3. Stay equilibrium: $\pi_M^S > \pi_M^V$ and $\pi_M^S > \pi_M^E$.

The formal proof is relegated to Appendix A. A parameters set satisfying the equilibrium conditions for one type of equilibrium does not overlap with another and the support of the union of all the sets covers the entire admissible parameters space. In other words, there is generically one and only on type of equilibrium in each profile of generic parameter values.

## 4.2 Mutual-Consent Divorce Law

We next consider mutual-consent divorce law. The game is illustrated by the matrix in Table 2.

| M / F | $V$ | $E$ | $S$ |
|---|---|---|---|
| $V$ | $V$ | $S$ | $S$ |
| $E$ | $S$ | $E$ | $S$ |
| $S$ | $S$ | $S$ | $S$ |

Table 2: The game under mutual-consent divorce law

**Proposition 2** Suppose Assumptions 1 and 2 hold. Then, the equilibrium conditions for each type of equilibria under the mutual-consent divorce law are as follows:

1. Voice equilibrium: $\pi_M^V > \pi_M^S$.
2. Exit equilibrium: $\pi_M^E > \pi_M^S$.
3. Stay equilibrium: $\pi_M^S > \pi_M^V$ and $\pi_M^S > \pi_M^E$.

The formal proof is relegated to Appendix B. Unlike under the unilateral divorce law, there may co-exist multiple equilibria under the mutual-consent divorce law. To be more precise, if both $\pi_M^V > \pi_M^S$ and $\pi_M^E > \pi_M^S$ hold, the game has two (pure strategy) equilibria: $(V, V)$ and $(E, E)$.

As we simply see above, spouses need to coordinate in order to exercise the voice option in any case. Furthermore, under the mutual-consent divorce law, the exit option also needs to be coordinated. Thus, the situation is like a "coordination game," and therefore a Pareto-inferior option can be exercised due to the coordination failure. In other words, the mutual-consent divorce law may produce some coordination friction among a couple.

# 5 Stationary Equilibria in the Matching Model

Based on the previous results, we next characterize the set of stationary equilibria in the matching model. We assume the utilities are non-transferable.[6] Below, we restrict our attention to generic parameters values. The value functions of each state are as follows:

$$\begin{aligned}
rU_i &= a(G_i - U_i), \\
rG_i &= y_g + \lambda_g(B_i - G_i), \\
rB_i^V &= y_b - v_i + \lambda_b(U_i - B_i^V) + \tau(G_i - B_i^V), \\
B_i^E &= U_i, \\
rB_i^S &= y_b + \lambda_b(U_i - B_i^S),
\end{aligned}$$

where $U_i$, $G_i$, and $B_i^j$ is the $i$'s value of single state, the $i$'s value of marriage with good state, and the $i$'s value of marriage with bad state when $j$ option is exercised, respectively.

## 5.1 Unilateral Divorce Law

We first consider unilateral divorce law. First, in the voice equilibrium (i.e., $B_i = B_i^V$), the value function is

$$\begin{aligned}
G_i - U_i &= \frac{(r + \lambda_b + \tau)y_g + \lambda_g(y_b - v_i)}{(r + \lambda_g)(r + \lambda_b) + a(r + \lambda_g + \lambda_b) + \tau(r + a)}, \\
B_i^V - U_i &= \frac{(\tau - a)y_g + (r + \lambda_g + a)(y_b - v_i)}{(r + \lambda_g)(r + \lambda_b) + a(r + \lambda_g + \lambda_b) + \tau(r + a)}, \\
B_i^S - U_i &= \frac{-a(r + \lambda_b + \tau)y_g + [(r + \lambda_g + a)(r + \lambda_b + \tau) - \tau\lambda_g]\, y_b + a\lambda_g v_i}{(r + \lambda_b)\,[(r + \lambda_g)(r + \lambda_b) + a(r + \lambda_g + \lambda_b) + \tau(r + a)]}.
\end{aligned}$$

It is easily verified

$$\begin{aligned}
B_M^V - B_M^E &< B_F^V - B_F^E, \\
B_M^V - B_M^S &< B_F^V - B_F^S,
\end{aligned}$$

[6] For the transferable utility case, see Appendix C.

in other words, Assumption 2 is satisfied. Then, Proposition 1 implies the equilibrium conditions for the voice equilibrium are $B_M^V > B_M^E$ and $B_M^V > B_M^S$. These are written down to

$$[\mathbf{1-VE}] \qquad \theta v < \frac{\tau - a}{r+\lambda_g + a} y_g + y_b,$$

$$[\mathbf{1-VS}] \qquad \theta v < \frac{\tau\left\{(r+\lambda_b+a)y_g - (r+a)y_b\right\}}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)}.$$

Next, in the exit equilibrium (i.e., $B_i = B_i^V$), the value function is

$$G_i - U_i = \frac{y_g}{r+\lambda_g+a},$$

$$B_i^V - U_i = \frac{(\tau-a)y_g + (r+\lambda_g+a)(y_b - v_i)}{(r+\lambda_g+a)(r+\lambda_b+\tau)},$$

$$B_i^S - U_i = \frac{-ay_g + (r+\lambda_g+a)y_b}{(r+\lambda_g+a)(r+\lambda_b)}.$$

It is easily verified

$$B_M^E - B_M^V \geq B_F^E - B_F^V,$$
$$B_M^E - B_M^S = B_F^E - B_F^S,$$

in other words, Assumption 2 is satisfied. Then, Proposition 1 implies the equilibrium conditions for the exit equilibrium are $B_M^E > B_M^V$ and $B_M^E > B_M^S$. These are written down to

$$[\mathbf{1-EV}] \qquad \theta v > \frac{\tau - a}{r+\lambda_g + a} y_g + y_b,$$

$$[\mathbf{1-ES}] \qquad y_b < \frac{a}{r+\lambda_g+a} y_g.$$

Lastly, in the stay equilibrium(i.e., $B_i = B_i^V$), the value function is

$$G_i - U_i = \frac{(r+\lambda_b)y_g + \lambda_g y_b}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)},$$

$$B_i^S - U_i = \frac{-ay_g + (r+\lambda_g+a)y_b}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)},$$

$$B_i^V - U$$
$$= \frac{(\tau-a)(r+\lambda_b)y_g + \left[(r+\lambda_g+a)(r+\lambda_b)+\tau\lambda_g\right]y_b - \left[(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)\right]v_i}{(r+\lambda_b+\tau)\left[(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)\right]}.$$

It is easily verified

$$B_M^S - B_M^V \geq B_F^S - B_F^V,$$
$$B_M^S - B_M^E = B_F^S - B_F^E,$$

in other words, Assumption 2 is satisfied. Then, Proposition 1 implies the equilibrium conditions for the stay equilibrium are $B_M^S > B_M^V$ and $B_M^S > B_M^E$. These are written down to

$$[\mathbf{1-SV}] \qquad \theta v > \frac{\tau\left\{(r+\lambda_b+a)y_g-(r+a)y_b\right\}}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)},$$

$$[\mathbf{1-SE}] \qquad y_b > \frac{a}{r+\lambda_g+a}y_g.$$

**Proposition 3** For generic parameter values, the equilibrium conditions under the unilateral divorce law are as follows:

1. Voice equilibrium: [1-VE] and [1-VS].
2. Exit equilibrium: [1-EV] and [1-ES].
3. Stay equilibrium: [1-SV] and [1-SE].

The equilibrium under unilateral divorce law is illustrated by Figure 3 when $r = 0$, i.e., there is no real friction for time consuming search activity. It is confirmed that the positive discount factor *per se* is the source of some inefficiency. In other words, under both unilateral and mutual-consent divorce law, the stay option is excessively chosen with respect to the voice option and exit option. In this case, the advantage of voice and exit lies in future, then discounted. See Figure 9-10 and Figure 12-13.

Figures 4 and 5 show that the incongruence between the real equilibrium and the optimal one when $r = 0$. We can see that inefficiency is due to the asymmetry of voice costs among a couple. When $\theta > \frac{1}{2}$, from Figures 4 and 5, we can see that region in which the economy is at the voice equilibrium is narrower than the region in which the optimal is achieved by the voice option. This is because there are cases that the agent with $\theta > \frac{1}{2}$ don't agree with voice option even if the other agent selects voice option. Under unilateral divorce law, the agent who is at the marriage with bad state can divorce without agreement by the other agent. Then, agents who bear high costs of voice option reject voice and select to divorce, when $y_b \leq \frac{a}{\lambda_g+a}y_g$, $\theta v > \frac{\tau-a}{\lambda_g+a}y_g + y_b$ and $(1-\theta)v \leq \frac{\tau-a}{\lambda_g+a}y_g + y_b$. In this case, the agent who has $\theta$ want to divorce, while the agent with $1-\theta$ wants to select voice option.

When $y_b \geq \frac{a}{\lambda_g+a}y_g$, $\theta v \geq \frac{\tau\{(\lambda_b+a)y_g-ay_b\}}{\lambda_g\lambda_b+a(\lambda_g+\lambda_b)}$ and $(1-\theta)v < \frac{\tau\{(\lambda_b+a)y_g-ay_b\}}{\lambda_g\lambda_b+a(\lambda_g+\lambda_b)}$, the agent with $\theta$ select the stay option, while the agent with $1-\theta$ wants to select voice option. However, voice equilibrium is not realized without agreement of both of husband and wife. Therefore, in this case, the economy is at the stay equilibrium.

When $\theta \neq \frac{1}{2}$, agents want to select different options with each other under some parameter values. In this marriage and divorce model, behavior of one agent of the couple influences on the utility of the other agent. Then, behavior of an agent have externality to the other agent. When option of two agents conflicts with each other, realized equilibrium is influenced by the divorce law.

Under unilateral divorce law, if one agent want to divorce, the realized equilibrium is the exit (divorce) equilibrium. In this case, utility of the agent with $1-\theta$ is lower than the case of voice equilibrium. Thus, under unilateral divorce law, at the equilibrium there may be too many divorce than the optimal.

Here, we discuss the effect of $r$. From $r = 0$, as $r$ grows,

- Line 1-ES goes down in parallel,
- Line 1-VE goes
  - down in parallel when $a > \tau$,
  - up in parallel when $a < \tau$, and
- Line 1-VS goes ambiguously.

As $r$ becomes positive, the incongruence between the stationary equilibrium and the first best option is enlarged. The intuition is that the advantage of voice or exit lies in future, and therefore discounted.

On the other hand, the trade-off between voice and exit is more subtle. Voice is excess if $a > \tau$ while exit is excess if $a < \tau$. The condition $a > \tau$ implies it is more likely for an agent in a bad marital condition to get a marriage in good condition by exit than by voice. Nevertheless, an agent is reluctant to exit due to discounting. A similar logic applies to the case of $a < \tau$.

**Remark 1** When $r = 0$, the equilibrium and the optimal one coincide with each other if utility of couple is transferable. See, Appendix C.

## 5.2 Mutual-consent Divorce Law

We next consider mutual-consent divorce law. The value function is the same as one under the unilateral divorce law. Then, Proposition 2 implies the following equilibrium conditions:

**Proposition 4** For generic parameter values, the equilibrium conditions under the mutual-consent divorce law are as follows:

1. Voice equilibrium: [1-VS].
2. Exit equilibrium: [1-ES].
3. Stay equilibrium: [1-SV] and [1-SE].

The region surrounded by Line 1-VS and Line 1-ES has multiple equilibria, the voice equilibrium and the exit equilibrium. Then the equilibrium under mutual-consent divorce law is illustrated by Figure 6 when $r = 0$. In the region surrounded by Line 1-VS and Line 1-ES, either the voice equilibrium or exit equilibrium is realized. In this region, the stay option brings both agents about lowest utilities among three options. Under mutual-consent divorce law, both voice option and divorce (exit) option need the agreements of both agents for realization. If both agents do not agree with each other, the couple goes to the stay equilibrium, which lowers utility of both agents. Then, if both agents agree with one of two option, both agents don't have incentive to deviate to other options. Note that multiple equilibria are also caused by mutual-consent divorce law in the transferable utility case (See Proposition 6 in Appendix C).

The region surrounded by Line 1-VS and Line 1-ES is the coexistence equilibrium, in which both couples which select the voice option and the couples which select exit option coexist. In this region we can derive the stationary conditions as follows:

$$\begin{aligned}
&u^C a + e_b^C \tau = e_g^C \lambda_g, \\
&\phi e_g^C \lambda_g = e_b^C(\lambda_b + \tau), \\
&u^C a = (1-\phi) e_g^C \lambda_g + e_b^C \lambda_b,
\end{aligned}$$

where $0 \le \phi \le 1$ represents the share of couples which select voice option when they enter into the marriage with bad state. From above equations and $u^C + e_g^C + e_b^C = 1$,

$$\begin{aligned}
u^C &= \frac{(1-\phi)\lambda_g(\lambda_b+\tau) + \phi\lambda_b\lambda_g}{(a+(1-\phi)\lambda_g)(\lambda_b+\tau) + \phi\lambda_g(a+\lambda_b)}, \\
e_g^C &= \frac{a(\lambda_b+\tau)}{(a+(1-\phi)\lambda_g)(\lambda_b+\tau) + \phi\lambda_g(a+\lambda_b)}, \\
e_b^C &= \frac{a\lambda_g}{(a+(1-\phi)\lambda_g)(\lambda_b+\tau) + \phi\lambda_g(a+\lambda_b)}.
\end{aligned}$$

We can see that when $\phi = 1$, $u^C = u^V$, $e_g^C = e_g^V$ and $e_b^C = e_b^V$. When $\phi = 0$, $u^C = u^E$, $e_g^C = e_g^E$ and $e_b^C = e_b^E$. Equilibrium value of $\phi$ depends on the behavior of each couple and any value of $\phi$ in $[0,1]$ is consistent with stationary conditions. In the region in which voice-couples and exit-couples coexist, equilibrium value of $\phi$ is determined by the social culture, norm, values, and religion, etc.

From Figures 3 and 6, we can see that under mutual-consent divorce law, the region in which voice and exit are equilibrium option is narrower than under unilateral divorce law. Under mutual-consent divorce law, both voice and exit (divorce) need the agreement of husband and wife, while under unilateral divorce law, voice need agreement and exit is realized without agreement. In the region surrounded by Line1-VE and Line 1-VS, the economy is at the exit equilibrium under unilateral divorce law, while both voice-couples and exit couples coexist under mutual-consent divorce law. In this region, the share of exit-couple is determined by the social norm, culture, values and religion, etc.

Figures 7 and 8 shows that the incongruence between the real equilibrium and the optimal one. When $y_b \ge \frac{a}{\lambda_g + a} y_g$, the comparison of equilibrium and optimal is the same the case of unilateral divorce law: The region in which the economy is at the voice equilibrium is narrower than the optimal.

When $y_b \le \frac{a}{\lambda_g + a} y_g$, there are two possibility: excess divorce or excess voice. Note that there may be some inefficiency even if there is neither real friction nor the cost asymmetry. It occurs due to the existence of multiple equilibria.

Figures 7 and 8 shows that in the region which is surrounded by Line 1-VE and Line 1-VS, there are excess voice, which is not observed under unilateral divorce law. Under unilateral divorce law, we only observe the inefficiency with the excess divorce. In the region which is surrounded by Line 1-ES and Line 1-VE, exit-couples and voice-couples coexist, and there are excess divorce.

In the case of excess voice, the switch from mutual-consent divorce law to unilateral divorce law improves the welfare of the economy. However, in the case of excess divorce, the divorce law cannot influence on the welfare. The social norm, culture, values and religion may improves the welfare, since when there are multiple equilibria, those social factors determines the divorce rates.

As previously discussed, from $r = 0$, as $r$ grows,

- Line 1-ES goes down in parallel,
- Line 1-VS goes ambiguously.

The intuition of the effects of $r$ is similar to the discussion of the case of transferable utility case. the advantage of voice or exit lies in future, and therefore discounted.

## 6 Conclusion

In this paper, we present a model in which agents choose voice, exit, or stay options when their marital condition becomes bad. To discuss effects of the unilateral divorce law and the mutual-consent divorce law is important. However, there are many complex effects of divorce law on divorce rates and welfare, as discussed in many papers. We focus on the role of "exit" and "voice" in the marriage market and our paper present a new channel of the effects divorce law on divorce rates and welfare.

Our paper shows that in the non-transferable utility case, the change in divorce law influences on the divorce rates and welfare. If divorce law is unilateral divorce law and the voice cost is higher for husband (wife) than for wife (husband), then husband (wife) may reject the voice although voice is an optimal option. Therefore, the voice under unilateral divorce are often insufficient relative to the optimal case. In this case, equilibrium divorce rates are higher than optimal divorce rates.

On the ohter hand, if divorce law is mutual-consent law, multiple equilibria occur. Under mutual-consent divorce law, possibility of multiple equilibria brings the inefficient voice, while asymmetry of voice cost induces the too much amount of divorce. In this multiple equilibria case, divorce rates are determined by social factors as culture, norm, and religion, etc. In a society in which divorce is a bad behavior from a view point of ethics, agents in bad marital condition may hesitate to choose a divorce option, and choose a voice option. In such type of society, divorce rates tend to be low when there are multiple equilibria. However, when there are multiple equilibria, there may be too much couples which select a voice option: divorce rates are too low relative to the optimal condition. If the economy is in this condition, the change of divorce law from mutual-consent to unilateral improves welfare of the economy.

Under the transferable utility case, it is confirmed that the Coase theorem holds and that the optimal options are chosen at the equilibrium when a husband and a wife coordinate. However, if a husband and a wife cannot coordinate, multiple equilibria occur.

In our paper, we assume the situation in which when an agent is mathced with another, it is always optimal to decide to marry him/her. To relax this assumption, we can introduce a match-specific productivity shock to the basic model. By this extension, we can deal with the situation in which an agent endogenously determines whom he/she marry with, and therefore we can study the effects of divorce law on marriage rates. In addition, to study the compensation of divorce will be interesting. They are future research problems.

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# Appendix

## A Proof of Proposition 1

Under the unilateral divorce law, the voice option is exercised only by action profile $(V, V)$. Then, the equilibrium conditions for the voice equilibrium are, for $i = M, F$,

$$\pi_i^V > \pi_i^E,$$
$$\pi_i^V > \pi_i^S.$$

It is verified that, under Assumptions 1 and 2, these conditions are boiled down to $\pi_M^V > \pi_M^E$ and $\pi_M^V > \pi_M^S$.

Also, under the unilateral divorce law, the exit option is exercised by action profiles $(E, E)$, $(E, V)$, $(V, E)$, $(E, S)$ or $(S, E)$. The equilibrium conditions for each action profile are

**$(E, E)$:** $\pi_M^E > \pi_M^V$ , $\pi_M^E > \pi_M^S$, $\pi_F^E > \pi_F^V$ , $\pi_F^E > \pi_F^S$.[7]

**$(E, V)$:** $\pi_M^E > \pi_M^V$ , $\pi_M^E > \pi_M^S$ , $\pi_F^V > \pi_F^S > \pi_F^E$.

**$(V, E)$:** $\pi_M^V > \pi_M^S > \pi_M^E$ , $\pi_F^E > \pi_F^V$ , $\pi_F^E > \pi_F^S$.

**$(E, S)$:** $\pi_M^E > \pi_M^S$ , $\pi_F^S > \pi_F^V$, $\pi_F^S > \pi_F^E$.

**$(S, E)$:** $\pi_M^S > \pi_M^V$ , $\pi_M^S > \pi_M^E$ , $\pi_F^E > \pi_F^S$.

However, if $\pi_M^E - \pi_M^S = \pi_F^E - \pi_F^S$, a possible equilibrium action profile is only $(E, E)$. Then, under Assumptions 1 and 2, the equilibrium conditions for the exit equilibrium are boiled down to $\pi_M^E > \pi_M^V$ and $\pi_M^E > \pi_M^S$.

Lastly, under the unilateral divorce law, the stay option is exercised by action profiles $(S, S)$, $(S, V)$ or $(V, S)$ The equilibrium conditions for each action profile are

**$(S, S)$:** $\pi_M^S > \pi_M^V$ , $\pi_M^S > \pi_M^E$ , $\pi_F^S > \pi_F^V$ , $\pi_F^S > \pi_F^E$.

**$(S, V)$:** $\pi_M^S > \pi_M^V$ , $\pi_M^S > \pi_M^E$ , $\pi_F^S > \pi_F^E$ , $\pi_F^V > \pi_F^S$.

**$(V, S)$:** $\pi_M^S > \pi_M^E$ , $\pi_M^V > \pi_M^S$ , $\pi_F^S > \pi_F^V$ , $\pi_F^S > \pi_F^E$.

Then, it is verified that, under Assumptions 1 and 2, the equilibrium conditions for the stay equilibrium are boiled down to $\pi_M^S > \pi_M^V$ and $\pi_M^S > \pi_M^E$ . ∎

[7] If we use (possibly not iteratively) undominated equilibrium as equilibrium concept, an equilibrium $(E, E)$ requires neither $\pi_M^E > \pi_M^V$ nor $\pi_F^E > \pi_F^V$, and then exit equilibrium may co-exist with voice equilibrium even under unilateral divorce law.

## B Proof of Proposition 2

Under the unilateral divorce law, the voice option is exercised only by action profile $(V,V)$. Then the equilibrium conditions for voice equilibrium are, for $i = M, F$,

$$\pi_i^V > \pi_i^S.$$

Then, under Assumptions 1 and 2, these are boilded down to $\pi_M^V > \pi_M^S$.

Also, under the mutual-consent divorce law, the exit option is exercised only by action profile $(E,E)$. Then the equilibrium conditions for exit equilibrium are, for $i = M, F$,

$$\pi_i^E > \pi_i^S.$$

Then, under Assumptions 1 and 2, these are boilded down to $\pi_M^E > \pi_M^S$.

Lastly, under the mutual-consent divorce law, the stay option is exercised by action profiles $(S,S)$, $(S,V)$, $(V,S)$, $(S,E)$, $(E,S)$, $(V,E)$ or $(E,V)$. The equilibrium conditions for each action profile are

$(S,S)$**:** $\pi_M^S > \pi_M^V$ , $\pi_M^S > \pi_M^E$ , $\pi_F^S > \pi_F^V$ , $\pi_F^S > \pi_F^E$.

$(S,V)$**:** $\pi_M^S > \pi_M^V$ , $\pi_M^S > \pi_M^E$ , $\pi_F^V > \pi_F^S > \pi_F^E$.

$(V,S)$**:** $\pi_M^V > \pi_M^S > \pi_M^E$ , $\pi_F^S > \pi_F^V$ , $\pi_F^S > \pi_F^E$.

$(S,E)$**:** $\pi_M^S > \pi_M^V$ , $\pi_M^S > \pi_M^E$ , $\pi_F^E > \pi_F^S > \pi_F^V$.

$(E,S)$**:** $\pi_M^E > \pi_M^S > \pi_M^V$ , $\pi_F^S > \pi_F^V$ , $\pi_F^S > \pi_F^E$.

$(V,E)$**:** $\pi_M^V > \pi_M^S > \pi_M^E$ , $\pi_F^E > \pi_F^S > \pi_F^V$.

$(E,V)$**:** $\pi_M^E > \pi_M^S > \pi_M^V$, $\pi_F^V > \pi_F^S > \pi_F^E$.

However, if $\pi_M^S - \pi_M^E = \pi_F^S - \pi_F^E$, then possible equilibrium action profiles are only $(S,S)$, $(S,V)$ , and $(V,S)$. Then, under Assumptions 1 and 2, the equilibrium conditions for the stay equilibrium are boild down to $\pi_M^S > \pi_M^V$ and $\pi_M^S > \pi_M^E$.

## C Transferable Utility

In this appendix we characterize stationary equilibria in which the utilities are transferable among a couple, or monetary transfer among them can be made. To simplify things, monetary transfer is made such that one person's surplus is equal to the partner's. Also, we restrict attention to generic parameters values.

Let $U_i$, $G_i$, and $B_i^j$ be the $i$'s value of single state, the $i$'s value of marriage with good state, and the $i$'s value of marriage with bad state when $j$ option is exercised, respectively. Also, let $t_i^G$ and $t_i^j$ be the monetary transfer for $i$ with the beginning of good marital state and the monetary transfer for $i$ when $j$ option is exercised, respectively. It must hold $t_M^j + t_F^j = 0$.

Then the value functions of each state are as follows:[8]

$$
\begin{aligned}
rU_i &= a(t_i^G + G_i - U_i),\\
rG_i &= y_g + \lambda_g(t_i^B + B_i - G_i),\\
rB_i^V &= y_b - v_i + \lambda_b(U_i - B_i^V) + \tau(G_i - B_i^V),\\
B_i^E &= U_i,\\
rB_i^S &= y_b + \lambda_b(U_i - B_i^S),
\end{aligned}
$$

where $B_i = B_i^j$ and $t_i^B = t_i^j$ if $j$ option is exercised on the equilibrium path. The transfer is determined as

$$
\begin{aligned}
\frac{1}{2}(G - U) &= t_i^G + G_i - U_i,\\
\frac{1}{2}(B^j - D) &= t_i^j + B_i^j - D_i,
\end{aligned}
$$

where $D_i$ is the $i$'s default value dependent upon which divorce law applies. Hereafter, we denote $t^j = t_M^j$.

## C.1 Unilateral Divorce Law

Under unilateral divorce law, the default option in bad marital state is exit option, i.e., $D_i = B_i^E$ and $t_i^B = t_i^E$. Moreover, $t^E = 0$.

In the voice equilibrum, since $B_i = B_i^V$ and $t^B = t^V$, the value functions and monetary transfers at the voice equilibrium become as follows:

$$
\begin{aligned}
t_i^G + G_i - U_i &= \frac{(r+\lambda_b+\tau)y_g + \lambda_g(y_b - \frac{1}{2}v)}{(r+\lambda_g+a)(r+\lambda_b+\tau)+\lambda_g(a-\tau)},\\
t_i^V + B_i^V - U_i &= \frac{(\tau - a)y_g + (r+\lambda_g+a)(y_b - \frac{1}{2}v)}{(r+\lambda_g+a)(r+\lambda_b+\tau)+\lambda_g(a-\tau)},\\
t_i^S + B_i^S - U_i &= \frac{-a(r+\lambda_b+\tau)y_g + \left[(r+\lambda_g+a)(r+\lambda_b+\tau) - \tau\lambda_g\right] y_b + a\lambda_g\frac{1}{2}v}{(r+\lambda_b)\left[(r+\lambda_g+a)(r+\lambda_b+\tau)+\lambda_g(a-\tau)\right]},\\
t^G &= t^S = 0,\\
t^V &= \frac{(2\theta-1)v}{2(r+\lambda_b+\tau)}.
\end{aligned}
$$

It is easily verified

$$
\begin{aligned}
(t_M^V + B_M^V) - (t_M^E + B_M^E) &= (t_F^V + B_F^V) - (t_F^E + B_F^E),\\
(t_M^V + B_M^V) - (t_M^S + B_M^S) &= (t_F^V + B_F^V) - (t_F^S + B_F^S),
\end{aligned}
$$

[8] In this formulation, it is implicitly assumed that there is no monetary transfer in a divorce caused by the arrival of Poisson shock from bad marital state. This assumption is made only for simplification of analysis.

in other words, Assumption 2 holds. Then, the equilibrium conditions are $t^V + B^V_M > t^E + B^E_M$ and $t^V + B^V_M > t^E + B^S_M$ . These are written down to

$$[\mathbf{e}-\mathbf{VE}] \qquad \frac{1}{2}v < \frac{\tau - a}{r+\lambda_g + a} y_g + y_b,$$

$$[\mathbf{e}-\mathbf{VS}] \qquad \frac{1}{2}v < \frac{\tau\left\{(r+\lambda_b+a)y_g - (r+a)y_b\right\}}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)}.$$

Next, in the exit equilibrium, since $B_i = B^E_i$ and $t^B_i = t^E_i$, the value functions and monetary transfers at the exit equilibrium are

$$\begin{aligned}
t^G_i + G_i - U_i &= \frac{y_g}{r+\lambda_g+a},\\
t^V_i + B^V_i - U_i &= \frac{(\tau-a)y_g + (r+\lambda_g+a)(y_b - \frac{1}{2}v)}{(r+\lambda_g+a)(r+\lambda_b+\tau)},\\
t^S_i + B^S_i - U_i &= \frac{-ay_g + (r+\lambda_g+a)y_b}{(r+\lambda_g+a)(r+\lambda_b)},\\
t^G &= t^S = 0,\\
t^V &= \frac{(2\theta-1)v}{2(r+\lambda_b+\tau)}.
\end{aligned}$$

It is easily verified that Assumption 2 holds, then the equilibrium conditions are $t^E + B^E_M > t^V + B^V_M$ and $t^E + B^E_M > t^S + B^S_M$. These are written down to

$$[\mathbf{e}-\mathbf{EV}] \qquad \frac{1}{2}v > \frac{\tau - a}{r+\lambda_g+a}y_g + y_b,$$

$$[\mathbf{e}-\mathbf{ES}] \qquad y_b < \frac{a}{r+\lambda_g+a}y_g.$$

Lastly, in the stay equilibrium, since $B_i = B^S_i$ and $t^B_i = t^S_i$, the value functions and monetary transfers at the exit equilibrium are

$$\begin{aligned}
t^G_i + G_i - U_i &= \frac{(r+\lambda_b)y_g + \lambda_g y_b}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)},\\
t^S_i + B^S_i - U_i &= \frac{-ay_g + (r+\lambda_g+a)y_b}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)},\\
t^V_i + B^V_i - U_i &\\
= \frac{(\tau-a)(r+\lambda_b)y_g + \left[(r+\lambda_g+a)(r+\lambda_b)+\tau\lambda_g\right]y_b - \left[(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)\right]\frac{1}{2}v}{(r+\lambda_b+\tau)\left[(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)\right]}&,\\
t^G &= t^S = 0,\\
t^V &= \frac{(2\theta-1)v}{2(r+\lambda_b+\tau)}.
\end{aligned}$$

It is easily verified that Assumption 2 holds, then the equilibrium conditions are $t^S + B_M^S > t^V + B_M^V$ and $t^S + B_M^S > t^E + B_M^E$. These are written down to

$$[\mathbf{e-SV}] \qquad \frac{1}{2}v > \frac{\tau\{(r+\lambda_b+a)y_g-(r+a)y_b\}}{(r+\lambda_g)(r+\lambda_b)+a(r+\lambda_g+\lambda_b)},$$

$$[\mathbf{e-SE}] \qquad y_b > \frac{a}{r+\lambda_g+a}y_g.$$

Then, we obtain the formal result.

**Proposition 5** For generic parameter values, the equilibrium conditions under the unilateral divorce law are as follows:

1. Voice equilibrium: [e-VE] and [e-VS].
2. Exit equilibrium: [e-EV] and [e-ES].
3. Stay equilibrium: [e-SV] and [e-SE].

If $r = 0$, i.e., agents are infinitely patient, the optimal option is always chosen on the equilibrium. This is because there is no real friction for time consuming search activity in this case.

However, as $r$ becomes positive, there is incongruence between the stationary equilibrium and the first best option, for each agent, more or less, discounts a stream of future payoffs.

This situation is illustrated by Figures 9 and 10. First, the stay option is excessively chosen with respect to the voice option and the exit option. The intuition is that the advantage of voice or exit lies in future, and therefore discounted.

On the other hand, the trade-off between voice and exit is more subtle. Voice is excess if $a > \tau$ while exit is excess if $a < \tau$. The condition $a > \tau$ implies it is more likely for an agent in a bad marital condition to get a marriage in good condition by exit than by voice. Nevertheless, an agent is reluctant to exit due to discounting. A similar logic applies to the case of $a < \tau$.

## C.2 Mutual-Consent Divorce Law

Under mutual-consent divorce law, the default option in bad marital state is, i.e., $D_i = B_i^S$ and $t_i^B = t_i^S$. Moreover, $t^S = 0$.

It will be verified that each person's surplus under mutual-consent divorce law is the same as under unilateral divorce law. However, when a couple cannot coordinate, there may co-exist Pareto rankable multiple equilibria. In other words, Coase theorem does not hold.

Similarly as done in the previous section, we obtain the formal result.

**Proposition 6** For generic parameter values, the equilibrium conditions under the mutual-consent divorce law are as follows:

1. Voice equilibrium: [1-VS].

2. Exit equilibrium: [1-ES].

3. Stay equilibrium: [1-SV] and [1-SE].

In other words, the equilibrium conditions are the same as in the case of non-transferable utility case (Proposition 4).

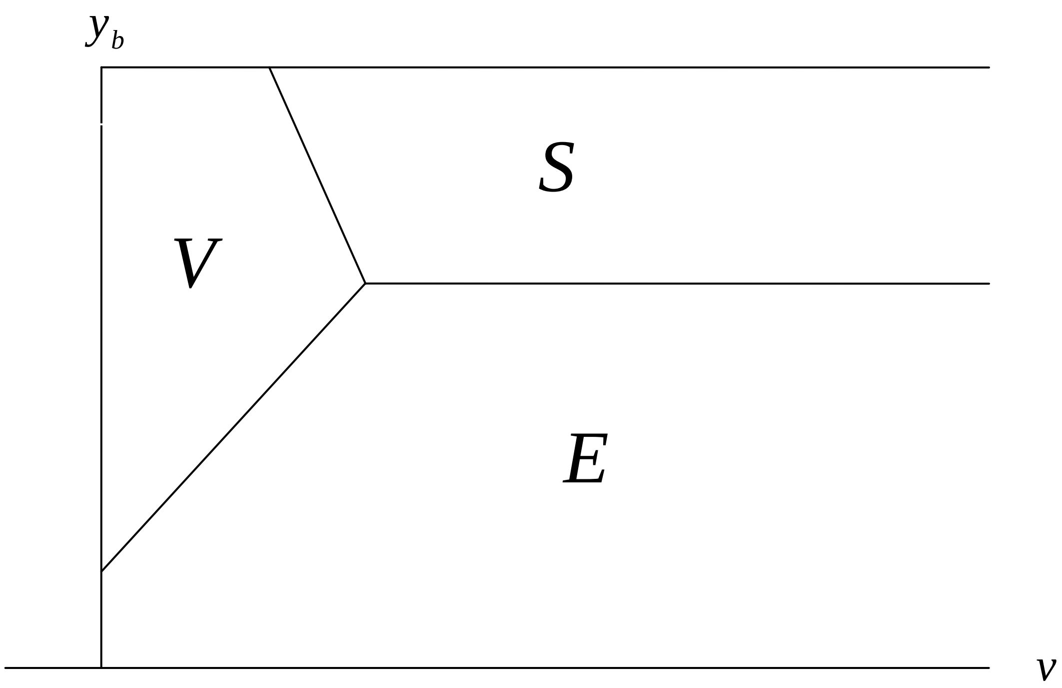


Figure 1: Welfare ($a > \tau$)

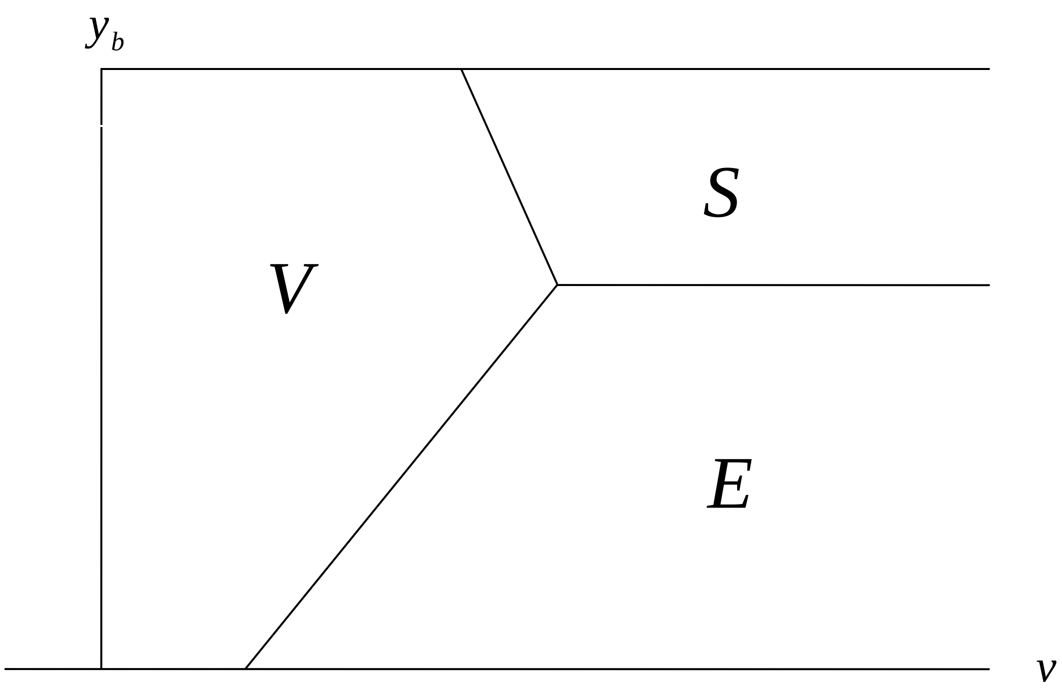


Figure 2: Welfare ($a < \tau$)

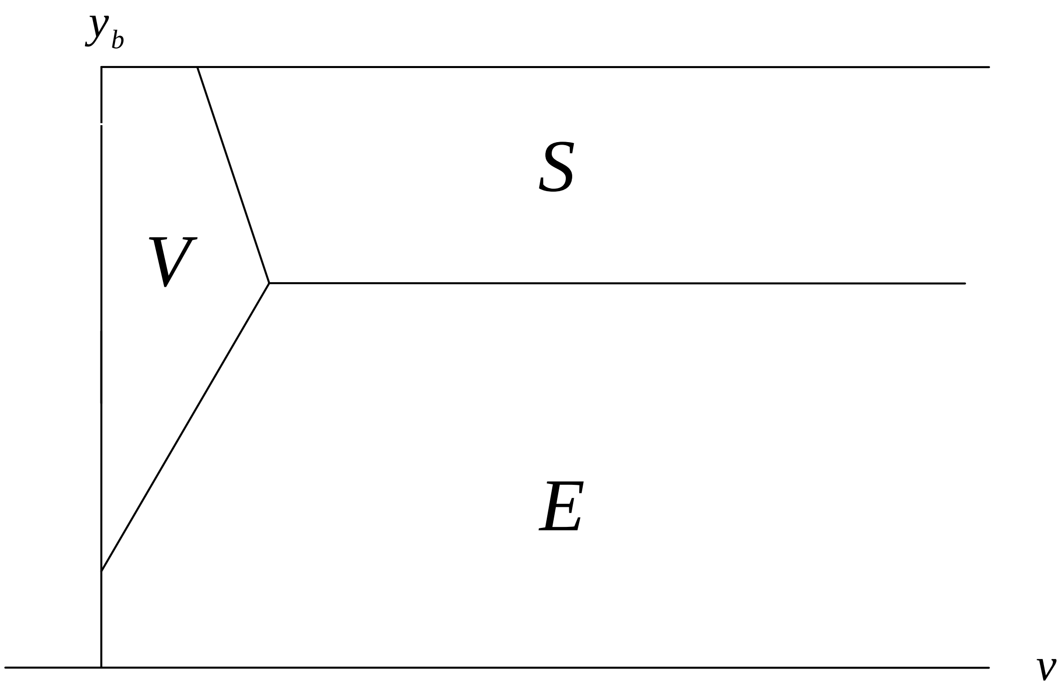


Figure 3: Equilibrium with unilateral divorce law when *r=0* ( $a > \tau$ )

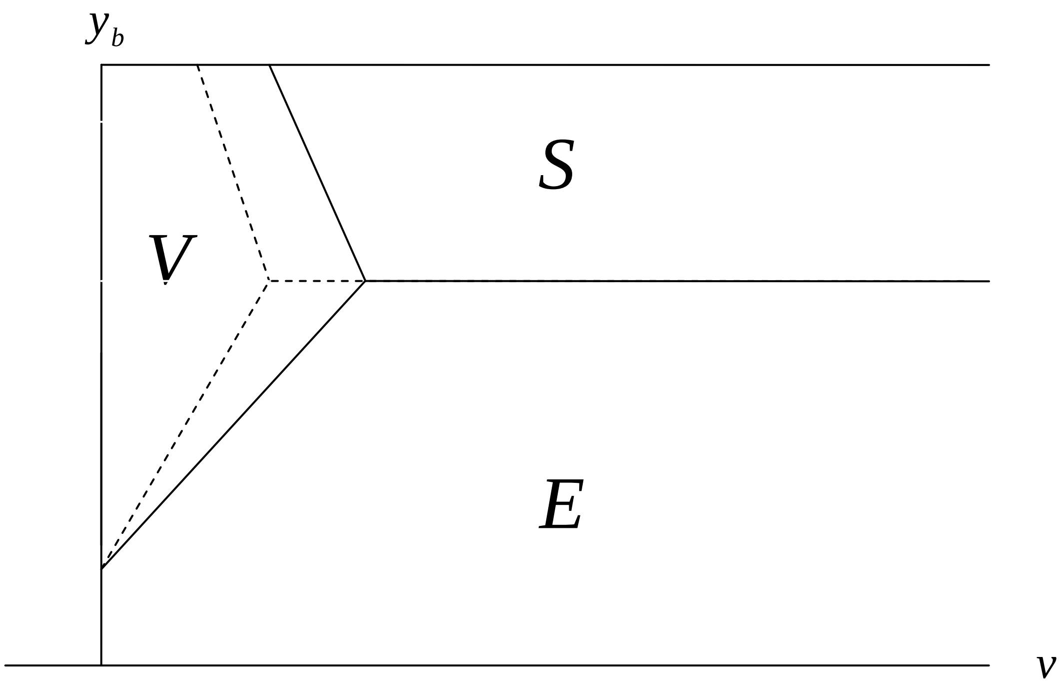


Figure 4: Welfare [solid line] and Equilibrium under unilateral divorce law [broken line] when $r=0$ ($a > \tau$)

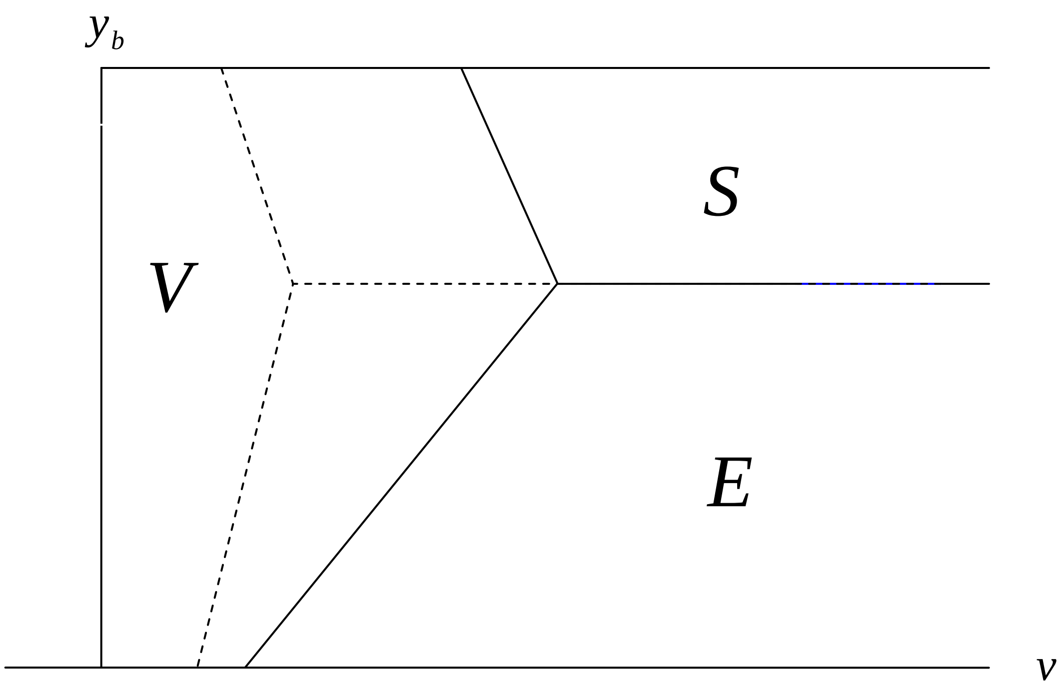


Figure 5: Welfare [solid line] and Equilibrium under unilateral divorce law [broken line] when $r=0$ ($a < \tau$)

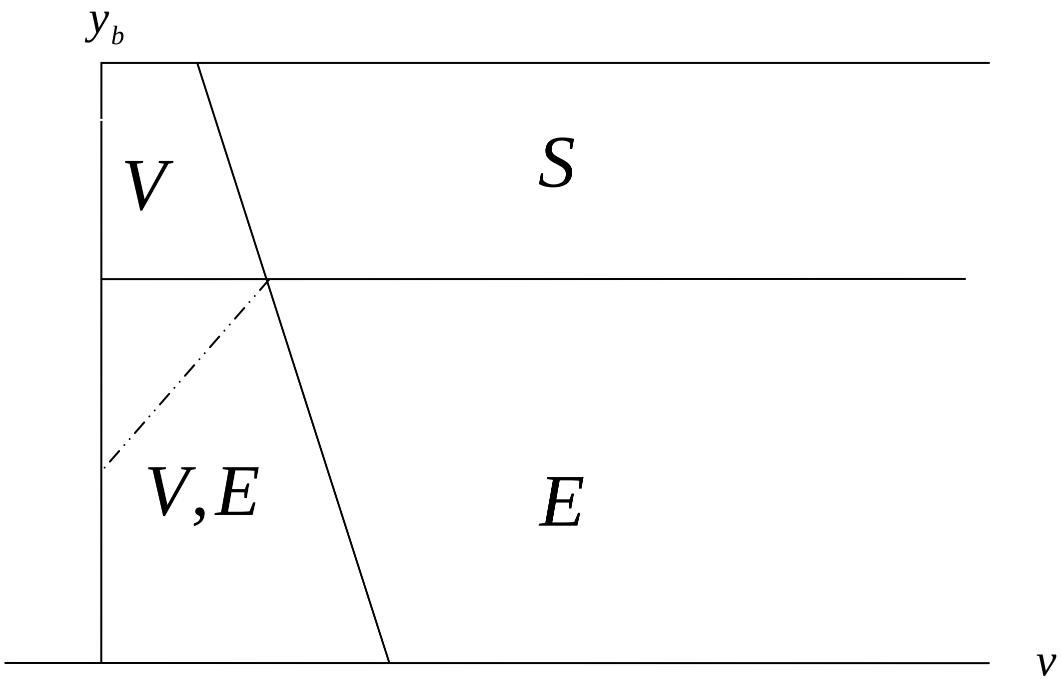


Figure 6: Equilibrium with mutual-divorce law when *r=0* ( $a > \tau$ )

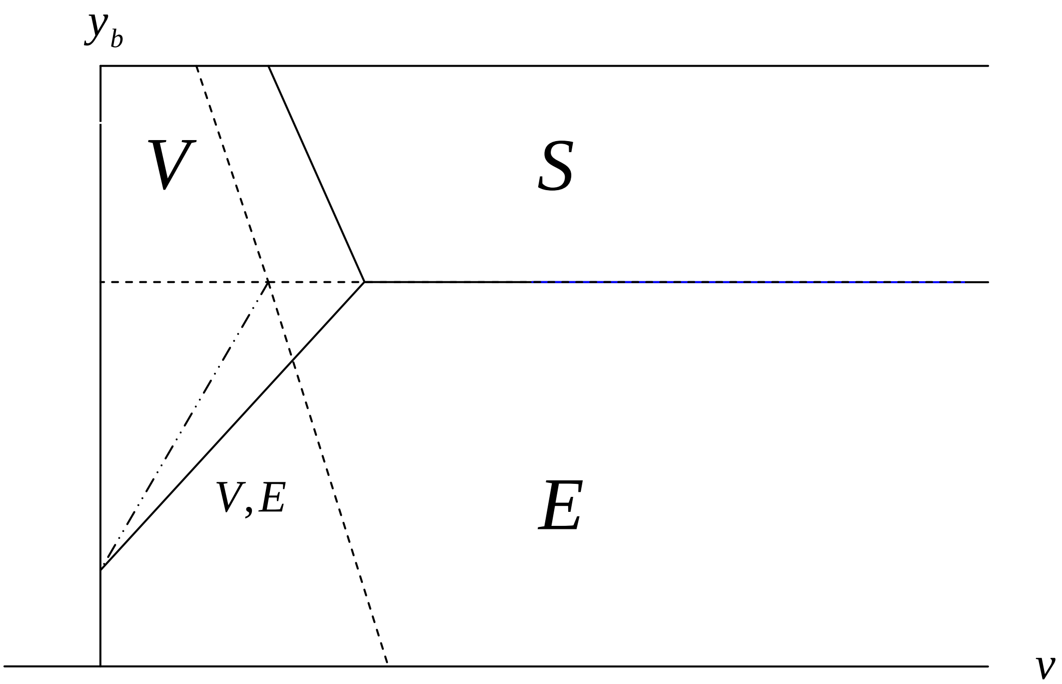


Figure 7: Welfare [solid line] and Equilibrium under mutual-divorce law [broken line] when *r=0* ( $a > \tau$ )

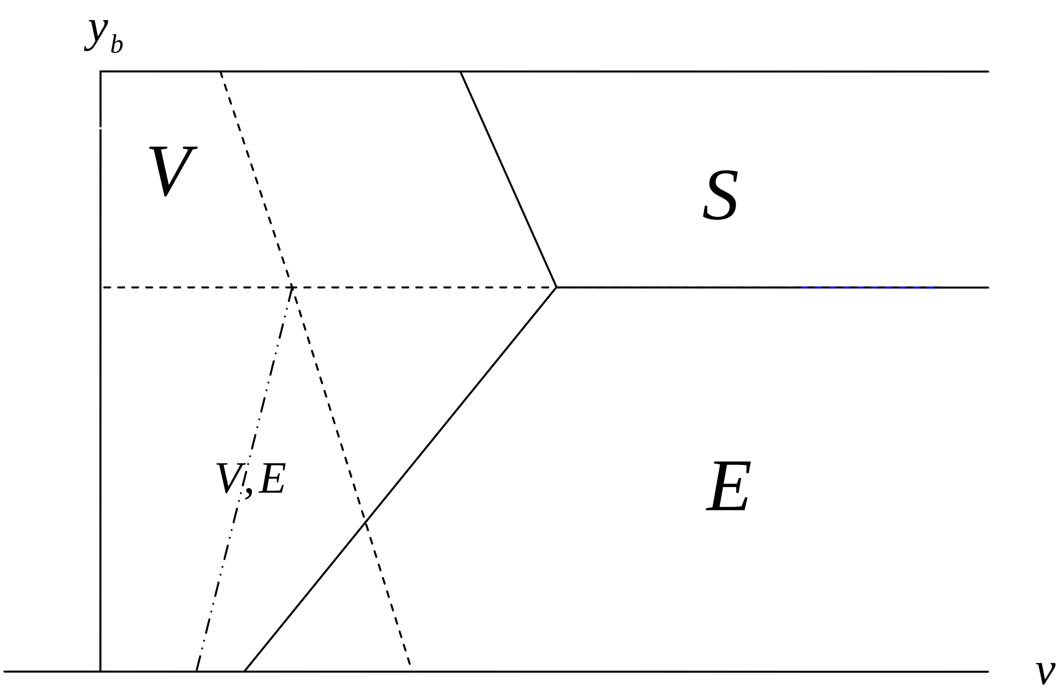


Figure 8: Welfare [black line] and Equilibrium under mutual-divorce law [blue line] when *r=0* ( $a < \tau$ )

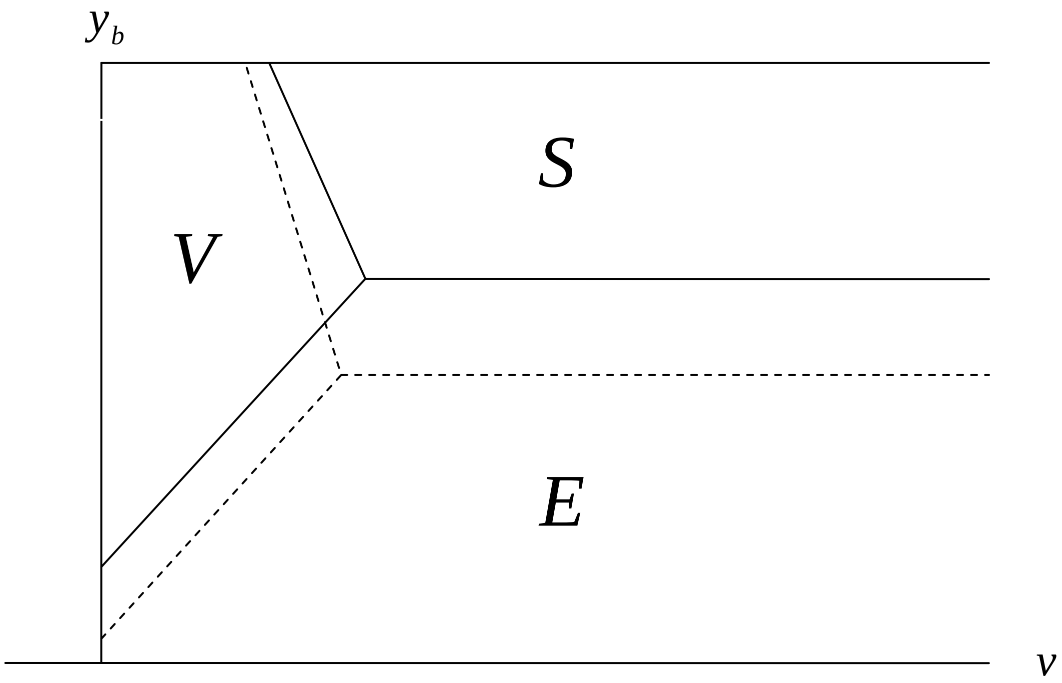


Figure 9: Welfare [solid line] and Equilibrium [broken line] when $r > 0$ $(a > \tau)$

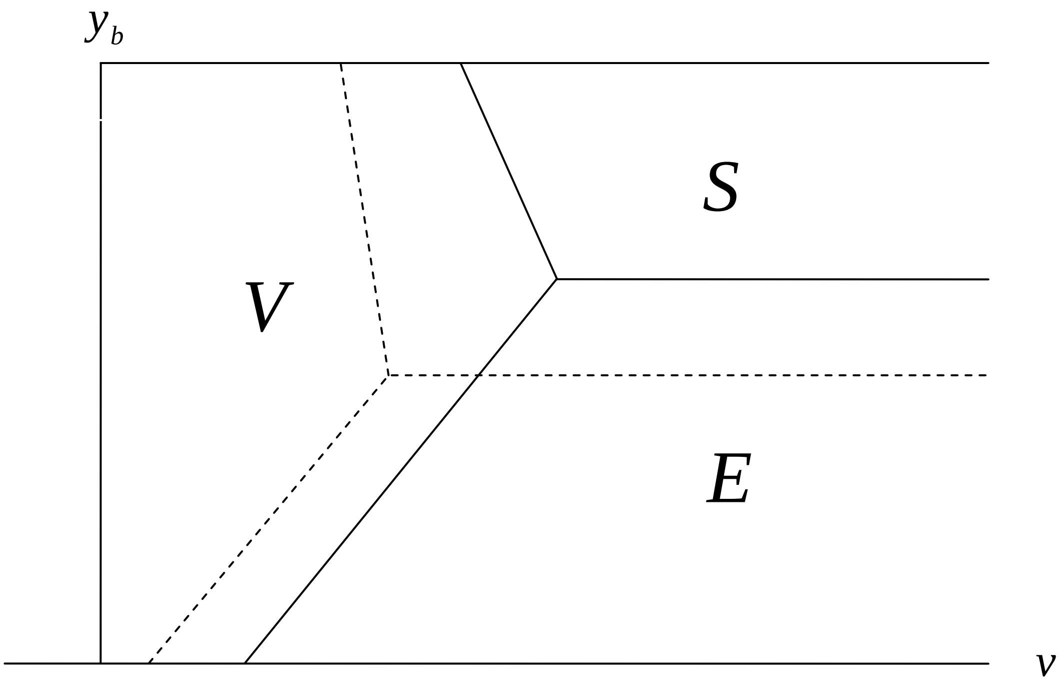


Figure 10: Welfare [solid line] and Equilibrium [broken line] when $r > 0$ $(a < \tau)$

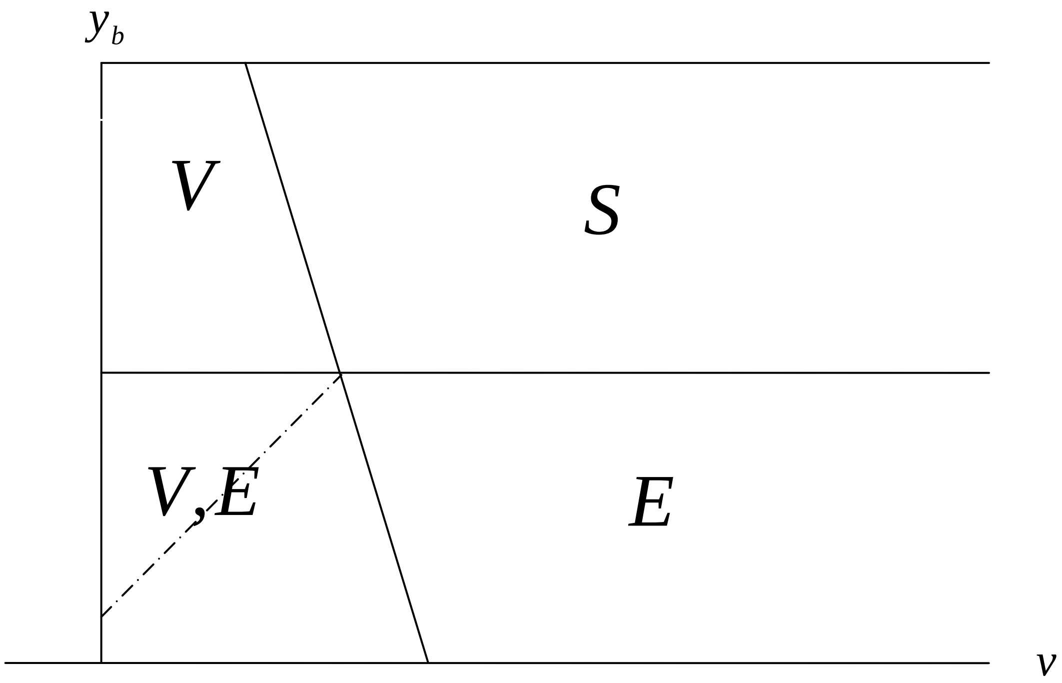


Figure 11 : Equilibrium with mutual-divorce law when $r > 0$ $(a > \tau)$

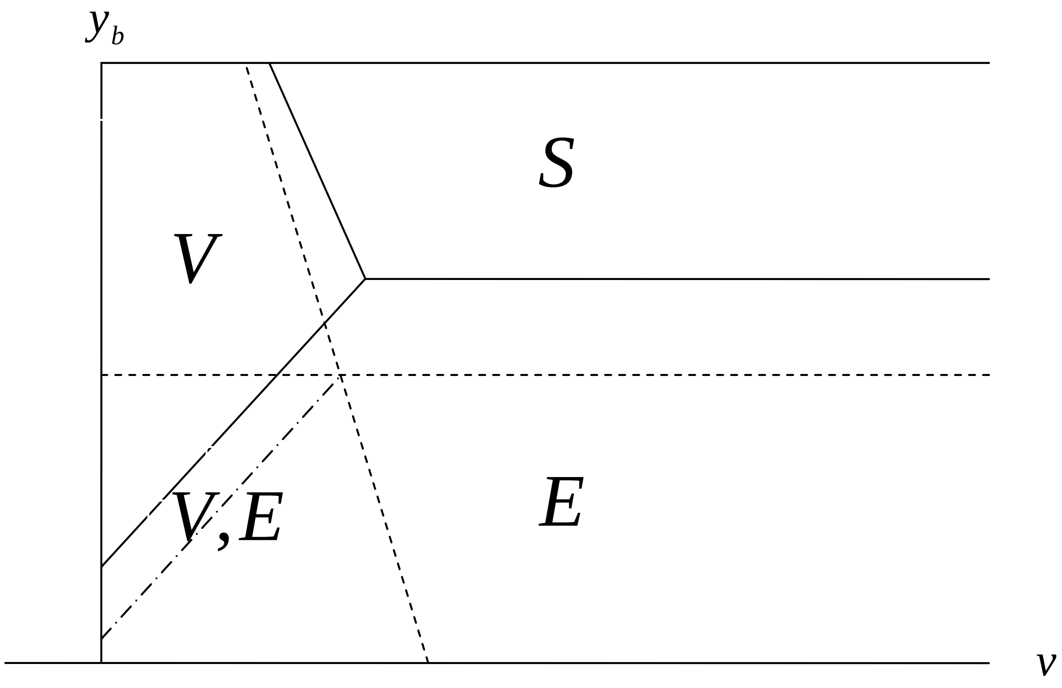


Figure 12: Welfare [solid line] and Equilibrium [broken line] when $r > 0$ $(a > \tau)$

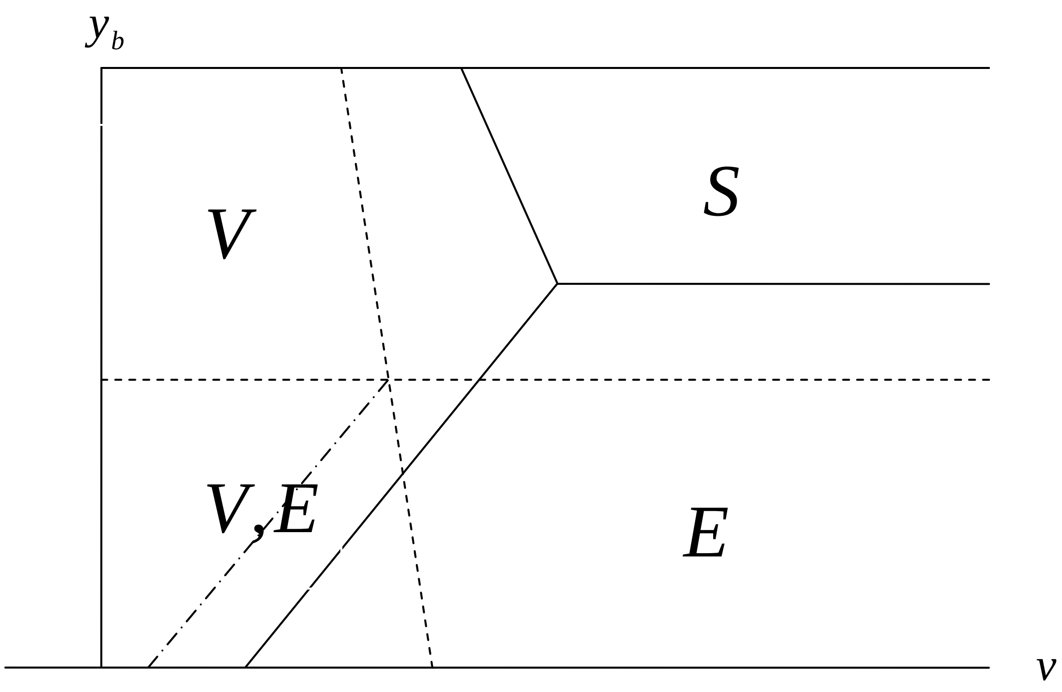


Figure 13: Welfare [solid line] and Equilibrium [broken line] $(a < \tau)$