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Marriage, divorce and coronavirus—theoretical analysis of the influence of COVID-19 on family capital[1]

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Abstract: The purpose of this paper is to provide the framework to analyze the impact of shocks related to the COVID-19 pandemic on the level of divorce. The model takes into account family/marriage capital with its depreciation, investments in this capital and the costs of divorce. The problem faced by the agent is analyzed and formulas for the optimal division of income between consumption and investments in family capital are derived. Comparative statics is performed by calculating the signs of all derivatives of all variables with respect to all parameters. The analysis shows that a change in economic conditions has the least effect of any factor influenced by COVID-19 in changing the probability of a divorce. To the best of the authors' knowledge this is the first mathematical model in the literature that covers the issues of the impact of a lockdown on the durability of marriages.

Keywords: divorce, COVID-19, family capital.

JEL codes: C60, D10, J12.

Introduction

In March 2020 the coronavirus epidemic paralyzed the world. Individual countries introduced various restrictions directed to stop the spread of the SARS--CoV-2 virus. These included restrictions on interpersonal contacts by introducing limits on people in specific places, closing certain types of economic activity (e.g. restaurants, cinemas, theatres), restricting the operation of others, introducing home office work requirements in many firms, etc. Work in new conditions turned out to be less effective (see Künn, Seel, & Zegners, 2020; Papanikolaou &

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Schmidt, 2022) as well as learning at all levels of education (Roman & Plopeanu, 2021; Burgess & Sievertsen, 2020). The change in the supply and demand aspects in individual industries was also of great importance for the economic welfare of a large number of households (Bui, Button, & Picciotti, 2020; Jastrzębska, 2021). At the same time, significant changes in the structure of consumption were observed (Baker, Farrokhnia, Meyer, Pagel, & Yannelis, 2020; Coibion, Gorodnichenko, & Weber, 2020). COVID-19 has also become a source of additional economic uncertainty (Baker, Bloom, Davis, & Terry, 2020; Altig et al., 2020; Binder, 2020; Jarocki, 2020). According to The World Bank (2021), global GDP in 2020 relative to 2019 decreased by 3.4%. On the other hand the scale of short-term changes in economic activity is estimated by many studies (e.g., Fezzi & Fanghella, 2020). Brodeur, Gray, Islam and Bhuiyan (2021) made an excellent review of research of the impact of COVID-19 on economies.

The lockdown also obviously affected the mental health of individuals (Adams-Prassl, Boneva, Golin, & Rauh, 2020; Brodeur, Clark, Fleche, & Powdthavee, 2021; Barczykowska & Pawełek, 2021) and interpersonal relationships, including marital relationships. With the need to spend more time at home only among the closest family, in a marriage or partnership, sometimes also with children the number of family interactions increases (Apriasari, Qotrunnada, Al-Jannah, & Amani, 2021). With an increased amount of family interactions in the face of external and health threats, family ties can tighten, leading to an improvement in the quality of marital life but also an increase in conflict and misunderstanding which in turn can accelerate the breakdown of marriages. These two opposing effects are already observed in the obtained empirical data in some countries or regions. Lebow (2020) indicates the potential two-way impact of COVID-19 on the number of divorces. On the one hand lockdown causes increased stress which has a negative impact on interpersonal relations. On the other—by being cut off from other people it creates certain conditions for intimacy and strengthening ties within the family. Zhang (2022) notices the problem of growing domestic violence in China because with the confinement of citizens at home those who experienced daily encounters with the torturer now do not even have the shortest opportunity to free themselves for any time. This raised the divorce rate. A similar problem is also noticed by Bettinger-Lopez and Bro (2020), Humphreys, Myint and Zeanah (2020) and Hsu and Henke (2021). In contrast Manning and Payne (2021) present research from five US states that recorded a decline in both the divorce rate and the marriage rate. A similar decline in divorce rates and separation applications was recorded in Denmark (Fallesen, 2021) and in South Korea where a reduced number of marriages and divorces were also noted (Kim & Kim, 2021). The situation of couples during the pandemic was described in detail by Goldberg, Allen and Smith (2021). They pointed to an increased level of stress, especially when having children.

It should be noted however that the actual impact of lockdown on the level of divorce and the durability of marriages may not be observed for several years.

At the time of writing this article, only twenty two months have passed since the first wave of coronavirus cases in the world and since the first decisions to close economies and the suggestion that families should spend their time only in their own homes. Taking into account the pace of collecting macroeconomic data and the different duration of divorce trials in different countries the real impact of the pandemic on the rates of marriages and divorces cannot be estimated sooner than in a few years. However, a mathematical model is needed to approximate reality and to consider at least theoretically the interactions between the relevant macroeconomic variables.

The purpose of this paper is to provide the framework model for the studies related to the analysis of the impact of shocks and in this particular case of the shock related to the COVID-19 pandemic on the level of divorce in a given economy. To the best of the authors' knowledge this is the first mathematical model in the literature that covers the issues of the impact of a lockdown on the durability of marriages. In the literature there are already examples of studies in which the pandemic effect is depicted as a demand or supply shock in mathematical models—Guerrieri, Lorenzoni, Straub and Werning (2020), Barrero, Bloom and Davis (2020), Baqaee and Farhi (2020), Brinca, Duarte and Faria e Castro (2020). There is also an attempt at mathematical modelling of marriages and divorces but without a description of the causes and the decision-making scheme (Tessema, Haruna, Osman, & Kassa, 2022).

In the second section a simple decision model illustrating the dilemma faced by a single agent is presented. Two scenarios are discussed—the first in which the agent remains married and the second in which the agent decides to divorce. Subsequently optimal choices for the level of consumption and investment in marriage capital are made. The decision-making process is based on the selection of the one of the two scenarios which is characterized by a higher level of total utility. The third section analyzes the impact of lockdown on individual model parameters and discusses changes in the basic variables of the model along with conclusions regarding the change in the probability of marriage breakdown. The paper ends with a summary.

1. Basic model

As divorce is usually not planned in advance a one-period model in which the agent considers two situations is proposed. In each of them the agent maximizes its total utility with a budget constraint.

1.1. Scenario 1

In the first scenario the agent has a time supply not devoted to leisure equal to y. This amount of time may be spent on professional work or on investments in the capital of marital relations which consists in spending time with the spouse or spending part of the income on activities aimed at building relationships. If he/she spends their time building relationships he/she is not spending that time working which obviously reduces his income. Therefore, it is assumed that

$$y = c + I_{K_M} \tag{1}$$

where c denotes level of consumption, I_{K_M} means level of investments in marital capital. These investments may therefore require the spending of some of agent's earnings on increasing the marital capital or spending time building relationships instead of working. In both cases the effect is the same—the total amount of income received decreases while at the same time the level of marriage capital increases. The rest of his time $y - I_{K_M}$ the agent devotes to work, which brings an income with which consumption is purchased.

The evolution of marital capital is as follows:

$$K_M = K_0 - \delta K_0 - \alpha \cdot I_{K_M} \tag{2}$$

where by K_0 the starting level of marriage capital held by the agent at the beginning of the analyzed period is denoted, $\delta \in (0; 1)$ is the marital capital depreciation rate, $\alpha \in (0; 1)$ is the investment in the marriage capital efficiency coefficient. The interpretation of the parameters in the above equation is as follows. In each period the share δ of marriage capital disintegrates and as a result if there are no adequate level of investments in the marriage capital its level decreases. In turn the parameter α has the following interpretation. Each unit of expenditure (in this case, monetary or time units) only in the share α turns into marriage capital. Thus spending one unit of y to increase the level of marital capital increases only in the amount of α.

The agent draws the utility from two sources. First is consumption and second he/she derives some satisfaction from the level of marriage capital obtained. The total utility function is thus of the following form

$$U(c, K_M) = u_1(c) + u_2(K_M) \tag{3}$$

where u_1 is the amount of satisfaction flowing from consumption and u_2 is the satisfaction that flows from the established level of marital capital.

Let us note that the additive form of the utility function is assumed. This means that it is also assumed that the satisfaction with consumption and the satisfaction with the level of obtained marital capital are separable.[4] Thus one

[4] The choice of complementarity or substitutability between consumption and marriage capital is entirely hidden in the choice of the form of the utility function. With the utility function (3) a perfect substitutability between these sources of utility is claimed. The justification is that people exist who seems to be happy without family or any relationship and there are people

can obtain a positive level of utility by deriving it from only one source. The low utility of consumption can be compensated by a correspondingly high level of satisfaction drawn from the level of marital capital. The reverse is also true. With a low level of marriage capital the desired level of utility can be obtained by compensating the low level of K_M by an appropriately high c. In the case of a multiplicative form of the utility function (e.g. the Cobb-Douglas utility function), a low level of one of the arguments automatically lowers the overall utility level. Both these functional forms have their theoretical justification and in each case the law of diminishing marginal utility is fulfilled.[5] For the additive function the hypothesis about the separability of satisfaction obtained from different sources is true and for the multiplicative function—about its connectivity. However, it is a theoretically unsettled if any of them is empirically suitable. An example of the discussion on the types of utility functions and the advantages and disadvantages of using some of its permissible forms is in Malaczewski (2019).

The next step is to determine a specific form of the utility function which is on the one hand theoretically correct and computationally simple on the other. The logarithmic form[6] of both functions u_1 and u_2 is assumed:

$$U(c, K_M) = \ln c + \psi \ln K_M \tag{4}$$

where $\psi \in R$ is a parameter converting utility units obtained from marriage capital into utility units obtained from consumption—one utility unit obtained from marriage capital is worth ψ units of utility derived from consumption. Notice that the relative value of utility derived from the marital relationship to utility derived from consumption is not thereby determined. The parameter ψ can be both greater than one (then the unit of utility flowing from marriage capital is worth more than the unit of utility flowing from consumption) smaller than one (then the satisfaction resulting from consumption is worth more to the agent) and equal to one (when the utility of the unit of consumption and of marriage capital is the same).

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who seems to be happy with a very low consumption level and strong family relationships. With the utility function of the Cobb-Douglas form it is clear that the agent has to have both sources of utility on a certain level to achieve a reasonable level of utility.

[5] Obviously in the Cobb-Douglas utility function case diminishing marginal utility exists only when elasticities of the utility with respect to arguments are lower than 1.

[6] The logarithmic form of the utility function is a special, but well-grounded in theoretical research, case of the CRRA function of the generic form: $u(c) = \frac{c^{1-\theta} - 1}{1-\theta}$, where θ is the elasticity of marginal utility. The logarithmic form is the limiting form for $\theta \to 1$. In many studies the logarithmic form is used because of its computational simplicity (e.g. Pérez-Barahona, 2011), of course, it meets all the required properties of the utility function.

The problem faced by the agent in the case of a situation of being married and a decision to invest in the marriage capital, is the following:

$$\ln c + \psi \ln\left((1-\delta)K_0 + \alpha I_{K_M}\right) \to \max \quad (5)$$

with the following constraint:

$$y = c + I_{K_M} \quad (6)$$

1.2. Scenario 2

In the second scenario the agent considers a situation in which he or she is no longer married. Thus there is no need to invest in marital capital but at the same time agent does not derive any utility from it either. Therefore, the only source of the agent's satisfaction is consumption. However, the decision to abandon the marriage is connected to divorce. Divorce results in certain costs related to the need to reorganize the lifestyle and incurring the costs of independent living, court costs, alimony, etc. Depending on the legislation in a given country divorce trials may take several years and in some countries it is not or at least until recently was not possible at all.

All these costs means that part of the time that can be devoted to earning for current consumption or a part of the income must be allocated to the above-mentioned divorce-related costs. These costs are represented in the analyzed case by D. Then the equation holds:[7]

$$y = c + D \quad (7)$$

As in the previous case the logarithmic form of the utility function is assumed. Bearing in mind that this time the agent is not benefiting from marital capital its utility function (denoted this time by U_D) is given by the equation:

$$U_D(c) = u_1(c) = \ln c \to \max \quad (8)$$

It is known that psychological factors often decide a possible divorce decision, even in a situation where the utility of independent living is significantly higher than that of being married. It is assumed that all these factors are already present in this model and are represented by appropriately high or low values of the parameters. For example if a possible stay in marriage is determined by the fear of the independent rearing of children even in a situation of domestic violence then it is assumed that parameter D is simply so high that the utility of independent living is lower than that of being married. Such an approach is of course highly debatable in economic theory especially rational choice theory)

[7] $D \geq 0$. If $D \geq y$, so when total divorce costs are greater than the entire agent's budget, divorce is not an accessible scenario. Furthermore, it is assumed that $D < y$.

but it has its basis in Becker's work on family capital (Becker, 1981). With such an assumption further analysis is conducted in terms of comparative statics.

2. The solution of the model

After considering both scenarios the agent compares the cumulative utilities in both cases—where he or she decides to remain married and another associated with the situation of the divorce decision. He/she then chooses a solution that gives them a greater level of utility.

The solution of the decision problem (5)–(6) can be obtained by applying the Lagrange conditional extremum theorem. The Lagrangian in this case is of the following form:

$$L(c, I_{K_M}) = \ln c + \psi \ln\Big((1-\delta)K_0 + \alpha I_{K_M}\Big) + \lambda(y - c - I_{K_M}) \tag{9}$$

First order conditions are as follows:

$$\frac{\partial L}{\partial c} = \frac{1}{c} - \lambda = 0 \tag{10}$$

$$\frac{\partial L}{\partial I_{K_M}} = \frac{\psi\alpha}{(1-\delta)K_0 + \alpha I_{K_M}} - \lambda = 0 \tag{11}$$

$$\frac{\partial L}{\partial \lambda} = y - c - I_{K_M} = 0 \tag{12}$$

Solving (10)-(12) following solution is derived (the proof for the existence of the conditional extremum is in the appendix):

$$c^* = \frac{\alpha y + (1-\delta)K_0}{(1+\psi)\alpha} > 0 \tag{13}$$

$$I^*_{K_M} = \frac{\psi\alpha y - (1-\delta)K_0}{(1+\psi)\alpha} \geq 0 \tag{14}$$

$$K^*_M = \frac{\psi\alpha y + \psi(1-\delta)K_0}{(1+\psi)} > 0 \tag{15}$$

Thus the total utility of the agent in the above case with the optimal (maximizing utility) level of consumption and investments in marriage capital is given by the equation:

$$U^* = U(c^*, K_M^*) = \ln\left[\left(\frac{\alpha y + (1-\delta)K_0}{(1+\psi)\alpha}\right)\cdot\left(\frac{\psi\alpha y + \psi(1-\delta)K_0}{(1+\psi)}\right)^{\psi}\right] \quad (16)$$

In the second scenario the decision problem is given by maximizing the utility function (8) with condition (7). Since there are no other decision variables this time one can easily see that $c_D^* = y - D$ and:

$$U_D^* = U_D(c_D^*) = \ln(y - D) \quad (17)$$

In the next section the obtained solutions are analyzed.

3. COVID and divorce decisions—the analysis

In the proposed model of choosing between marriage and divorce the impact of COVID-19 can be accounted for in the following ways:

C1 By changing the economic situation. Along with the limitation of the possibility of paid work in many industries the income of employees decreases. It is therefore manifested by a decrease[8] in y.

C2 A decrease in income may also be caused by the necessity to incur expenditure on improving health (in the case of COVID-19 disease or other diseases) and in the case of isolation and quarantine—a reduction in the amount of time spent on possible paid work or spent on building relationships with loved ones.

C3 At the same time other sectors of the economy experienced a prosperity (e.g. logistics, new technologies, etc.) and revenues grew very strongly. This in turn is observed by the increase in y.

C4 Increasing the amount of interactions with one's spouse may cause more conflict situations which may be further amplified by a sense of personal economic frustration. Increased conflicts cause a faster depreciation of marital capital. In this model it is illustrated by an increase in the value of the parameter δ.

C5 The decrease in the value of the parameter ψ has a similar interpretation. This means that the unit of marriage capital relative to the unit of consumption brings a lower level of satisfaction.

C6 Positive changes in the level of the parameter ψ illustrate the obtaining of more satisfaction from the marriage capital which may also occur during

[8] Variable y represents the amount of time not spent on leisure which may be converted into income when needed. Decreasing y obviously does not mean that the amount of total time decreased but that either the time not devoted to leisure (and therefore work) is reduced (due to e.g. unemployment) or the value of the agent's work decreases (e.g. due to a reduction in remuneration per working time unit). Similar argument may be used in the case of increasing y.

isolation. If for professional reasons the family has so far been separated for most of the time the emergence of unplanned opportunities to spend time together may help to understand the value of family relationships and bear fruit by increasing the satisfaction derived from marital capital.

C4 Due to the isolation and exclusion of use of many public places (cinemas, theatres, restaurants) for a certain period and thus limiting the range of opportunities to spend time with loved ones investments in marriage capital may be less effective. In the proposed model it is illustrated by a decrease in the parameter α.

C4 The new situation faced by the judiciary during the pandemic caused, inter alia, prolongation during divorce processes. In the proposed model this means an increase in the *D* parameter which is the total cost of divorce.

Table 1 contains the signs of the calculated first derivatives of the variables appearing in the model with respect to every parameter. In most cases the relationships are linear and so the computations are straightforward and so they are left to the reader. In six cases the necessary transformations are presented in the Appendix.

Table 1. Signs of the corresponding derivatives

	$x = y$	$x = \delta$	$x = \alpha$	$x = \psi$	$x = D$
$\frac{\partial c^*}{\partial x}$	> 0	< 0	< 0	< 0	$= 0$
$\frac{\partial I^*_{K_M}}{\partial x}$	> 0	> 0	> 0	> 0	$= 0$
$\frac{\partial K^*_M}{\partial x}$	> 0	< 0	> 0	> 0	$= 0$
$\frac{\partial U^*}{\partial x}$	> 0	< 0	> 0	$= \ln K^*_M$	$= 0$
$\frac{\partial U^*_D}{\partial x}$	> 0	$= 0$	$= 0$	$= 0$	< 0

Source: Own calculations.

The signs of particular derivatives in Table 1 illustrate the direction of changes of specific variables in the case that the given parameter increases. It can be interpreted in terms of comparing two alternative realities—two agents that are identical in all respects who differ only in the value of that one specific parameter. Then if the selected derivative has a positive sign it means that the agent with a higher level of a given parameter has a higher value of a given variable *ceteris paribus*. If under the influence of one of the parameters the value of the total utility changes (increase or decrease) in one of the scenarios and remains the same in the other the conclusion is that the probability of the implementation of a specific scenario increases. This interpretation comes from the possibility to draw macro-conclusions from the micro-type decision model—one representative agent in the situation where there is one specific set of all parameters is considered. If one of these parameters changes under the epidemic shock it will more or less shift in the same direction (increase or decrease) for all agents. For each of them, therefore, the total utility in this particular scenario also changes and in the other remains the same. This means that for some agents (not for all and not for all to the same degree) the total utility of a particular decision will exceed the level of total utility in the second case. Therefore, for some individuals the decision made will change. It is not possible to specifically indicate the values of the model parameters in specific situations on a macro scale but a cumulative increase in divorces can be observed it can be said that the average probability of divorce has increased or that the duration of an average marriage has shortened.

An analysis of cases C1-C8 of the impact of COVID-19 and lockdown on the probability of divorce will be undertaken. Along with the change of the parameter y (C1-C3) representing the total amount of time not spent on leisure (or the income generated by it) the values of all variables in the model change. In the case of the stay-married scenario there is an increase in consumption and investments in marital capital. Given a constant relationship of derivatives for both consumption and investments in marriage capital with respect to y the relationship of the two decision variables is approximately constant with an increase in y. Thus having more to spend an increase in the value of both decision variables is observed. Thus an increase in income leads to a proportional increase in both c and I_{K_M}, as well as an increase in total utility. The total utility also increases in the second scenario in the case of a divorce decision although most likely not proportionally to the increase in total utility in the first scenario. It depends on the value of individual parameters which scenario offers the agent higher total utility. The reverse is also true—a decline in y leads to a decrease in consumption, investment in marriage capital, marital capital stock and total utility in both scenarios. It also depends on the specific values of individual parameters which of the scenarios after a change in the amount of income will then be characterized by greater total utility and will be selected by the agent. Therefore, it can be concluded that the economic situation (or health situation, reflected in a decrease in free income or time that can be devoted to professional work) does not have to directly, on the basis of the this model, affect the increase or decrease in the number of divorces.

In the case of an increase in the value of parameter δ (C4), the rate of depreciation of the marriage capital the basic variables change only in the first scenario. Note that the properties of the utility function do not change only the rate of decay of marriage capital does. An agent who wants to keep the satisfaction ratio of consumption and marriage capital at the same level is forced to incur higher expenditure on I_{K_M}. With constant income this means lower levels of consumption eventually also decreasing, albeit slightly, marital capital. This leads to a decrease in total utility in the first scenario. However, the total utility of the agent in the second scenario does not change. Therefore, with specific values of all parameters in individual cases the agent will relatively more often choose the second scenario—divorce. Thus the increased number of spouses' interactions resulting in conflict and leading to a faster rate of decay of marital capital is a direct cause of the increase in divorce rates.

The parameter ψ illustrated the agent's preferences. Its level is interpreted in terms of the relative satisfaction that the agent draws from the marriage capital in relation to the unit of consumption expenditure. The agent whose utility function has a higher value of ψ *ceteris paribus* prefers spending time with family over consumption. Lockdown which became common during the COVID-19 epidemic has a negative effect on this parameter (C5–C6). The non-choice necessity to spend more time with a spouse leads to more conflicts and therefore reduces the agents' relative satisfaction with their marriage capital. Therefore, a decrease in the value of the parameter ψ leads to a decrease in investment in marriage capital which obviously leads to a decrease in K_M. At the same time consumption increases with steady income. The change in the level of total utility in this case depends on the level of marital capital. However, it can be assumed that since y has an income interpretation and the the parameters determined in the model assume specific, meaningful values then K_M^* is most often greater than 1. Then with a decrease in the value of the parameter ψ, the total utility decreases. With constant utility in the divorce choice scenario, this means an increase in the probability of divorce.

The parameter α reflected the efficiency of transformation of investment expenditure in K_M to a specific value of the marital capital stock. Thus one unit of expended income/time turns into α units of marriage capital. The decrease in this parameter (C7) is interpreted in terms of reduced opportunities for the effective and fruitful spending of time one unit I_{K_M} then gives a smaller increase in K_M, and therefore it is extremely less effective. On the other hand, there is an increase in consumer spending the efficiency of which remains the same and therefore they are relatively more effective. This leads to an increase in consumption, a decrease in investment in marriage capital and the K_M stock itself. In total the agent loses and its total utility is lower. This puts the marriage scenario at a disadvantage compared to the utility of the agent choosing to divorce. Thus as the effectiveness of investment expenditure on marital capital decreases the probability of divorce increases. Closing the variety of opportunities for effective leisure activities results in the breakdown of marriages.

The last parameter that might be compared in comparative statics is parameter D which denotes the costs of divorce and therefore the expenditure of resources and/or time to be incurred in relation to the choice of the end of the marriage (C8). It is not difficult to notice that the first scenario, the choice of marriage is not affected by changing parameter D—equilibrium consumption, investment in marriage capital, marital capital stock and total utility are exactly the same as before. However, the increase in the cost of divorce quite strongly affects the level of total utility in the event of choosing a divorce. Therefore, with the increase in the widely understood costs of divorce the probability of divorce decreases. Conversely as the cost of divorce decreases, the chance of making a divorce decision increases.

Conclusions

This paper contains a simple decision model reflecting the dilemma faced by every spouse in the world, i.e. whether to continue a previously contracted marriage within a given period or decide to divorce. The model takes into account the usual consumption expenses, family/marriage capital with its depreciation, income, investments in this capital, the effectiveness of these investments, the relative satisfaction of family capital and consumption, the costs of divorce and the total utility obtained by the agent in two situations—staying in marriage and divorce. The problem faced by the agent is analyzed in two scenarios and formulas for the optimal division of income between both categories of expenses are derived. Then comparative statics is performed by calculating the signs of all derivatives of all variables with respect to all parameters. The theoretical consideration is the impact of the COVID-19 epidemic and lockdown on individual aspects of the proposed model. The obtained results are interpreted in terms of this impact.

This simple model shows that a change in economic conditions has the least effect of any factor influenced by COVID-19 in changing the probability of a divorce or the probability of a marriage continuing. If the agent's income changes it changes regardless of his further decision to divorce or not. Declining income decreases in both scenarios and the relatively greater decrease in total utility in one of these scenarios is a question of the value of all model parameters. With the diversity of all agents in the world regardless of the form of the probability distribution function it is difficult to conclude that one of the scenarios shows a significantly lower level of total utility after a decline in income. It therefore seems reasonable to conclude that the probabilities of selecting each of the two scenarios would remain more or less the same on a macro scale.

The remaining parameters of the model—the rate of depreciation of marital capital, the efficiency of investment expenditure, the relative utility of marriage capital, divorce costs—only affect one of the scenarios. The first three influences the first scenario and the cost of divorce—the second one. The change in their values resulting from the lockdown during the COVID-19 epidemic significantly changes the probability of selecting individual scenarios on a macro scale. It is only a matter of a specific economy, inhabited by people with a specific culture and specific family relationship patterns which of these effects in a given situation may be more visible and have a greater impact on the shape of the total utility in either of the scenarios.

It is not difficult to notice the disadvantages of the proposed model. First, it is quite simple so it does not take into account many aspects of the marital situation such as the duration of the marriage, the number of children or expected number of children, or the quite obvious aspect of divorce undertaken in order to enter into another marriage right away. Second, the selected functional forms are quite simple. It is possible to consider more complex forms of the utility function or even the non-linear impact of investment in marriage capital on the size of the marital capital stock. The authors assume these particular functional forms due to the mathematical simplicity while maintaining all theoretical requirements and the most important conclusions that can be obtained from such a model. This does not mean the perfect empirical suitability of the model to reality.

The empirical potential of the proposed model is noticeable not only in analysis of the COVID-19 related shocks. In general the framework could be used to study the impact of any shocks on marriage-divorce dilemma. In this paper the focus is on the current issue, which is the coronavirus pandemic. It is possible after collecting appropriate data to observe changes taking place in specific time series and to calibrate the appropriate parameters of the model. It is also possible to quite simply transform the proposed model into a multiperiod model in which specific shocks appear in each period economic, random and COVID-19-specific. However, since specific data on changes in the number of divorces and contracted marriages will only be possible to collect in a few years (due to the different duration of divorce processes in different countries) the empirical application of the model still needs to wait.

Acknowledgments: The authors would like to thank their son for constant inspiration to explore the advantages of family capital.

Appendix

Proposition 1. $(c^\star, I^\star_{K_M})$ is a conditional maximum of the decision problem (5)–(6).

Proof. $$det(H_L) = det\begin{pmatrix} \frac{-1}{c^{\star 2}} & 0 & -1 \\ 0 & \frac{-\psi\alpha^2}{\left[(1-\delta)K_0+\alpha I^\star_{K_M}\right]^2} & -1 \\ -1 & -1 & 0 \end{pmatrix} > 0 \blacksquare$$

Proposition 2. $\frac{\partial U^\star}{\partial \alpha} > 0$

Proof: $$\frac{\partial U^\star}{\partial \alpha} = \frac{\partial(\ln c^\star + \psi \ln K^\star_M)}{\partial \alpha}$$

$$= \frac{(1+\psi)\alpha}{\alpha y + (1-\delta)K_0} \cdot \frac{y(1+\psi)\alpha - \left(\alpha y + (1-\delta)K_0\right)(1+\psi)}{(1+\psi)^2\alpha^2}$$

$$+\psi\frac{(1+\psi)}{\psi\alpha y + \psi(1-\delta)K_0} \cdot \frac{\psi y}{(1+\psi)} = \frac{-(1-\delta)K_0\frac{1}{\alpha}}{\alpha y + (1-\delta)K_0} + \frac{\psi y}{\alpha y + (1-\delta)K_0}$$

$$= \frac{\psi y - (1-\delta)K_0\frac{1}{\alpha}}{\alpha y + (1-\delta)K_0} = \frac{1}{\alpha}\frac{\psi\alpha y - (1-\delta)K_0}{\alpha y + (1-\delta)K_0} = \frac{1}{\alpha}\frac{I^\star_{K_M}}{c^\star} > 0 \blacksquare$$

Proposition 3. $\frac{\partial U^\star}{\partial \psi} = \ln K^\star_M$

Proof: $$\frac{\partial U^\star}{\partial \psi} = \frac{\partial(\ln c^\star + \psi \ln K^\star_M)}{\partial \psi}$$

$$= \frac{(1+\psi)\alpha}{\alpha y + (1-\delta)K_0}\frac{-\left(\alpha y + (1-\delta)K_0\right)\alpha}{(1+\psi)^2\alpha^2} + \ln K^\star_M$$

$$+\psi\frac{(1+\psi)}{\psi\alpha y + \psi(1-\delta)K_0}\frac{\left(\alpha y + (1-\delta)K_0\right)(1+\psi) - \left(\psi\alpha y + \psi(1-\delta)K_0\right)}{(1+\psi)^2}$$

$$= \frac{1}{\alpha y + (1-\delta)K_0}\frac{-\left(\alpha y + (1-\delta)K_0\right)}{(1+\psi)} + \ln K^\star_M$$

$$+ \frac{1}{\alpha y + (1-\delta)K_0}\frac{\alpha y + (1-\delta)K_0}{(1+\psi)} = \frac{-1}{(1+\psi)} + \ln K^\star_M + \frac{1}{(1+\psi)}$$

$$= \ln K^*_M = \ln\left(\frac{\psi\alpha y + \psi(1-\delta)K_0}{(1+\psi)}\right) \blacksquare$$

Proposition 4. $\frac{\partial c^{*}}{\partial \alpha} < 0$

Proof. $\frac{\partial c^{*}}{\partial \alpha} = \frac{\alpha y(1+\psi) - \left(\alpha y + (1-\delta)K_0\right)(1+\psi)}{(1+\psi)^2 \alpha^2}$

$$= \frac{\alpha y - \alpha y - (1-\delta)K_0}{(1+\psi)\alpha^2} = \frac{-(1-\delta)K_0}{(1+\psi)\alpha^2} < 0 \blacksquare$$

Proposition 5. $\frac{\partial I^{*}_{K_M}}{\partial \alpha} > 0$

Proof. $\frac{\partial I^{*}_{K_M}}{\partial \alpha} = \frac{\psi \alpha y(1+\psi) - \left(\psi \alpha y - (1-\delta)K_0\right)(1+\psi)}{(1+\psi)^2 \alpha^2} \blacksquare$

Proposition 6. $\frac{\partial I^{*}_{K_M}}{\partial \psi} > 0$

Proof. $\frac{\partial I^{*}_{K_M}}{\partial \alpha} = \frac{\alpha^2 y(1+\psi) - \alpha\left(\psi \alpha y - (1-\delta)K_0\right)}{(1+\psi)^2 \alpha^2} = \frac{\alpha^2 y + (1-\delta)K_0}{(1+\psi)^2 \alpha^2} > 0 \blacksquare$

Proposition 7. $\frac{\partial K^{*}_{M}}{\partial \psi} > 0$

Proof. $\frac{\partial K^{*}_{M}}{\partial \psi} = \frac{\left(\alpha y + (1-\delta)K_0\right)(1+\psi) - \left(\psi \alpha y + \psi(1-\delta)K_0\right)}{(1+\psi)^2}$

$$= \frac{\alpha y + (1-\delta)K_0}{(1+\psi)^2} > 0 \blacksquare$$

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