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DEFINING BAD AND GOOD PROCRASTINATION

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Abstract

Often people procrastinate unpleasant tasks for immediate gratification in doing nothing today. Therefore many scholars have been engaged in designing incentive schemes to avoid it. We think the process is very complicated and many features need to be analyzed, as the subjective evaluations of the probability of success and rewards. In this paper we explore these factors and analyse under what conditions procrastination is a *bad* decision, with negative consequences or, on the contrary, it is the better choice. We also analyse a particular case of *good* procrastination, that is when procrastination may have positive consequences because people spend their time in alternative activities, useful for other ex post best rewarded tasks. We define this case as “*productive procrastination*” .

Key words: Time-Inconsistent Preferences; Procrastination; Inter-temporal Choice.

Jel Numbers: D03, D74, D91.

1. Introduction

There is a growing interest in the economics literature about the effects of procrastination and how to design incentives schemes to persuade people to complete a task sooner. Both psychological and economics researches, as well as common intuition, find that people procrastinate because of their time-inconsistent preferences for immediate gratification in doing nothing today¹. Many theoretical analyses focused on time-inconsistent preferences and self-control problems² (Ainslie, 1991; Hoch and Loewenstein, 1991; Baumeister and Muraven, 2000; O'Donoghue and Rabin, 1999, 2000; Prelec, 2004; Strotz, 1956; Shefrin and Thaler, 1981; Shafir and Tversky, 1992; Bargh and Gollwitzer, 1994; Laibson, 1994; Laibson, Repetto and Tobacman, 1998) and a number of researches have also empirically tested how the models of hyperbolic discounting can explain trends in data on procrastination better than models based on exponential discounting (see for instance, Laibson, Repetto, Tobacman, 1998; Angeletos, Laibson, Repetto, Tobacman, and Weinberg, 2001; Ariely and Wertenbroch, 2002; Shui and Ausubel, 2004; Della Vigna and Paserman, 2005; Shapiro, 2005; Gruber and Mullainathan, 2005 and Della Vigna and Malmendier, 2006).

According to some of these studies (O'Donoghue and Rabin, 1999a and 1999b, 2001), because of their biased perceptions, people may not behave in their own long-run best interest, so there is scope for firms, policymakers, friends and family and the people themselves, to create incentives schemes to induce people to complete their task in the short-run (O'Donoghue and Rabin, 1999).

In this paper we aim to analyze the process of procrastination in more detail and to show that, despite it has always been considered a negative concept, procrastination could also have positive consequences and increase the agents' well-being³.

¹ The assumption of time-inconsistent preferences implies that immediately available rewards have a disproportionate effect on preferences relative to more delayed rewards.

² According to the approach of inter-temporal choice with hyperbolic agents, a self-control problem arises because the agents, despite they know when to do a task, they are not able to self-control themselves successfully to complete the task in that time (for more detailed description of self-control problem see D.Dragone, 2005).

³ Obviously if a person postpones a task and at the same time invests her time and effort to improve her performance, so to produce a better outcome in the future, she may experiment a loss in current welfare which is more than compensated by a future welfare increase. This is a problem of "inter-temporal choice of effort allocation". On the contrary, the term procrastination implies that people delay tasks without achieving them. This is the reason why procrastination has always been considered a negative process and scholars have searched ways to rescue from this "illness".

In particular our objective is to analyze why people procrastinate and the possible consequences of these behaviour. We distinguish between *bad* and *good* procrastination: the first has only negative consequences, the second one might lead to a positive result.

First of all, we consider that an agent's informative set may be incomplete. According to some psychologists (Brasini, M. 2008), when a subject decides whether or not procrastinate he often uses his subjective evaluations or self-estimations of values and trends, which may be incorrect.

The variables measured to take a decision depend on the subjective values that a person attaches to the reward and costs of the task, and, more in general, on her own "vision of the world". (Brasini, M. 2008).

In particular, the initial assessment of the importance of the task and the probabilities of success may be very important for the consequences of procrastination. Ex post people could see that procrastination was the best decision because the task was less important then expected (i.e. less rewarded and satisfying) or the subject overestimated his probability of success (he accomplished the task but with a failure, so he did not get any reward. In this case it is better to delay the task forever and spend the time in other activities).

In this paper we try to translate in an economic model the several features of procrastination above mentioned and their consequences. To this aim we say that procrastination is *bad* when doing the task is worth and the following conditions are satisfied⁴:

1)the task can be successfully accomplished but people procrastinate either because they fear of not being able to realize it or because they have a general attitude for procrastination (as when they want to reach easy results with minimal efforts or because of laziness); 2) while procrastinating people only waste their time (that is, they do not engage themselves in alternative activities)⁵; 3) there are costs supported for the planned procrastinated task and they are just "losses of money" because the task will never accomplished⁶.

On the contrary, procrastination may be *good* under at least some of the following conditions:

1)the subject overestimated the importance/reward of the task; 2) the subjects overestimated his probabilities of success. 3) subjects who procrastinate spend their time, in other useful or more

⁴ Obviously, because of the complexity of the phenomenon, we are probably missing some cases. Anyway our approach, on our knowledge, is one of the first attempt to look at the procrastination in a more extensive, not only negative, way. Nevertheless we think that it needs further, both theoretical and empirical, analyzes and researches. In particular, we also rule out the distinction between naive and sophisticated subjects, which surely need further detailed analyses.

⁵In this analysis we want stress the cases for a good procrastination, so we rule out the case when the subject procrastinates to do a task with greater intensity in the future but this harms the agent himself, as he fails to complete the task adequately in a vain attempt of perfection. Nevertheless this is an important case which also need further analyses.

⁶ Things could worse off if people must pay a penalty for the uncompleted task. This could be seen as an increase in the cost of the task, so it does not imply any changes in our analysis.

satisfying activities (as in producing social capital or relational goods, etc.) or to make productive investments to improve their performance which will be ex post useful for other better rewarded activities. This maximizes the agent’s welfare more than if he realized the initial planned task (we define this case as “*productive procrastination*”, and we analyze it in section 4)

In the paper there are 5 sections, including introduction and conclusions, and it is organized as follows. In the next section we describe the basic model and analyze respectively variables affecting procrastination and the related consequences. In section 3 we try to give a definition of *bad* and *good* procrastination and in section 4 we discuss our results according to the case of “*productive procrastination*”.

2 The Basic Model: tasks, inconsistent preferences and variables affecting the decision about procrastination.

Our starting point is the *present-biased preferences* model used by Laibson D.(1994) to model time inconsistency within an individual⁷. This is a two-parameter model which represents a simple modification of the standard one-parameter exponential discounting model, where now it is assumed that people have time-inconsistent preferences for immediate gratification.

Formally, let u_t be the instantaneous utility a person gets in period t , her inter-temporal preferences at time t , U^t can be represented by the following utility function:

For all t

$$U^t(u_t, u_{t+1}, \dots, u_T) \equiv \delta^t u_t + \beta \sum_{\tau=t+1}^T \delta^\tau u_\tau \quad (1)$$

The parameter $\delta \leq 1$ represents standard “time-consistent” impatience, whereas the parameter β represents the time-inconsistent preference for immediate gratification. For $\beta = 1$, these preferences are time-consistent, and for $\beta < 1$ at any given moment the person has an extra bias for now over the future.

Following O’Donoghue and Rabin (2001), we imagine that an agent must choose whether and when to do the task x , which implies costs and rewards: if a person completes the task x in the period $\tau \geq t$ she incurs in a cost $c \geq 0$ in the period τ itself and benefits from a reward $v \geq 0$ paid in $\tau+1$, that is the reward is paid just a period after she did the task. We assume the an agent

⁷ The model was originally developed by Phelps and Pollak (1968), in the context of intergenerational altruism.

may do only a task x , therefore the only admissible set of actions available in each period is $A \equiv \{x, \emptyset\}$, where the action x means “to complete the task x ” and the action \emptyset means “doing nothing”.

We define a strategy $s = (a_1, a_2, \dots)$ the decision to accomplish in the period t the action $a_t \in A$. For instance, a person may choose to do nothing either in t and $t+1$, and to do the task x only in $\tau=3$. In this case her strategy may be represented with the set: $s \equiv \{a_1, a_2, a_3\} \equiv \{\emptyset, \emptyset, x\}$.

Now we denote by \hat{a}_τ^t the person’s belief in the period t on what action she would choose in τ if she starts the new period without have completed the task before, therefore $\hat{s}^t = (\hat{a}_{t+1}^t, \hat{a}_{t+2}^t, \dots)$ represents the person’s period- t beliefs about her future behavior.

Following the thoughts of some psychologists (Brasini, 2008 and Sears, 2008), we try to introduce in this model two other possible variables which affect the decision about doing a task now or later . These variables are related to the subjective evaluations and individual self-estimations. One is the expectation of success, that is the probability to successfully achieve the task. In our basic model this implies that if an individual must decide to realize x in t or in $\tau > t$, \hat{p}_τ^t measures his expectation in t to successfully achieve the outcome x in τ . The probability of success that individuals take into consideration is the result of their own subjective evaluations. It is an estimated probability $\hat{p}_\tau^t = \hat{p}_\tau(I_t)$ which is a function of the full available information I in t and which may be different from the true probability of success. p_τ , with $\tau \geq t$ These two probabilities are the same if the informative set is complete (for instance this happens in t so that $\hat{p}_t^t = p_t$); instead in case of incompleteness they may be different. When the first is higher (lower) than the second one, this means that the subject overestimated (underestimated) his abilities to succeed. Notice that if individuals have in their informative set the information that they have not accomplished the task in the past, their expected probability of success should be lower. In fact, if individuals procrastinate the task until $t+1$ their informative set includes the information that up to $t+1$ they have “failed” in achieving x , in the sense that they have not accomplished it until that time. Under the initial assumption that people are not investing in additional effort to improve their performance in the future, this may only imply lower probabilities of success in the future: $p_t \geq p_{t+1}$, and for a subject with rational expectations it is also $\hat{p}_t^t \geq \hat{p}_{t+1}^t$.

The second important variable of this problem is the reward $v(\tau) = v_\tau$ which is a function of the periods until the task is realized. Because the reward is paid a period after the task is realized we may assume that its true value is uncertain. In some cases people are not well informed on the precise value of the reward or they are paid- or paid more- if the task is achieved on time. In addition, also when the value of the reward is well fixed in advance, there could be other factors which could change this value until the task is done, so that what is of worth today could be less important in the afterwards. We model this usual case, with reward lower as the time is higher, by assuming that $v_t \geq v_{t+1}$ and for a subject with rational expectations it is also $\hat{v}_t \geq \hat{v}_{t+1}$.

There are also other variables (Sears, 2008) which may affect the decisions about procrastination and we should take them into account in our analysis. For instance, one of these variables concerns the general attitude for procrastination. About that, in our model we assume that a very important factor is motivation. Subjects do not procrastinate because they are lazy, but because they are unmotivated and they expect not to succeed or because they think that doing x is not really important. Higher the value that people attach to the task (the expected reward v), the more they strive to achieve it. In fact, people usually procrastinate tasks they think are boring or unuseful⁸.

Another variable that we need to take into account is the individual self-esteem, but it makes sense thinking that a higher expectation of success induces people to do a task sooner, while a lower one induces to procrastinate it. Being the probability a variable subjectively estimated we may also conclude that procrastinators are individuals with low self-esteem or with a low estimated probability of success.

Finally, for what concerns consequences of procrastination, we can say that more serious are the consequences of a failure and more a person tends to procrastinate. These consequences afford the expected final payoff, which also depends on all the variables above mentioned and on their interaction. To sum up in our model the subjective probability of success and expected rewards may include many of the factors above mentioned so they are enough for our objective in this paper to analyse how subjective evaluations and estimates affect the final expected payoff and therefore the decisions about procrastination. Consequently, the final expected payoff may be measured as: $\hat{V}^t \equiv (\hat{a}^t, \hat{s}^t, \hat{p}^t, \hat{v}^t, \beta, \delta, c)$

⁸ In an hypothetical scale of motivations, on the other side, there are perfectionists: they procrastinate and at the same time invest in higher effort to reach a better performance in the future. We don't analyse this case in this paper, whose main focus is to see when procrastination may have positive consequences.

3. A Definition of *Bad* and *Good* Procrastination.

In this section we aim to introduce in the basic model our previous considerations and in particular those about the real and estimated values of probabilities of success and reward. For simplicity, we assume, that the person who procrastinates a task is a *pathological procrastinator*: she does not take into consideration the possibility to spend her delayed time in other activities, but she does absolutely nothing.

Therefore there are three possible cases:

a) The person expects she completes the task in t , so that her expected payoff is:

$$\hat{V}^t(\hat{a}^t, \hat{s}^t, \hat{p}^t, \hat{v}^t, \beta, \delta, c) \equiv \left[-c + p_t \frac{\delta}{1-\delta} \beta v_t \right]$$

That is, he does not discount the immediate cost c by β , but does discount the delayed reward by β .

Because all the expectations are devised in t , to simplify our notations we ruled out the apex t from the expected probabilities and rewards so that from now on \hat{p}_τ denote \hat{p}^t .

b) The subject does nothing now and expects never to complete any tasks, therefore his payoff is zero⁹.

c') The subject expects he realizes the task x in $\tau > t$, so that his expected payoff is:

$$\hat{V}^t(\hat{a}^t, \hat{s}^t, \hat{p}^t, \hat{v}^t, \beta, \delta, c) \equiv \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} \hat{p}_\tau \hat{v}_\tau \right] \quad \text{with} \quad a_t = \emptyset \quad \text{for} \quad \text{each} \quad t < \tau \quad \text{and}$$

$$\tau = \min(t \mid a_t \neq \emptyset).$$

Following O'Donoghue and Rabin (1999), under our assumptions, now we may define the task

x as *β -worthwhile* if $p_t \left\{ \beta \frac{\delta}{1-\delta} v_t \right\} \geq c$, which is more probably verified for higher values of

p_t and v_t .

⁹ We could also imagine that the subject gets a minimal utility from doing nothing (satisfaction from relaxing, from laziness, etc.). This reward could be lower as the time until he completes the task is higher, because people will be bored or on the contrary it could be higher because people get accustomed to laziness. For simplicity, we do not take into consideration this possibilities, which are not strictly important for our analysis. Therefore, in this paper we assume only that the reward of doing nothing is so low that we can approach it to zero.

When is it more probable that a person decides to procrastinate? If she thinks the task is worth-while, but she postpones the task until τ because she thinks that she may get a higher payoff. That is, the payoff expected in t if she achieves x in τ must be higher than the expected payoff in t if the task is realized in t itself (and this must be true for each t , so that she postpones the task forever).

Definition 3.1 *The pathological procrastinator is a person who estimates:*

$$\beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} \hat{p}_\tau \hat{v}_\tau \right] \geq 0 \quad \forall \tau > t \quad (2)$$

and

$$-c + p_t \left(\beta \frac{\delta}{1-\delta} v_t \right) < \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} \hat{p}_\tau \hat{v}_\tau \right] \quad \forall \tau > t \quad (3)$$

A person procrastinates if she thinks that $\forall \tau > t$ her payoff will be higher than in t (3) and if she also thinks that before or later it would be worth-while doing the task, so that she does not abandon the plan (2).

Definition 3.2. Bad and Good Procrastination.

a) *Procrastination has ex post negative consequences if a person procrastinates the task x (Definition 3.1), but the task is worth-while in t and the real payoff in τ is lower than the real payoff in t . Therefore if a person behaves sub (2) and (3) and on the contrary the following conditions are satisfied:*

$$-c + p_t \left\{ \beta \frac{\delta}{1-\delta} v_t \right\} \geq 0 \quad (4)$$

and

$$-c + p_t \left(\beta \frac{\delta}{1-\delta} v_t \right) > \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} p_\tau v_\tau \right] \quad \forall \tau > t \quad (5)$$

b) Procrastination is a good decision if:

$$-c + p_t \left\{ \beta \frac{\delta}{1-\delta} v_t \right\} < 0 \quad (6)$$

and

$$\beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} p_\tau v_\tau \right] < 0 \quad (7)$$

In each period of time, the utility of doing nothing is higher than that of doing the task; in other words the task should not be worth-while either in t (6) nor in τ (7).

Therefore, a person thought the task was worth-while in t , but in τ she postponed the task again, for fear of a failure, or rethinking the importance of x , so she did not achieve x neither in t nor τ .

In the first case a) procrastination is *bad* because it implies a welfare loss equal to the missed payoff as in (4); nevertheless in b) procrastination is *good* because the decision to procrastinate saved the subject from a welfare loss equals to c

Proposition 3.1 For a pathological procrastinator, who does not spend the delayed time in alternative activities nor in investment in effort, procrastination is ever a bad procrastination when the task is worth-while in t .

Proof. If the task is worth-while in t the (4) is satisfied: $-c + p_t \left\{ \beta \frac{\delta}{1-\delta} v_t \right\} > 0$.

We must check that also (5) is verified.

The procrastinator is pathological so he thinks that (2) is satisfied

$$-c + p_t \left(\beta \frac{\delta}{1-\delta} v_t \right) < \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} \hat{p}_\tau \hat{v}_\tau \right]$$

being $p_t > \hat{p}_\tau, v_t > \hat{v}_\tau$ it is also

$$-c + p_t \beta \frac{\delta}{1-\delta} v_t < \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} p_t v_t \right]$$

$$-c + p_t \beta \frac{\delta}{1-\delta} v_t < \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} p_t v_t \right]$$

or

$$-c[1 - \beta(\delta^\tau)] < 0 < [\beta(\delta^\tau) - \beta] \left[p_t \frac{\delta}{1-\delta} v_t \right]$$

but for $\beta(\delta^\tau) < \beta < 1$ (as under the assumption of time-inconsistent preferences) this is impossible. So only the condition (5) may be satisfied.

From the previous considerations we may conclude that:

- i) A person is more used to procrastinate as more incorrect are their subjective estimates of probabilities of success and rewards. In this case she thinks the (3) is satisfied while the true expression is (5). This means that she procrastinates if she underestimates her probability of success in doing the task today and/or she overestimates the rewards of doing the task in the future compared with that she gets if she realizes it immediately.
- ii) If the procrastinator is pathological, to take the right decision, the most important thing is to make a good estimate of the current situation in t . If the task is worth-while in t and the person can achieve it now, then procrastination will surely have negative consequences.

4. A particular case of *Good Procrastination*: the *Productive Procrastination*

In the previous section we showed that for a pathological procrastinator, who does not invest to improve his performance, procrastination may only lead to negative consequences (*bad procrastination*).

In this section we analyse a particular case where to procrastinate may be a good decision because the subject also invests (we use this term to mean that he supports in any case the cost c) for the planned task x . Even if he never realizes the task, this investment may also be useful for an alternative activity y which produces a positive higher reward in τ .

Alternatively we can also imagine that a person invests for all the time between t and τ to improve her abilities or she spends this time, not just for a productive task, but for some other activities (as relational goods, etc.) which produce a higher satisfaction than the utility of doing x or nothing at all (which we assumed is equal to zero). In all these cases procrastination is not only a waste of time, but it may become a good strategy implying a welfare increase. This happens under the following condition: the payoff of procrastinating until τ is higher because

the ex post reward for the unplanned task y is higher than doing x in t or in τ and higher than doing y in t (or because of welfare increases due to spend time in relational goods). This last condition may be verified under the assumption that c may be used for y only in τ and this increases for instance the probability of success in doing y in τ itself¹⁰.

Notice that productive procrastination is not just doing something else as in a problem of multi-choice tasks. The central issue here is that reward of y is due to the investment made for x but not used for this last, given that the subject never realizes x itself. Agents do not have to choose what task to accomplish (x or y) but, by using ex post for y resources they have initially planned to use for x, they can get higher rewards. If they have never planned to do x they would have never invested in these resources which increased their welfare from the unplanned y.

The possibility for a productive procrastination substantially suggests that even if people decide not to do a task immediately, they would have better invest today to improve their performance in a way which can be useful at least for another activity, even if at the moment she is not their preferred choice.(For instance to invest in learning another language is ever useful even if we learned them because we have initially planned to go to work abroad and we never did that; the same is about learning computer programs, etc, etc.).

Now we want to translate all these considerations in analytical terms. For simplicity we assume that procrastinators invest the same the cost c in t for the initially planned task x (and not during all the time between t and τ), so we must add a fourth possibility to the three expected payoff defined in section 3.

That is, the subject does not realize x neither in t nor in τ , but he supports the same the cost c in t and this will be useful to realize y in τ producing a positive reward v_τ^y in τ

In this case the expected payoff is:

$$-c + \beta(\delta^\tau) \left[\frac{\delta}{1-\delta} \hat{p}_\tau^y v_\tau^y \right].$$

Definition 4.1. *If the subject is a pathological procrastinator ((2) and (3) are satisfied) of a task x, but he invests in cost c in t to do x and this is an investment useful also to perform in τ*

¹⁰ An example of this situation may be when people plan to take a course today, at a cost c, to do an examination or job but they don't really like it or they are not good at doing it. So they postpone this task, but in the afterwards, in a time τ , they may use their knowledge for another examination or another job they can perform better. Therefore they get an higher reward: if they would have done that job or examination probably they have failed and got anything. On the contrary if they would have realized the other job or examination immediately they could have not use the knowledge and experience acquired for the other task(examination) initially planned. In this case ex post procrastination has been revealed as the best decision.

the task or activity y which produces a positive reward $\hat{p}_\tau^y v_\tau^y$ in τ itself, there is a **productive procrastination** in τ if:

$$-c + \beta(\delta^\tau) \left[\frac{\delta}{1-\delta} \hat{p}_\tau^y v_\tau^y \right] > -c + \left(\beta \frac{\delta}{1-\delta} \hat{p}_t^x \hat{v}_t^x \right) \quad (9)$$

Obviously a person will be persuaded to support c in t , whatever thing happens until τ , only if he also expects to recover this cost, that is c is not a sunk cost.

$$\left(\beta(\delta^\tau) \frac{\delta}{1-\delta} p_\tau^y v_\tau^y \right) \geq c$$

Proposition 4.1. *People who have a general attitude towards procrastination, so that they are pathological procrastinators on many tasks, may only suffer from bad procrastination, and they rule out for themselves also the possibility for a productive procrastination.*

Proof. For simplicity we consider the case of only two possible tasks available to a subject. We assume that there is the possibility for a productive procrastination and that a person procrastinates x so that (2) and (3) are satisfied. We also assume that procrastination on x is *bad* so that the (5) and (6) are satisfied. Nevertheless there is the possibility for a productive procrastination (9).

We also assume that the subject is a pathological procrastinator on y , so that

$$-c + \left(\beta \frac{\delta}{1-\delta} \hat{p}_t^y \hat{v}_t^y \right) < \beta(\delta^\tau) \left[-c + \frac{\delta}{1-\delta} (\hat{p}_\tau^y \hat{v}_\tau^y) \right]$$

which may be rewritten as

$$\frac{\delta}{1-\delta} \left[\beta \hat{p}_t^y \hat{v}_t^y - \beta(\delta^\tau) \hat{p}_\tau^y \hat{v}_\tau^y \right] < c [1 - \beta(\delta^\tau)]$$

$$\hat{p}_t^y \hat{v}_t^y < \frac{1}{\beta(\delta^\tau)} \left(\frac{\delta}{1-\delta} \right)^{-1} \left\{ c [1 - \beta(\delta^\tau)] - \beta \hat{p}_\tau^y \hat{v}_\tau^y \right\}$$

The subject invests in the cost c in t if $\hat{p}_t^y \hat{v}_t^y \geq c^* \left(\frac{\delta}{1-\delta} \right)^{-1} \frac{1}{\beta(\delta^r)}$

but

$$\frac{1}{\beta(\delta^r)} \left(\frac{\delta}{1-\delta} \right)^{-1} \{c[1-\beta(\delta^r)] - \beta \hat{p}_t^y \hat{v}_t^y\} < \left(\frac{\delta}{1-\delta} \right)^{-1} c \frac{1}{\beta(\delta^r)}$$

because

$$\{c[1-\beta(\delta^r)] - \beta \hat{p}_t^y \hat{v}_t^y\} < c$$

or

$$-\beta \hat{p}_t^y \hat{v}_t^y < c\beta(\delta^r)$$

which is ever satisfied being $-\beta \hat{p}_t^y \hat{v}_t^y < 0 < c\beta(\delta^r)$

Therefore the pathological procrastinator on x and y will rule out also the possibility to benefit from productive procrastination.

5 Conclusions

Procrastination is a rather strange behavior because it implies that people continually delay a task they need to complete. Many factors can be in action for that, in particular under time-inconsistent preferences people prefer doing nothing today if this cause them immediate gratification, while it could be in their best long-run interest to complete it sooner.

In this framework we add considerations about the possibility that procrastination is a positive behavior if today is not the optimal time to realize a given task. We try to define theoretical conditions under which this may happen. To stress the possibility for the existence of a good procrastination we also analyse the case of what we call a *productive procrastination*, which is related to the importance of investmens not used for the initially planned task, but useful also for alternatives activities. The possibility for a productive procrastination suggests that if unplanned but useful activities you can do in the the future do exist, if you procrastinate the

task x, in the meanwhile you are better to invest in a way which lead you to better realize those other alternative activities in the future.

We find that a pathological procrastinator, either on only a given worth-while task or also on the alternatives activities (that is a person who has a general attitude towards procrastination), may only suffer from bad procrastination. In the second case a procrastinator also rule out for himself the possibility to benefit from a productive procrastination.

Nevertheless we think that, taking into account the multi-faces of procrastination, not only negative but the positive ones, other more more deeply both theoretical (like dynamic models with variables like probabilities, rewards, costs, etc. changing over time) and empirical analyzes. should be managed to better highlight problems related to procrastination. Similarly empirical analyses should be addressed to understand if people use to postpone in a productive way or this is just a waste of time. Empirical and experimental analyzes could be managed for instance in the fields of undergraduate students' decisions about when taking an examinations, in the job search, or in starting up a new activity, etc.

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