The Silver Lining of Crises - A Loss Aversion Based Model of Reform

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Abstract

We explore how and when crises can help firms, organizations, and societies undertake beneficial reforms. In our model, a loss averse decision maker decides whether she should undertake a new project (a reform), characterized by a sequence of cash-flows, or stick with the status quo. In normal times, the decision maker may not pursue a beneficial project, a project with a positive net-present-value, for she places a greater emphasis on losses than on (equal sized) gains. We show that a sufficiently bad crisis guarantees that she undertakes the most beneficial project and characterize when a crisis begets change. When choosing between a single project and the status quo, a crisis can only shape preferences for the better. When choosing among multiple projects, it may distort choices. However, the crisis will always push the decision maker towards implementing a project that is better than the status quo. Implications for economic reforms and policy changes are discussed.

Keywords: Economic Crisis, Reform, Loss Aversion, Reference-dependent utility
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1. Introduction

Crises are often followed by changes in policies, economic or institutional reforms, and various beneficial actions that are otherwise not implemented. Indeed, studies in political science have illustrated that beneficial reforms tend to occur during economic crises (Rancière and Tornell, 2016; Drazen and Easterly, 2001; Bruno and Easterly, 1996; Tommasi and Velasco, 1996; Drazen and Grilli, 1993).[1] According to the World Bank, the Covid-19 pandemic may give rise to organizational and technological changes that will increase long-run productivity (Dieppe et al., 2020; Caballero and Hammour, 1994). Jared Diamond (2020) went as far as saying that the pandemic may bring permanent benefits to world by motivating us "to deal with those bigger issues that we have until now balked at confronting" such as "climate change; unsustainable use of essential resources (...); and the consequences of the enormous differences in standard of living between the world's people, destabilising our globalised existence". If these changes and reforms are beneficial, why is a crisis necessary for their implementation? Why were they not already implemented beforehand? This is especially puzzling because the costs of policy changes and reforms can be larger during times of crises (Rodrik, 1992).

We develop a simple decision-making framework to explore how crises can help firms, organizations, societies, and individuals make useful decisions that had been put off.[2] In our model, a loss averse decision maker (she) decides whether to undertake a new project, which results in a stream of positive and/or negative cash-flows, or stick to the status quo. In normal times, the decision maker may not undertake a beneficial project, a project with a positive net-present-value, for she places a greater emphasis on losses than on (equal sized) gains when making her decision. A crisis imposes a sequence of negative shocks on the decision maker's payoffs, shifting her perception of the status quo into the loss-domain. This in turn makes any positive payoffs from the project more valuable as they reduce at least some of those losses. As our first finding, we show that a crisis can overturn the agent's previous decision of forgoing a beneficial project if the crisis is sufficiently bad. In contrast, if the agent initially undertakes a beneficial project, then the crisis will not reverse her choice. We characterize the "smallest crisis", a crisis that imposes the smallest possible costs while at the same time ensuring that the decision maker pursues beneficial projects. The greater the decision maker's degree of loss-aversion, the larger such a crisis must be.

[1]See Mahmalat and Curran (2018) for a recent review of the literature.

[2]While we adopt the literal perspective of a decision problem, our model may also be understood as a reduced form model for more complex group-decisions.

The intuition and mechanism behind these first set of results is best illustrated with a simple example. Suppose a new project requires an immediate investment of $3/4$ and generates a future benefit of 1. For now, disregard any discounting. When the decision maker views losses as twice as bad as gains, the project is never carried out in normal times as $2 \times (-3/4) + 1 < 0$. Suppose the economy goes into a deep recession, which imposes persistent losses of $L > 1$ onto the agent, both in the current time period and when the investment generates a return. Now, she undertakes the project because the utility from doing so, $2 \times (-3/4 - L) + 2 \times (1 - L)$, is greater than from not doing so, $-4L$. In this crisis, the decision maker's preferences change as she evaluates the project's return not as a gain but as a reduction of losses. More generally, a crisis will alter the agent's preferences when it (L) is large enough.

We extend these findings to an environment with multiple projects, where we also show that a sufficiently bad crisis enables the agent to undertake the most beneficial project. The intuition is similar to before, namely that the crisis allows the agent to evaluate payments from all projects in all periods in the loss domain. During such a crisis, the projects' ranking by utility is equivalent to their ranking by the net present value criterion, and, hence, the best project is selected. Similarly to the single project setting, the total losses in the "smallest crisis", which ensures that the best project is taken, increases in the agent's degree of loss aversion. However, unlike in the single project setting, crises may distort choices, away from the most beneficial project towards lesser projects. For example, a crisis may induce the decision maker to undertake a shorter, less beneficial project instead of a longer project, whose payoffs occur further in the future, outside the scope of the crisis. Nevertheless, the crisis will always push the decision maker towards implementing a project that is better than the status quo.

Our decision model contributes to the literature on crises and economic reform by illustrating why crises induce reforms without relying on strategic interactions between political groups, strategic voters, or uncertainty regarding optimal policies. More importantly, it highlights that induced reforms do not need to be related to the crisis itself. Not only does our model generate a "threshold effect" – a crisis must be bad enough to induce reforms, a common argument in the empirical literature (Mahmalat and Curran, 2018) – but it also clarifies how this threshold interacts with the particular features of the reform in question. This may help to further clarify why some reforms get implemented during crises while others do not (Tommasi, 2003). In addition, we show that crises can distort choices, which is consistent with empirical observations by, for example, Weyland (1996) and Tommasi (2003). In doing so, we contribute to the theoretical politics literature which often highlights that crises beget reform, but seldom discusses distortions. More generally, our paper highlights that politicians, managers, or even private individuals should connect a crisis' cost with the potential gains from a reform, i.e., to frame the respective gains as a reduction in losses, in order to break resistance of or gain support from voters, departments, or themselves.[3]

Related literature: Why do crises beget reforms? The simplest answer to this question is a learning model, where crises indicate a failure of current policies and so reforms follow crises just as "smoke follows fire" (Rodrik, 1996). This view ignores the fact that signs of policy failure often appear long before a crisis, yet reforms are still being delayed until the last minute. Alesina and Drazen (1991) argue that necessary reforms are delayed because interested parties engage in a prolonged war of attrition to determine who bears a disproportionate share of the burden. Changes in the external environment, for example a crisis, can cause one group to given up early, bringing reforms forward in time.[4] Using the same framework, Drazen and Grilli (1993) show that a crisis can improve welfare. Rancière and Tornell (2016) consider competing rent-seeking groups and highlight that crises lead to structural reforms through lowering the benefits of current rent-extraction. In these models, the crisis is endogenous, it is a result of the sub-optimal policies or choices that require change. Our model contributes to this literature by suggesting that crises can also induce change in areas not immediately related to the crisis and even without affecting the reform's payoffs. Spiegler (2013) suggests a behavioral explanation for the reform phenomenon. In his model, a policy maker implements a placebo reform, a reform without any real impact, when the economy is bad. Such reforms are evaluated favorably by the electorate as it neglects the economy's natural tendency to revert back to its mean.

In contrast to these game theoretical models, this paper illustrates the beneficial role of crises in a decision theoretic framework by relying on loss averse decision makers (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991). A key implication of loss aversion is an endowment effect or status quo bias as the dis-utility of giving something up is greater than the utility of receiving it (Thaler, 1980; Samuelson and Zeckhauser, 1988; Kahneman et al., 1990). In our model, this causes (some) useful projects to not be undertaken in normal times. In the political science literature, loss aversion has been used recently to make similar arguments. Alesina and Passarelli (2019) show how it gives rise to a status quo bias for policies in a median voter model (Downs, 1957). In electoral competition between an incumbent and challenger, it leads

[3]For the classical study on the framing of gains and losses, see Tversky and Kahneman (1981).

[4]See Cason and Mui (2005) for a laboratory experiment that largely confirms Alesina and Drazen (1991)'s theory. Martinelli and Escorza (2007) extend the model to an asymmetric setting.

to platform rigidity (Lockwood and Rockey, 2020).[5] The idea that negative income shocks can affect people's preferences goes back to (at least) Kahneman and Tversky (1979), who highlighted that it can shift preferences towards riskier gambles.[6] To the best of our knowledge, Weyland (1996) is the only other paper that applied this idea to crises explicitly. He argues that the crisis-induced reforms in South-American countries during the 80s and 90s can be explained by risk-seeking behavior, with the aim to eliminate losses. His work is purely descriptive. Unlike our paper, he interprets these reforms as costly gambles.[7] Our work suggests that risk is not a necessary ingredient for crises to induce change.[8]

The remaining paper is organized as follows. Section 2 describes our model. Section 3 analyzes the single (3.1) and multi-project setting (3.2). In the discussion, section 4, we relate our work to previous ideas in prospect theory and outline how it extends to non-linear gain-loss functions. We also discuss welfare implications, the relationship of economic crises to economic booms, as well as the consequence of adaptive reference points. Section 5 concludes. Unless explicitly provided within the text, all proofs can be found in the appendix.

2. Model

The decision maker (she) is loss-averse with respect to her material payoff $\pi_t \in \mathbb{R}$. Consequently, she evaluates her time t payoff π_t against a reference point $r_t \in \mathbb{R}$ using a gain-loss function $\mu : \mathbb{R} \to \mathbb{R}$. Her utility from a risk-less payoff stream $\pi = (\pi_0, \pi_1, \ldots)$ at time $t = 0$ given a reference point $r = (r_1, r_2, \ldots)$ when she discounts the future by $\delta \in [0, 1)$ is

$$U(\pi \mid r) = \sum_{t=0} \delta^t \cdot \mu(\pi_t - r_t) \tag{1}$$

[5] Naturally, there is also a large literature in political science on the relationship between political constraints and reforms, some of which make the connection to crises. See, for example, Prato and Wolton (2018) on the successful implementation of reforms, populism, and the competence of politicians.

[6] Note that this is exactly the opposite prediction of a classic model with concave utility. Here, a negative wealth effect makes the agent more risk-averse.

[7] An interesting model that only relies on uncertainty to generate a status quo bias is Fernandez and Rodrik (1991). They show how uncertainty regarding the distribution of gains and losses in the population can create a bias towards the status quo - without relying on non-classical preferences.

[8] Other related papers are Barberis and Huang (2001), who analyze how loss averse investors adjust their portfolios in response to external shocks, and Blumberg and Kremer (2014), who study the impact of loss-aversion on asset choices in developing countries. Blumberg and Kremer suggest loss aversion helps to explain under-investment in high-yield projects.

In our model, payoffs are always risk-less and decisions are always made at $t = 0$. Hence, to keep notation short, we will omit the explicit $t = 0$ from summation signs.[9]

Throughout this paper, we analyze whether the decision maker (1) wants to implement a project with a payoff stream of $c = (c_0, c_1, \ldots)$ or (2) which project among many she wants to carry out. In general, π_t describes the joint payoff (cash-flows) from existing, exogenous sources (e_t) and this new project (c_t). For tractability, we focus only on the payoffs from projects rather than from exogenous sources, i.e., we set $e_t = r_t$. In other words, we assume that the decision maker's reference point has fully adapted to the exogenous payoffs. The project's payoffs, however, are new or unexpected and are therefore evaluated as either gains or losses when they are positive or negative, respectively.

A crisis is captured by real-valued losses $L = (L_0, L_1, \ldots)$ with non-negative L_t and at least one period with $L_t > 0$. Unlike existing exogenous payoffs, a crisis is an event to which the reference point has not yet adapted to. In such times, a project's payoff at time t is $c_t - L_t$ and the project's utility is therefore

$$U(c - L) = \sum_t \delta^t \cdot \mu(c_t - L_t) \tag{2}$$

We call an environment in which $L_t = 0$ for all t "normal times" or simply "a time with no crisis". For these times, the notation simplifies in the obvious way to $U(c) = \sum_t \delta^t \cdot \mu(c_t)$.[10]

Assumption 1: *The gain-function is linear:* $\mu(z) = z$ *for* $z \geq 0$ *and* $\mu(z) = \lambda \cdot z$ *for* $z < 0$ *with* $\lambda > 1$.

The key implication of loss-aversion is that projects with positive discounted cash-flows may still be rejected by a decision maker. For example, a project with $c = (-1/2, 1)$ results in a negative utility when $\lambda > 2$ even in the absence of discounting.

We focus on linear gain-loss functions in order to isolate the main effect of loss-aversion on decision making. Allowing for diminishing sensitivity to gains and losses would introduce additional concerns regarding the size of such gains and losses. We discuss such generalizations in section 4.1.

[9] Note that $\mu(\cdot)$ directly evaluates material payoffs in this model. For our setting, this is the most natural specification. It is also ideal to reduce notational clutter. Generalizing equation (2) to include utilities over payoffs is simple, resulting in a re-scaling of payoffs, i.e., $\mu(u(\pi_t) - u(r_t))$.

[10] In the language of our model, the decision maker can be in a time of crisis even if there are no current losses, i.e., $L_0 = 0$ and $L_1 > 0$. As the decision maker is forward looking, this is a necessary and useful feature. For many real world application, crises are likely to arise suddenly and so the decision makers will view times as normal until a crisis unexpectedly hits.

3. Analysis

3.1. A single project

We now show that a crisis can help the decision maker undertake a beneficial project that she may not pursue otherwise. A beneficial project is defined as a project with a positive discounted sum of payoffs: $\sum_t \delta^t c_t > 0$. In general, the utility of a beneficial project does not need to be positive as loss aversion causes losses to be weighted more heavily. If this is the case, the agent will not undertake the project in normal times. We begin with a simple sufficient condition.

Proposition 1: *Suppose* $\sum_t \delta^t c_t > 0$. *Then a crisis enables the decision maker to undertake the project if* $\min_t\{L_t\} \geq \max_t\{c_t\}$.

Proof. When the crisis hits, the utility from undertaking the project is given by

$$\begin{aligned}
\sum_t \delta^t \cdot \mu(c_t - L_t) &= \lambda \sum_t \delta^t \cdot (c_t - L_t) \\
&= \lambda \sum_t \delta^t c_t - \lambda \sum_t \delta^t L_t \\
&> \underbrace{-\lambda \sum_t \delta^t L_t}_{\text{payoff from not undertaking the project}}
\end{aligned}$$

where the first equality is due to $\min_t\{L_t\} \geq \max_t\{c_t\}$, which (weakly) shifts all payoffs into the loss domain. The inequality follows from $\sum_t \delta^t c_t > 0$. □

Proposition 1 highlights that a sufficiently bad crisis guarantees that the decision maker undertakes the project. A sufficiently bad crisis, one where the smallest loss is no less than the project's maximum payoff (i.e. $\min_t\{L_t\} \geq \max_t\{c_t\}$), turns any gains from the project into a reduction of losses. In turn, *all* payoffs are weighted by λ, which leads the agent to undertake the beneficial project since its discounted sum of payoffs is positive. The crisis shapes the agent's preferences positively, pushing her to pursue beneficial projects.

We now go into more detail for when the project is undertaken. Let $\mathcal{P}^+ \equiv \{t \mid c_t \geq 0\}$ and $\mathcal{P}^- \equiv \{t \mid c_t < 0\}$ be the periods in which the project's cash-flow is (weakly) positive and negative respectively. The decision maker takes on the project if and only if

$$U(c-L)=\sum_t \delta^t\cdot\mu(c_t-L_t)\geq\sum_t \delta^t\cdot\mu(-L_t)=U(-L) \tag{3}$$

Note that in any $t\in\mathcal{P}^-$, the decision maker is always in a loss-frame regardless of whether the project is undertaken. The inequality can therefore be simplified to

$$\sum_{t\in\mathcal{P}^+}\delta^t\cdot\mu(c_t-L_t)+\lambda\sum_{t\in\mathcal{P}^+}\delta^t L_t\geq-\lambda\sum_{t\in\mathcal{P}^-}\delta^t c_t \tag{4}$$

The LHS describes the project's relative benefits while the RHS captures its cost. Inequality (4) highlights a variety of interesting aspects. First, any positive cash flow is worth more during a crisis than in normal times since $\mu(c_t-L_t)+\lambda L_t>c_t$ in any $t\in\mathcal{P}^+$.[11] These cash-flows make the project relatively more attractive. In particular, when $c_t-L_t\leq 0$, the project's benefit is $\lambda\cdot c_t$ at $t\in\mathcal{P}^+$. If this is true for all $t\in\mathcal{P}^+$, the project will be undertaken following the same argument as in Proposition 1. Consequently, the sufficiency condition could be strengthened to: $L_t\geq c_t$ for all $t\in\mathcal{P}^+$. When $c_t-L_t>0$, the project's benefit at time $t\in\mathcal{P}^+$ is $c_t+(\lambda-1)L_t$, which is increasing in L_t. As a result, there must exist a minimal crisis for which the decision maker is indifferent between implementing the project or not. To find this point, write the inequality as

$$\sum_{t\in\mathcal{P}^+}\delta^t\cdot(c_t+(\lambda-1)\min\{L_t,c_t\})\geq-\lambda\sum_{t\in\mathcal{P}^-}\delta^t c_t$$

which yields:

Theorem 1: *The decision maker undertakes the project if and only if*

$$\sum_{t\in\mathcal{P}^+}\delta^t\cdot\min\{L_t,c_t\}\geq-\frac{1}{\lambda-1}\left[\sum_{t\in\mathcal{P}^+}\delta^t c_t+\lambda\sum_{t\in\mathcal{P}^-}\delta^t c_t\right]=-\frac{U(c)}{\lambda-1} \tag{5}$$

From this inequality, three observations regarding when a crisis alters preferences follow. We will frame these observations in terms of the "smallest crisis". In particular, define the size of a crisis as its sum of discounted losses, $S\equiv\sum_t\delta^t L_t$, and define the smallest crisis as the crisis that satisfies inequality (5) with the smallest S.

Corollary 1: *The smallest crisis S satisfies*

1. $L_t=0$ for all $t\in\mathcal{P}^-$

[11] The inequality obviously becomes an equality when $L_t=0$.

2. $L_t \leq c_t$ for all $t \in \mathcal{P}^+$

3. $S = \max\left\{0, -\frac{U(c)}{\lambda-1}\right\}$ and is increasing in λ.

Part 1 of Corollary 1 states that crisis-induced losses only matter (for altering preferences) in periods in which the project has positive cash-flows. In many interesting real world scenarios, the project is an investment-like project with current costs and delayed benefits. In this case, the current losses induced by a crisis are irrelevant. What matters is that the crisis persists until a future period, in which the investment generates positive payoffs. Our model predicts that short-term crises, i.e., $L_0 > 0$ and $L_t = 0$ for all $t \neq 0$, don't induce change when the project's benefits are delayed regardless of their severity. This deepens our understanding of the mechanisms behind the crisis-hypothesis (Mahmalat and Curran, 2018), i.e., a crisis that is large enough begets reform. For change to occur, the size of a crisis and its interaction with reforms matters. In particular, it must overlap with a reform's positive effects.

Part 2 states that while a crisis needs to be sufficiently large to impact choices, at some point, the size of the crisis becomes irrelevant. Losses beyond $c_t > 0$ simply do not matter. Finally, part 3 states that the stronger the decision maker's loss-aversion, the greater a crisis must be to alter choices. This is only relevant, however, when the decision maker does not already prefer to undertake the project in normal times, i.e. $U(c) \geq 0$. Note that the smallest crisis may not be unique.

In the previous discussion, we saw that a crisis makes the project's cash-flows more attractive, namely $\mu(c_t - L_t) + \lambda L_t > c_t$ in any $t \in \mathcal{P}^+$. It follows that any project that is implemented in normal times, $U(c) > 0$, must still be pursued in a crisis. For such projects, a crisis does not change the decision maker's preferences.[12]

Corollary 2: *If the project is undertaken in normal times, $U(c) > 0$, it will also be carried out in any crisis.*

To illustrate the intuition behind our results so far, we now turn to a simple two-period investment problem: a project has an immediate cost of $k > 0$ and generates a positive cash-flow of $v > 0$ in the next period, $c = (-k, v)$. The investment is beneficial, i.e., $\delta \cdot v > k$. In normal times, the decision maker invests if and only if $U(c) = -\lambda \cdot k + \delta \cdot v \geq 0$. Clearly, when the decision maker is too loss averse, $\lambda > \frac{\delta \cdot v}{k}$, the project is not undertaken. Next, suppose a crisis, which causes a loss of $L > 0$ in

[12] Note that any project which satisfies $U(c) > 0$ must be beneficial for $U(c) = \sum_{t \in \mathcal{P}^+} \delta^t c_t + \lambda \sum_{t \in \mathcal{P}^-} \delta^t c_t \geq \sum_t \delta^t c_t$.

both periods, arrives.[13] The investment is now made if and only if

$$\begin{aligned} U(c-L) = \mu(-k-L) + \delta \cdot \mu(v-L) &\geq (1+\delta)\cdot\mu(-L) = U(-L) \\ \Leftrightarrow \qquad \delta\cdot[\mu(v-L)+\lambda\cdot L] &\geq \lambda\cdot k \end{aligned}$$

In the second inequality, the LHS captures the relative benefit of undertaking the investment and the RHS represents the cost of doing so. Crisis-induced losses in the current period do not affect preferences. They only affect the overall utility level. By also continuing into the future, the crisis alters the project's relative benefits. In particular, when the crisis is sufficiently large or the project's payoff is relatively small ($v - L < 0$), the (undiscounted) relative benefit becomes $\mu(v-L) + \lambda \cdot L = \lambda \cdot v$. Any future gain represents a full reduction in future losses, which makes the project optimal for any degree of loss aversion. This is a special case of Proposition 1. When losses are relatively small or the project's payoff is relatively large ($v - L > 0$), $\mu(v-L) + \lambda \cdot L = v + (\lambda - 1) \cdot L$. While the relative benefit is still larger than v, it is now smaller than before as the project only reduces losses up to L. The loss that makes the decision maker indifferent is $\underline{L} = \frac{\lambda\cdot k - \delta\cdot v}{\delta(\lambda-1)}$, which is increasing in her degree of loss-aversion. Any crisis larger than $\underline{L}$ results in the project to be undertaken.

When we think of beneficial projects that have not been undertaken, we typically think of projects with an immediate cost followed by delayed benefits.[14] Such projects rely on a continuing crisis in order to be implemented. Indeed, the pure expectation of a future crisis would be sufficient. In some settings, we expect this prediction to hold, e.g., a startup that anticipates to run out of cash in the near future. In other settings, we expect that a crisis must materialize first. This may be due to behavioral reasons, such as optimism bias (Sharot, 2011). It may also be due to technical reasons: if a crisis is known to arrive tomorrow, the act of anticipation would make it happen today, e.g., stock market crashes.[15]

[13] We abuse notation and use L for both the vector and the individual losses in the equations below.

[14] The investment costs may also last for multiple periods, due to repeated effort, longer learning costs, etc.

[15] For example, in the classic model of exchange rate crises by Krugman (1979), knowing that a country, who operates a fixed exchange-rate regime, will run out of foreign exchange reserves in the future, speculators attack early, bringing the crisis forward.

3.2. Multiple projects

3.2.1. When crises improve choices

After having explored how a crisis can motivate a decision maker to make beneficial choices, we now explore how it shapes their preferences over multiple projects. In particular, we analyze preferences over two projects, P_1 and P_2, with associated payoffs of $c = (c_0, c_1, \ldots)$ and $c' = (c'_0, c'_1, \ldots)$. We say a project *is better* than another if its discounted sum of payoffs are larger. Without loss, we generally assume that P_1 is better than P_2, that is $\sum_t \delta^t c_t > \sum_t \delta^t c'_t$.

We begin by extending Proposition 1 to the context of multiple projects.

Proposition 2: *Suppose P_1 is better than P_2. Then the agent prefers P_1 during a crisis if* $\min_t\{L_t\} \geq \max\{\max_t\{c_t\}, \max_t\{c'_t\}\}$.

The proof follows the same logic as the proof of Proposition 1. In a sufficiently large crisis all payoffs are evaluated in the loss domain. As a result, the agent weights all payoffs from the two projects equally, regardless of whether they are gains or losses, and chooses the better project – which she may not have preferred in normal times.

Characterizing when P_1 is preferred turns out to be more involved in the multi-project setting as we impose no assumptions on the projects' overall and relative structure of cash-flows. As a result, a simple equation corresponding to equation (5) does not exist.[16] Describing the general problem is still useful for improving our understanding of the impact of crises on preferences, however. In general, the decision maker prefers P_1 if and only if $\sum_t \delta^t \mu(c_t - L_t) \geq \sum_t \delta^t \mu(c'_t - L_t)$. Using our previous notation for periods in which cash-flows are positive or negative, using subscripts 1 and 2 to indicate the respective project, this condition can be written as

$$\begin{aligned}
&\sum_{t\in\mathcal{P}_1^-\cap\mathcal{P}_2^-} \delta^t \cdot [\mu(c_t - L_t) - \mu(c'_t - L_t)] \; + \sum_{t\in\mathcal{P}_1^+\cap\mathcal{P}_2^-} \delta^t \cdot [\mu(c_t - L_t) - \mu(c'_t - L_t)] \qquad (6)\\
+ &\sum_{t\in\mathcal{P}_1^-\cap\mathcal{P}_2^+} \delta^t \cdot [\mu(c_t - L_t) - \mu(c'_t - L_t)] \; + \sum_{t\in\mathcal{P}_1^+\cap\mathcal{P}_2^+} \delta^t \cdot [\mu(c_t - L_t) - \mu(c'_t - L_t)] \; \geq 0
\end{aligned}$$

Crisis-induced losses in $t \in \mathcal{P}_1^- \cap \mathcal{P}_2^-$ and $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^-$ have the same, familiar impact as in the single project setting. In the first case, their impact is none as both terms are already in a loss-frame; L_t simply cancels out. The second case essentially matches the single project case with positive cash-flows, where P_1's cash-flows are weighted more

[16] It is, however, fairly simple to provide a constructive description of the smallest crisis. For further details, consult the respective proof of Proposition 3.

strongly. By reducing crisis-induced losses, P_1 becomes relatively more valuable. The third case, $t \in \mathcal{P}_1^- \cap \mathcal{P}_2^+$, represents the polar opposite. Losses in these periods result in P_2 becoming relatively more valuable. Finally, losses in periods with positive cash-flows for both projects, $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^+$, may favor either project depending on which cash-flow is greater.[17] Broadly speaking, this discussion re-emphasizes our previous claim that the timing of losses during a crisis is important. It not only determines whether the decision maker undertakes a project but also which project she undertakes.[18]

We now explore these ideas in more detail, starting with two two-period investment projects. Suppose P_1's payoffs are $(-k, v)$ and P_2's payoffs are $(-k', v')$, where $k, k', v, v' > 0$. The interesting case in this context is when the better project P_1 is also the larger, more costly project ($v > v' > 0$ and $k > k' > 0$) as loss-aversion penalizes the larger cost project relatively more. Moreover, suppose a crisis results in a constant loss of L in both periods.

In normal times, the decision maker prefers P_1 over P_2 if and only if $\delta \cdot (v - v') \geq \lambda \cdot (k - k')$. If P_1 is not already preferred in normal times, a crisis can align preference in favor of the better project. As both projects feature an immediate cost, the relative costs of the two projects remain unchanged. When the crisis is large enough, $L \geq v > v'$, both projects reduce the damages of the crisis and the better project becomes optimal: $U(P_1 - L) - U(P_2 - L) = \lambda \cdot \delta \cdot (v - v') - \lambda(k - k') > 0$. Just like in the single project example, there exists a minimal crisis level $\underline{L} = \frac{\delta \cdot (v - \lambda \cdot v') - \lambda \cdot (k - k')}{\delta \cdot (\lambda - 1)}$ for which the decision maker is indifferent between the two projects. She prefers P_1 for any $L \geq \underline{L}$. Moreover, $\underline{L}$ is increasing in λ. This observation remains true in the general multi-period setting, according to Proposition 3.

Proposition 3: *The smallest crisis that enables the better project P_1 to be preferred when P_2 is preferred in normal times is increasing in λ.*

In fact, in this specific two-period setting, a crisis can make the decision maker switch from the worse to the better project but it cannot cause her to switch from the better to the worse projects.[19] A constant crisis is, if anything, beneficial for aligning

[17] For more details on $\mu(c_t - L_t) - \mu(c'_t - L_t)$ in each of the four cases, see the appendix.

[18] In this section, we focus on preferences over two projects in order to keep the discussion as simple as possible. If the decision maker does not have to choose between the two but can opt to implement none, the single project analysis, section 3.1, provides the characterization for that choice.

[19] Suppose P_1 is better than P_2. Then, it can be shown that: (1) If P_1 is preferred over P_2 when there is no crisis, then it is also preferred over P_2 for any levels of $L > 0$; (2) If P_2 is preferred over P_1 when there is no crisis, then there exists a $\underline{L} > 0$ such that P_1 is preferred if $L \geq \bar{L}$. The remaining cases are much simpler than the one we have already discussed. Either a project dominates another, say P_1 dominates P_2, that is $v > v' > 0$ and $0 < k < k'$, in which case it is always preferred by the decision maker regardless of λ. Or alternatively, the better project is the smaller one, in which case

incentives in favor of the better project. In the next section will show that this is not generally true, however.

3.2.2. When crises distort choices

We now turn to a three-period investment problem to show how a crisis can distort preference towards a worse project. Suppose P_1 requires an immediate cost but only generates a profit in two periods from now, $(-k, 0, v)$, while P_2 already generates a profit in the next period, $(-k', v', 0)$. P_1 represents a long-run project while P_2 is a short-run project. Assume further that the crisis does not extend too far into the future, that is, it only causes losses today and in the next period, $L = (L_0, L_1, 0)$. The difference in utilities between the two projects is

$$U(P_1 - L) - U(P_2 - L) = \delta^2 \cdot v - \delta \cdot \lambda \cdot L_1 - \delta \cdot \mu(v' - L_1) - \lambda \cdot (k - k')$$

In this crisis, the short-run project P_2 has the key advantage of reducing losses in the next period. In contrast, P_1's profit in $t = 2$, v, is only evaluated as gains. The larger the crisis ($L_1 \uparrow$), the relatively more attractive P_2 becomes to the decision maker. As crises generally tend to be temporary, they favor shorter investment projects. This distorts preferences whenever the longer project is preferred in normal times and is also the better project.

Example 1: *Let* $P_1 = (-2, 0, 5)$*,* $P_2 = (-1, 2, 0)$*,* $L = (3, 3, 0)$*, with* $\lambda = 2$ *and* $\delta = 1$*.*

In Example 1, P_1 is better than P_2. P_1 is also preferred in normal times despite larger initial costs. In a crisis, however, the decision maker's preferences change in favor of the worse project as the crisis doubles P_2's benefits without affecting P_1's benefits.[20] The payoffs in this example were chosen to capture the sensible situation where the longer-run project is also larger. However, other parameter combinations can generate the same results. Indeed, such disadvantageous preference reversals can occur even in simpler settings if we move beyond investment projects.[21]

In the single-project setting, our results emphasized a crisis' potential usefulness for enabling better decisions. This insight continues to be true in the multiple-project

loss-aversion actually increases the utility difference between the two projects in normal times, that is $U(P_1) - U(P_2)$ is increasing in λ.

[20] Details: $U(P_1 - L) = 2\cdot(-2-3)+2\cdot(-3)+5 = -11$ and $U(P_2 - L) = 2\cdot(-1-3)+2\cdot(2-3)+0 = -10$.

[21] For instance, let $P_1 = (-1, 0, 2)$ and $P_2 = (-1, 3/2, 0)$ with $L = (3/2, 3/2, 0)$, $\delta = 1$ and $\lambda = 2$. Clearly, P_1 is preferred in the absence of a crisis. However in a crisis, P_2 becomes the superior choice for $U(P_1 - L) - U(P_2 - L) = -2 \cdot 3/2 + 2 = -1$. An even simpler, 2-period example is the following: $P_1 = (-3/4, 2)$, $P_2 = (1/3, 0)$, $L = (1, 0)$, with $\delta = 1$ and $\lambda = 2$. In normal times $U(P_1) = 1/2 > U(P_2)$ while during a crisis $U(P_1 - L) = -3/2 < -4/3 = U(P_2 - L)$.

environment if the crisis is large enough in all periods (Proposition 2). When a crisis is not large enough, either in length or in the size of its losses, it may distort preferences in favor of less optimal choices. This idea is consistent with the observations by Tommasi (2003), who is skeptical of crises as a driver of useful reforms. He argues that reforms tend to be too short-term focused, addressing issues only at the low or intermediate policy level, and neglect beneficial changes to deep institutions.

Before concluding this section, we make three more general observations that further clarify how and when a crisis can be useful. First, a crisis is always beneficial in shaping choices in the following sense: take any set of potential projects $\{P_1, P_2, \ldots, P_n\}$. If none of these projects is implemented in normal times, then a crisis will, if anything, shift the choice in favor of a better, albeit not necessarily the best project.

Proposition 4: *Suppose the decision maker does not want to implement any project in normal times, $U(P_i) < 0 \;\; \forall i \in \{1, 2, \ldots n\}$. Then, any project that is chosen during a crisis satisfies $\sum_t \delta^t c_t > 0$.*

Applied to the single project case, this proposition emphasizes that a crisis never results in a bad choice, i.e., the implementation of a negative net-present-value project.

For our next two observations, we restrict the types of project in consideration. First, suppose a project is strictly better than another in the sense that all its cash-flows are greater. Then a decision maker strictly prefers this project regardless of whether she is in a crisis or not.

Proposition 5: *Suppose P_1 dominates P_2, that is $c_t \geq c_t'$ for all t, with a strict inequality in at least one period. Then, P_1 is always preferred for any $(L_0, L_1, \ldots)$.*

The result follows from the fact that the gain-loss function is strictly increasing. If P_1 is not already implemented in normal times, then any crisis will push the agent towards implementing the dominant project.

Finally, suppose that project P_1 is a bigger version of P_2 in the following sense: $c_t = k_t \cdot c_t'$ with $k_t \geq 1$. Note that k_t may vary across periods; it may result in greater losses and/or greater gains. Also, the bigger project may or may not be better. For such projects, a crisis is never distorting preferences towards the worse project.

Proposition 6: *Let P_1 be some bigger version of P_2, that is $c_t = k_t \cdot c_t'$, with $k_t \geq 1$. If P_1 is better than P_2, then a crisis may shift the decision maker's preference from P_2 to P_1. If P_2 is better, it is always preferred.*

4. Discussion

In this paper, we have shown how a crisis shapes preferences over a single or multiple projects. Before concluding, we discuss how these findings extend to non-linear gain-loss functions, highlight their welfare implications, relate crises to their counterpart, i.e., economic booms, and comment on the implications of adapting reference points.

4.1. Diminishing Sensitivities to Gains and Losses

In their seminal paper on loss-aversion, Kahneman and Tversky (1979) assume that the decision maker becomes less sensitive to gains and losses as their absolute size increases to explain observed preferences over gambles (prospects). These preferences are captured by an S-shaped value-function - or in the language of our model, an S-shaped gain-loss function. In a setting with uncertainty, it is natural to start with the assumption of diminishing sensitivities (over gains) as it implies risk-aversion over non-negative gambles. In turn, Kahneman and Tversky show that diminishing sensitivity gives rise to risk-seeking behavior when gambles are over losses. By re-framing a gamble over losses as a positive gamble in the context of negative income shocks, they also highlight that shifts in the external environment can alter preferences.[22]

In our model, we focus on non-risky payoffs that accrue over time to understand how crises can enable a decision maker to make beneficial choices. The key difference between the two settings, static gambles and non-risky payoff streams, is the way external losses are accounted for. In a (static) model of uncertainty, these losses are constant. When payoffs arise over time, as in our model, such external losses may vary.[23] This allows us to discuss the relationships between the structure of payoffs and the structure of a crisis. The simplest way to incorporate loss-aversion into such a setting is a linear gain-loss function, which allows us to focus purely on the implications of whether the decision maker is in a gain or loss frame and how this frame is affected

[22]They provide an example of a businessman who lost 2000 and is now facing a gamble between a sure gain of 1000 and an equal chance to win 2000 or nothing. The benefit of eliminating losses make this gamble appealing. This particular example requires a non-linear gain-loss function, however, for preference to switch from the sure-thing to the risky gamble.

[23]In contrast, the difference between time-discounting and probability weighting does not introduce major technical differences. Indeed, our linear-analysis from section 3 can be recast in terms of gambles, where a project results in a payoff of c_i with probability $p(c_i)$ and yields an (expected) utility with a crisis $L = (l, \ldots, l)$ of $U(c - L; p) = \sum_i p(c_i)\mu(c_i - l)$. Hence, we could rewrite Proposition 1 as: "Suppose $\sum_i p(c_i)c_t > 0$. Then, a crisis enables the decision maker to undertake the project if $l \geq \max_i\{c_t\}$." Consequently, the loss-averse decision maker acts as if she is risk-neutral when all her payoffs are evaluated in a loss-frame. In their treatment of reference-dependent preference in risk-less environments, Tversky and Kahneman (1991) do not discuss the impact of external losses on preferences.

in a crisis. Such analysis disregards any alternative motivation stemming from the size of the crisis or the project.

The inherent generality of our setting, both in terms of payoffs and crisis, make a complete characterization for all non-linear gain-loss function difficult. Our insights generalize when the diminishing sensitivity is mild or when the losses are not too extreme. We now clarify this statement using a general two-period environment. The arguments extend to a T-period setting in the obvious ways. In general, the decision maker is loss-averse if for any $y > x \geq 0$, $\mu(y)+\mu(-y) < \mu(x)+\mu(-x) \leq 0$. Diminishing sensitivities are captured by $\mu(z)'' \leq 0$ for $z > 0$ and $\mu(z)'' \geq 0$ for $z < 0$. The utility of undertaking a project during a crisis is

$$U(c - L) = \mu(c_0 - L_0) + \delta \cdot \mu(c_1 - L_1) \tag{7}$$

whereas the utility of not undertaking it is

$$U(-L) = \mu(-L_0) + \delta \cdot \mu(-L_1) \tag{8}$$

To fix ideas, suppose the project is beneficial and that $c_0 < 0 < c_1$. With diminishing sensitivities, an increase in current losses L_0 reduces the project's perceived costs: $|\mu(c_0 - L_0) - \mu(-L_0)|$ decreases in L_0. Unlike in the linear case, current losses make the project appears more useful, or rather, less costly.

When future losses L_1 are relatively small, that is $c_1 - L_1 > 0$, the project also becomes more attractive for

$$\begin{aligned} &\mu(c_1 - L_1) - \mu(-L_1) \\ \geq\ &\mu(c_1) - \mu(L_1) - \mu(-L_1) \\ =\ &\mu(c_1) - [\mu(-L_1) + \mu(L_1)] > \mu(c_1) > 0 \end{aligned}$$

The first inequality follows from the concavity of $\mu(\cdot)$ whereas the second inequality is due to loss-aversion. Hence, when the crisis is 'mild', it is conducive to reforms. When L_1 becomes large, $c_1 - L_1 \leq 0$, the diminishing sensitivity argument from period 0 also applies to period 1, however. An increase in L_1 reduces the relative benefits from c_1. The larger L_1 is, the less attractive the project becomes. A crisis still pushes the decision maker towards the project as long as $L_1 \leq L_0$ for the reduction in losses from c_1 are worth relatively more than respective additional losses from c_0. When $\mu(\cdot)$ is not too convex, this remains to be true even for some $L_1 > L_0$ as the benefit of c_1 outweighs the additional cost of c_0 when the project is beneficial. However, such arguments do not extend to all possible gain-loss functions. For instance, suppose $L_0 = 0$ and $L_1 \to \infty$. When $\mu(-L_1)$ is essentially flat, the project offers little to no perceived benefits whereas its cost is unaffected. While such limiting argument are interesting in theory, they rely on treating crisis-induced losses as completely independent, which appears rather contrived.

Instead of modelling payoffs over time, one could also analyze projects that results in some immediate benefit and some immediate cost. Modelling choices as multi-dimensional outcomes is a common approach in the loss-aversion literature (Tversky and Kahneman, 1991; Köszegi and Rabin, 2006).[24] While this approach is conceptually sensible when the decision maker brackets different aspects of an outcome separately, how to model a crisis in such a setting is not immediately clear. After all, we would need to know which dimension a crisis impacts. One potentially interesting interpretation of such a model is to view it as a way of describing the decision making process of multiple people. Here, different dimensions would capture the utility of different people, with the group decision determined by aggregate utility. In such a context, a crisis may help to overcome group conflict and foster agreement since the group now values the project more.

4.2. Welfare

Given that crises can shape preference towards better choices, is it possible that they also improve overall welfare despite their direct costs? The answer to this question is a resounding no. To see this, suppose P_0 is chosen in normal times and P_1 is chosen during a crisis. P_0 could be a real project or simply capture the status quo, in which case $c = (0, 0, \ldots)$. As a crisis imposes losses, the decision maker's utility from a given project is strictly decreasing in L_t, which is true for both the linear and non-linear specification. Consequently, it must be that a crisis makes the decision maker worse-off for

$$U(P_1 - L) < U(P_1) \leq U(P_0)$$

While a crisis may result in a beneficial change in choices, overall welfare is strictly below normal times.[25]

[24] In a static setting, suppose a project results in a risk-less, n-dimensional outcome $x = (x_1, \ldots, x_n) \in \mathbb{R}^n$. Assuming that utility is linearly separable, the decision maker's single-period utility given a respective reference point $r = (r_1, \ldots, r_n) \in \mathbb{R}^n$ is $U(x|r) = \sum_i \mu(u_i(x_i) - u_i(r_i))$.

[25] In a game of attrition, Drazen and Grilli (1993) showed that crises can be welfare enhancing. In games, such counter-intuitive effects occur more easily since negative shocks may change the player's

Alternatively, one may view this question from an ex-post perspective, after the crisis has passed. When the majority of P_1's costs have already been borne by the decision maker's past self, the question is trivial and has a positive answer in our simple setting.

4.3. Economic Booms

In our model, crisis-induced losses increase the value of positive cash-flows. This raises the question whether the opposite, namely unexpected gains in good economic times can also induce beneficial reforms. Indeed, introducing windfalls from an economic boom is but a simple extension of our model. All of our findings extend naturally. For an overview of the respective results, see Appendix B.

Previously, Blumberg and Kremer (2014) highlighted that the empirical evidence from Thaler and Benartzi (2004), Duflo et al. (2011), and Bryan et al. (2014), all of which focus on a (perceived) reduction of upfront costs or losses, is consistent with the behavior of a loss-averse decision maker who is sensitive to upfront costs.[26] Translating this micro-evidence to the state of the overall economy suggests that economic booms may have more benefits than just temporary output gains.

4.4. Reference Points

A model of loss-aversion is incomplete without a reference point. A payoff of $\pi_t = 1000$ may be a pure gain if the decision maker expected nothing but can also be seen as a loss if she expected more. We simplified our analysis by focusing solely on the payoffs from projects that the decision maker is currently considering and those from crises. We justified our approach with the idea that the decision maker's reference point has fully adapted to exogenous payoffs, $r_t = e_t$, but is not affected by the project or the crisis.[27]

opponent's strategy to his or her benefit.

[26] Their paper analyzed the impact of loss aversion in a more general Ramsey-setting with risky investments. In their model, a decision maker chooses how to divide her wealth over consumption and multiple assets, which generate an uncertain net-return in the next period, in an infinite period model. As loss-aversion makes risky-gambles more costly, the model can explain why risky, high-return investment opportunities remain unexploited. The impact of a reduction in up-front cost was not modelled explicitly.

[27] The presence of exogenous payoffs would also not impact the decision maker's preferences if she places such payoffs into a different evaluation bracket. In this case, each per-period utility would be $\mu(c_t - r_{t,c}) + \mu(e_t - r_{t,e})$, where $r_{t,i}$ is the respective reference point for each bracket. As we already highlighted in section 4.1, such multi-dimensional approach raises the broader question of how to incorporate losses from a crisis.

When a crisis is relatively short, this approach seems plausible. However, the longer a crisis lasts, the more a decision makers may get used to it, resulting in a downward adjustment of the reference point. This in turn would limit the impact of crises, implying fewer behavioral changes over time. Even if such adaptations occur over time, it is doubtful that the decision maker would anticipate it at the outset (Riis et al., 2005; Stutzer and Frey, 2008; Loewenstein et al., 2003).[28]

5. Conclusion

While crises and crashes are undoubtedly painful events, with both short run and long term costs (Oyer, 2006; Schwandt and von Wachter, 2019), this paper outlined a simple framework that suggests that they can also be an opportunity for inducing positive change.[29] When there is only a single project in consideration, we have seen that a crisis can shape preference for the better, but never for the worse. With multiple projects, crises may distort choices. If no project would be implemented in normal times, crises will at least induce a second best outcome, in the sense that the decision maker is better off compared to not implementing any project.

In our model, we took the set of potential projects as given. Their payoffs did not vary with the state of the economy and hence could be viewed as reforms that are orthogonal to crises themselves. Even in this stylized model, crises beget change. It is undoubtedly true, however, that many reforms or behavioral adjustments are indeed a direct response to crises. Crises may highlight flaws in the current system that need rectifying or create new opportunities by altering both short-term and long-term payoffs. For instance, the shift towards the digital economy during the Covid-19 Pandemic is a direct consequence of face-to-face interactions becoming increasingly difficult. Despite being predicted long before the pandemic, this change was certainly not orthogonal. Even if many reforms are directly connected to a crisis, i.e., they become more profitable in this new state of the economy, our model should be seen as complementary to such a change-in-the-environment explanation. After all, we have documented how crises promote the pursuit of such beneficial projects and reforms.

[28] Quantitative Models of adaptation were pioneered by Helson (1947, 1948, 1964). Brickman and Campbell (1971) propose that people experience a "hedonic treadmill": they temporary react to good (bad) events with short periods of happiness (sadness) but quickly return to their neutral state of being. For excellent reviews of and commentary on this literature, see Frederick and Loewenstein (1999) and Diener et al. (2006). For an economic perspective, consult Powdthavee and Stutzer (2014). Recently, DellaVigna et al. (2017) uses adaptation to explain job-search of the unemployed.

[29] See also Malmendier and Nagel (2011), who show that crises can fundamentally shape preferences in the long run.

An interesting direction for future research would be to classify the type of reforms that are undertaken during crises - both at the corporate and the governmental level - by the fundamental reasons that drive them. From a scientific perspective, we are neutral with regards to the outcome of these findings. From a societal perspective, we hope that future work provides support for our predictions, for then, the Covid-19 pandemic may yet bring about at least some unexpected benefits.

A. Proofs

Proof of Corollary 1. Part 1 and 2 follow immediately by inspection. Given Part 1 and 2 and the definition of L_t, $0 \leq L_t$ and $L_t \leq c_t$ and so the size of the smallest crisis $S = \sum_{t \in \mathcal{P}} \delta_t L_t = \sum_{t \in \mathcal{P}^+} \delta_t L_t \geq 0$ only depends on losses in $\mathcal{P}^+$. Moreover, losses in $\mathcal{P}^+$ cannot exceed the respective gains of c_t.

When $U(c) \geq 0$, i.e., the decision maker undertakes the project in normal times, the RHS of the inequality (5) is negative. This implies that a zero-size crisis ($S = 0$) is sufficient for undertaking the project and the smallest crisis does not vary with λ.

When $U(c) < 0$ instead, the smallest crisis must be one with size S equals the RHS of inequality (5), which can be rewritten as follows:

$$\begin{aligned}
-\frac{1}{\lambda - 1}\left[\sum_{t \in \mathcal{P}^+} \delta^t c_t + \lambda \sum_{t \in \mathcal{P}^-} \delta^t c_t\right] &= -\frac{1}{\lambda - 1}\left[\sum_t \delta^t c_t + (\lambda - 1) \sum_{t \in \mathcal{P}^-} \delta^t c_t\right] \\
&= -\frac{1}{\lambda - 1} \sum_t \delta^t c_t - \sum_{t \in \mathcal{P}^-} \delta^t c_t.
\end{aligned}$$

As the sum of discounted payoffs is positive, the first term is negative and hence the whole expression is strictly increasing in λ. □

Proof of Corollary 2. As $\mu(c_t - L_t) + \lambda L_t = c_t + (\lambda - 1)\min\{L_t, c_t\} \geq c_t$ for all $t \in \mathcal{P}^+$, we get

$$\begin{aligned}
U(c - L) - U(-L) &= \sum_{t \in \mathcal{P}^+} \delta^t \cdot \mu(c_t - L_t) + \lambda \sum_{t \in \mathcal{P}^+} \delta^t L_t + \lambda \sum_{t \in \mathcal{P}^-} \delta^t c_t \\
&\geq \sum_{t \in \mathcal{P}^+} \delta^t c_t + \lambda \sum_{t \in \mathcal{P}^-} \delta^t c_t = U(c) > 0
\end{aligned}$$

□

Proof of Proposition 2.

$$\begin{aligned}
U(P_1 - L) = \sum_t \delta^t \cdot \mu(c_t - L_t) \quad &= \quad \lambda \sum_t \delta^t \cdot (c_t - L_t) \\
&= \quad \lambda \sum_t \delta^t c_t - \lambda \sum_t \delta^t L_t \\
&> \quad \lambda \sum_t \delta^t c'_t - \lambda \sum_t \delta^t L_t
\end{aligned}$$

$$= \sum_t \delta^t \cdot \mu(c'_t - L_t) = U(P_2 - L)$$

where the second and fourth equality is due to $\min_t\{L_t\} \geq \max\{\max_t\{c_t\}, \max_t\{c'_t\}\}$ and the inequality follows from $\sum_t \delta^t c_t > \sum_t \delta^t c'_t$. $\square$

Further details regarding equation (6):
For any $t \in \mathcal{P}_1^- \cap \mathcal{P}_2^-$, $\mu(c_t - L_t) - \mu(c'_t - L_t) = \lambda \cdot (c_t - c'_t)$.

For any $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^-$, $\mu(c_t - L_t) - \mu(c'_t - L_t) = c_t - \lambda \cdot c'_t + (\lambda - 1) \cdot \min\{c_t, L_t\}$.

For any $t \in \mathcal{P}_1^- \cap \mathcal{P}_2^+$, $\mu(c_t - L_t) - \mu(c'_t - L_t) = \lambda \cdot c_t - c'_t - (\lambda - 1) \cdot \min\{c'_t, L_t\})$.

For any $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^+$,

$$\mu(c_t - L_t) - \mu(c'_t - L_t) = \begin{cases} c_t - c'_t & \text{if} \quad L_t \leq \min\{c_t, c'_t\} \\ \lambda \cdot (c_t - c'_t) & \text{if} \quad L_t \geq \max\{c_t, c'_t\} \\ c_t - \lambda \cdot c'_t + (\lambda - 1) \cdot L_t & \text{if} \quad c_t > L_t > c'_t \\ \lambda \cdot c_t - c'_t - (\lambda - 1) \cdot L_t & \text{if} \quad c_t < L_t < c'_t. \end{cases}$$

Lemma A.1: *Suppose P_1 is better than P_2, yet P_2 is chosen in normal times. Then P_1 features more costs and more benefits than P_2:*

1. $\sum_{t \in \mathcal{P}_1^-} \delta^t c_t < \sum_{t \in \mathcal{P}_2^-} \delta^t c'_t$ *and*
2. $\sum_{t \in \mathcal{P}_1^+} \delta^t c_t > \sum_{t \in \mathcal{P}_2^+} \delta^t c'_t$

Proof of Lemma A.1: As P_1 is better than P_2, it must be that

$$\sum_{t \in \mathcal{P}_1^-} \delta^t c_t + \sum_{t \in \mathcal{P}_1^+} \delta^t c_t > \sum_{t \in \mathcal{P}_2^-} \delta^t c'_t + \sum_{t \in \mathcal{P}_2^+} \delta^t c'_t. \tag{9}$$

If P_2 is chosen in normal times, we have

$$\lambda \sum_{t \in \mathcal{P}_1^-} \delta^t c_t + \sum_{t \in \mathcal{P}_1^+} \delta^t c_t < \lambda \sum_{t \in \mathcal{P}_2^-} \delta^t c'_t + \sum_{t \in \mathcal{P}_2^+} \delta^t c'_t. \tag{10}$$

If inequality (9) is true, then for inequality (10) to be true, it must be that $\sum_{t \in \mathcal{P}_1^-} \delta^t c_t < \sum_{t \in \mathcal{P}_2^-} \delta^t c'_t$. But when P_1 has greater costs than P_2, its benefits must also be larger for inequality (9) to hold. $\square$

Proof of Proposition 3: From proposition 2, we know that there exists some level of crisis for which P_1 is strictly preferred, i.e. $\min_t\{L_t\} \geq \max\{\max_t\{c_t\}, \max_t\{c'_t\}\}$. Given that P_2 is strictly preferred in normal times, there must consequently also exist a crisis that makes the decision maker indifferent between the two. We now characterize the smallest of such crisis. From equation (6), we know that L_t can affect $U(P_1 - L) - U(P_2 - L)$ through changing the relative benefits or costs in that period: $\Delta(L_t) \equiv \mu(c_t - L_t) - \mu(c'_t - L_t)$. This may happen in up to four ways according to "Further details regarding equation (6)": If $t \in \mathcal{P}_1^- \cap \mathcal{P}_2^-$, L_t cancels and $\Delta(L_t)' = 0$. If $t \in \mathcal{P}_1^- \cap \mathcal{P}_2^+$, then increasing L_t, if anything, decreases $\Delta(L_t)$. In both cases, the smallest crisis must satisfy $L_t = 0$. Indeed, the same is true for $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^+$ in which $c_t < c'_t$.

For any of the remaining cases, namely $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^-$ or $t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^+$ with $c_t > c'_t$, a crisis weakly increases $\Delta(L_t)$. As losses beyond c_t do not increase $\Delta(L_t)$, $L_t \leq c_t$ in the smallest crisis. Moreover, in the smallest crisis, there must be at least some periods in which $L_t < c_t$, for if it was equal in all, then P_1 would be strictly preferred. To see why this is true, note that in the extreme case of $L_t = \max\{\max_t\{c_t\}, \max_t\{c'_t\}\}$, P_1 is strictly preferred over P_2 despite the possibility that some periods may actually decreased $\Delta(L_t)$ (relatively to $\Delta(0)$).

From Lemma A.1.1, we know that the sum of discounted negative cash-flows are (absolutely) larger for P_1. Hence any increase in λ increases the utility difference between the two projects in normal times: $U(P_1) - U(P_2)$ decreases in λ. Thus, for a higher degree of loss aversion, the smallest crisis must increase some $\Delta(L_t)$ to make up for this difference. □

Proof of Proposition 4: As the project is chosen over doing nothing during a crisis, i.e.,

$$U(P - L) \geq U(-L)$$

the following holds:

$$\sum_{t\in\mathcal{P}^+} \delta^t \cdot \mu(c_t - L_t) + \lambda \sum_{t\in\mathcal{P}^+} \delta^t L_t + \lambda \sum_{t\in\mathcal{P}^-} \delta^t c_t \geq 0.$$

If the crisis was so large as to satisfy $L_t \geq c_t$ for all $t \in \mathcal{P}^+$, the inequality simplifies to $\lambda \sum_{t\in\mathcal{P}^+} \delta^t c_t + \lambda \sum_{t\in\mathcal{P}^-} \delta^t c_t > 0$ and the result follows. If instead, there are some periods, say $\mathcal{P}^{++}$, in which $L_t < c_t$, then the inequality becomes

$$\sum_{t\in\mathcal{P}^{++}} \delta^t \cdot (c_t - L_t) + \sum_{t\in\mathcal{P}^{+}\setminus\mathcal{P}^{++}} \delta^t \cdot \lambda \cdot (c_t - L_t) + \lambda \sum_{t\in\mathcal{P}^{++}} \delta^t L_t + \lambda \sum_{t\in\mathcal{P}^{+}\setminus\mathcal{P}^{++}} \delta^t L_t + \lambda \sum_{t\in\mathcal{P}^{-}} \delta^t c_t$$
$$= \sum_{t\in\mathcal{P}^{++}} \delta^t \cdot (c_t + (\lambda-1)\cdot L_t) + \lambda \sum_{t\in\mathcal{P}^{+}\setminus\mathcal{P}^{++}} \delta^t c_t + \lambda \sum_{t\in\mathcal{P}^{-}} \delta^t c_t \geq 0$$

If $\sum_t \delta^t c_t < 0$, then the above inequality would be negative as $c_t + (\lambda - 1)\cdot L_t < \lambda \cdot c_t$ for any $t \in \mathcal{P}^{++}$. But then the project would not be chosen. □

Proof of Proposition 5: As P_1 dominates P_2, $\mu(c_t - L_t) \geq \mu(c_t' - L_t)$ for all t as $\mu(\cdot)$ is strictly increasing. Moreover, the inequality is strict whenever $c_t > c_t'$. Hence, the agent always prefers P_1. □

Proof of Proposition 6: The relative utility between the two projects simplifies to

$$U(P_1 - L) - U(P_2 - L) = \lambda \sum_{t\in\mathcal{P}_1^-\cap\mathcal{P}_2^-} \delta^t \cdot (c_t - c_t') + \sum_{t\in\mathcal{P}_1^+\cap\mathcal{P}_2^+} \delta^t \cdot [\mu(c_t - L_t) - \mu(c_t' - L_t)]$$

Since $c_t > c_t'$ for all periods with positive payoffs, the latter term is of the form

$$\mu(c_t - L_t) - \mu(c_t' - L_t) = \begin{cases} c_t - c_t' & \text{if} \quad L_t \leq \min\{c_t, c_t'\} \\ \lambda \cdot (c_t - c_t') & \text{if} \quad L_t \geq \max\{c_t, c_t'\} \\ c_t - \lambda \cdot c_t' + (\lambda - 1)\cdot L_t & \text{if} \quad c_t > L_t > c_t' \end{cases}$$

Note that all cases are bounded by $c_t - c_t' > 0$ from below and $\lambda \cdot (c_t - c_t')$ from above. It follows that if P_2 is better than P_1, $U(P_1 - L) - U(P_2 - L) < 0$ for any L. If P_1 is better than P_2, then it is either always chosen or there exists some minimal crisis beyond which it is also chosen. □

B. Booms

In this section, we extend our model to booms and summarize how our results from section 3 translate. All proofs follow a similar logic as their crisis counterparts.

Define an economic boom as $B = (B_0, B_1, \ldots)$, where B_t is non-negative and strictly positive in at least one period. The decision maker's utility from a project with payoffs c given B is

$$U(c+B) = \sum_t \delta^t \cdot \mu(c_t + B_t) \tag{11}$$

The first result, which corresponds to Proposition 1, illustrates that a large enough boom enables the decision maker to make the efficient choice.

Proposition B.1: *Suppose* $\sum_t \delta^t c_t > 0$. *Then a boom enables the decision maker to undertake the project if* $\min_t\{B_t\} \geq \max_t\{-c_t\}$.

Proof.

$$U(c+B) = \sum_t \delta^t \cdot \mu(c_t + B_t) = \sum_t \delta^t \cdot (c_t + B_t) > \sum_t \delta^t B_t = U(B)$$

where the second equality is due to $\min_t\{B_t\} \geq \max_t\{-c_t\}$, which (weakly) shifts all payoffs into the gain domain. The inequality follows from $\sum_t \delta^t c_t > 0$. $\square$

In general, the decision maker undertakes the project if and only if

$$\sum_{t\in\mathcal{P}^+} \delta^t c_t + \sum_{t\in\mathcal{P}^-} \delta^t \cdot \mu(c_t + B_t) \geq \sum_{t\in\mathcal{P}^-} \delta^t B_t \tag{12}$$

Notice that booms reduce the effect of loss-aversion for $\mu(c_t + B_t) - B_t > \mu(c_t)$ in any $t \in \mathcal{P}^-$.

The next Theorem provides the necessary and sufficient condition for an economic boom to ensure efficient decision of undertaking the project.

Theorem B.1: *The decision maker undertakes the project if and only if*

$$\sum_{t\in\mathcal{P}^-} \delta^t \cdot \min\{B_t, -c_t\} \geq -\frac{1}{\lambda-1}\left[\sum_{t\in\mathcal{P}^+} \delta^t c_t + \lambda \sum_{t\in\mathcal{P}^-} \delta^t c_t\right] = -\frac{U(c)}{\lambda-1}$$

Proof. The basic idea is that booms are only useful up to $-c_t > 0$, i.e., their impact is limited to $\min\{B_t, -c_t\}$. Rewrite inequality (12) using

$$\mu(c_t + B_t) - B_t = \begin{cases} c_t & \text{if} \quad c_t + B_t \geq 0 \\ \lambda c_t + (\lambda - 1) \cdot B & \text{otherwise.} \end{cases}$$

as

$$\sum_{t\in\mathcal{P}^+}\delta^t c_t + \sum_{t\in\mathcal{P}^-}\delta^t\cdot[\lambda c_t + (\lambda-1)\cdot\min\{B_t,-c_t\}] \geq 0, \text{ or simply as}$$

$$(\lambda-1)\sum_{t\in\mathcal{P}^-}\delta^t\min\{B_t,-c_t\} \geq\ -\sum_{t\in\mathcal{P}^+}\delta^t c_t - \lambda\sum_{t\in\mathcal{P}^-}\delta^t c_t$$

The result follows. □

Following the sufficient and necessary condition given by Theorem B.1, Corollary B.1 characterizes the smallest boom that ensures that beneficial projects are undertaken. The size of a boom is defined as $S = \sum_t \delta^t B_t$, corresponding to the definition of the size of a crisis.

Corollary B.1: *The smallest boom S satisfies*

1. $B_t = 0$ *for all* $t \in \mathcal{P}^+$
2. $B_t \leq -c_t$ *for all* $t \in \mathcal{P}^-$
3. $S = \max\left\{0, -\frac{U(c)}{\lambda-1}\right\}$ *and is increasing in* λ.

The proof of Corollary B.1 follows directly from that of Corollary 1 and is, hence, omitted.

Similar to Corollary 2, Corollary B.2 below shows that booms do not distort choices in single-project settings. The proof is also omitted.

Corollary B.2: *If the project is undertaken in normal times, $U(c) > 0$, it will also be carried out in any boom.*

We now turn to the multiple-project setting and illustrate the effect of a boom on the decision maker's choice of projects. Proposition B.2 provides a sufficient condition for a boom to ensure the decision maker choose the better project.

Proposition B.2: *Suppose P_1 is better than P_2. Then the agent prefers P_1 during a boom if* $\min_t\{B_t\} \geq \max\{\max_t\{-c_t\}, \max_t\{-c'_t\}\}$.

Proof.

$$U(P_1+B) = \sum_t \delta^t\cdot\mu(c_t+B_t) = \sum_t \delta^t c_t + \sum_t \delta^t B_t$$

$$
\begin{aligned}
&> \sum_t \delta^t c'_t + \sum_t \delta^t B_t \\
&= \sum_t \delta^t \cdot \mu(c'_t + B_t) = U(P_2 + B)
\end{aligned}
$$

□

The smallest boom must also be increasing in the decision maker's degree of loss aversion, according to Proposition B.3 given below.

Proposition B.3: *The smallest boom that enables the better project P_1 to be preferred when P_2 is preferred in normal times is increasing in λ.*

Proof. Clearly the smallest boom exists. From Lemma A.1.1, we know that the sum of discounted negative cash-flows are (absolutely) larger for P_1. Hence, any increase in λ decreases the utility difference between the two projects in normal times: $U(P_1) - U(P_2)$ decreases in λ. Thus, for a higher degree of loss aversion, the smallest boom must increase as to decrease the relative costs in some periods. □

Observation. With multiple projects, booms can distort preferences towards worse projects. For example, $P_1 = (2 + x, -1)$, where $0 < x < 3/4$, and $P_2 = (-3/4, 1.5)$, with $\delta = 1$ and $\lambda = 2$. In normal times P_1 is preferred: $U(P_1) = x > 0 = U(P_2)$. Preference can reverse during a boom. Take, for example, a boom with $B_0 \geq 3/4$ and $B_1 = 0$: $U(P_1 + B) = x + B_0 < (B_0 - 3/4) + 1.5 = U(P_2 + B)$.

Proposition B.4 - B.6 extend the corresponding results on crises, given by Proposition 4 - 6, to booms.

Proposition B.4: *Suppose the decision maker does not want to implement any project in normal times, $U(P_i) < 0 \quad \forall i \in \{1, 2, \ldots n\}$. Then any project that is chosen during a boom satisfies $\sum_t \delta^t c_t > 0$.*

Proof. As the project is undertaken, we have

$$
\sum_{t \in \mathcal{P}^+} \delta^t c_t + \sum_{t \in \mathcal{P}^-} \delta^t \cdot \mu(c_t + B_t) \geq \sum_{t \in \mathcal{P}^-} \delta^t B_t
$$

If $B_t \geq -c_t$ for all $t \in \mathcal{P}^-$, the result follows immediately. If instead, there are some periods for which $B_t + c_t < 0$, say $\mathcal{P}^{--}$, the inequality becomes

$$
\sum_{t \in \mathcal{P}^+} \delta^t c_t + \sum_{t \in \mathcal{P}^- \setminus \mathcal{P}^{--}} \delta^t \cdot [c_t + B_t] + \sum_{t \in \mathcal{P}^{--}} \delta^t \cdot [\lambda c_t + (\lambda - 1) \cdot B_t] \geq \sum_{t \in \mathcal{P}^-} \delta^t B_t
$$

$$\sum_t \delta^t c_t + (\lambda - 1) \sum_{t \in \mathcal{P}^{--}} \delta^t \cdot [c_t + B_t] \geq \sum_{t \in \mathcal{P}^{--}} \delta^t B_t$$

If $\sum_t \delta^t c_t < 0$, the LHS must be negative for $c_t + B_t < 0$ in any $t \in \mathcal{P}^{--}$. Consequently, the inequality cannot be satisfied. The result follows. □

Proposition B.5: *Suppose P_1 dominates P_2, that is $c_t \geq c_t'$ for all t, with a strict inequality in at least one period. Then, P_1 is always preferred for any $(B_0, B_1, \ldots)$.*

Proposition B.6: *Let P_1 be some bigger version of P_2, that is $c_t = k_t \cdot c_t'$, with $k_t \geq 1$. If P_1 is better than P_2, then a boom may shift the decision maker's preference from P_2 to P_1. If P_2 is better, it is always preferred.*

Proof.

$$U(P_1 + B) - U(P_2 + B) = \sum_{t \in \mathcal{P}_1^+ \cap \mathcal{P}_2^+} \delta^t \cdot (c_t - c_t') + \sum_{t \in \mathcal{P}_1^- \cap \mathcal{P}_2^-} \delta^t \cdot [\mu(c_t + B_t) - \mu(c_t' + B_t)]$$

Since $c_t < c_t'$ for all periods with negative payoffs, the latter term is of the form

$$\mu(c_t + B_t) - \mu(c_t' + B_t) = \begin{cases} c_t - c_t' & \text{if} \quad B_t \geq \max\{-c_t, -c_t'\} \\ \lambda \cdot (c_t - c_t') & \text{if} \quad B_t \leq \min\{-c_t, -c_t'\} \\ \lambda c_t - c_t' + (\lambda - 1) \cdot B_t & \text{if} \quad -c_t > B_t > -c_t' \end{cases}$$

The difference is bounded by $\lambda \cdot (c_t - c_t')$ from below and by $c_t - c_t' < 0$ from above. It follows that if P_2 is better than P_1, $U(P_1 + B) - U(P_2 + B) < 0$ for any B. If P_1 is better than P_2, then it is either always chosen or there exists some minimal crisis beyond which is also chosen. □

References

Alberto Alesina and Allan Drazen. Why are stabilizations delayed? The American Economic Review, 81(5):1170–1188, 1991.

Alberto Alesina and Francesco Passarelli. Loss aversion in politics. American Journal of Political Science, 63(4):936–947, 2019.

Nicholas Barberis and Ming Huang. Mental accounting, loss aversion, and individual stock returns. The Journal of Finance, 56(4):1247–1292, 2001.

Seth Blumberg and Michael Kremer. Dynamic loss aversion, growth, and development. Working Paper, 2014.

Philip Brickman and Donald T. Campbell. Hedonic relativism and planning the good society. In M. H. Appley, editor, Adaptation-level theory: a symposium, pages 287–302. New York Academic Press, 1971.

Michael Bruno and William Easterly. Inflation's children: tales of crises that beget reforms. The American Economic Review, 86(2):213–217, 1996.

Gharad Bryan, Shyamal Chowdhury, and Ahmed Mushfiq Mobarak. Underinvestment in a trofitable technology: The case of seasonal migration in Bangladesh. Econometrica, 82(5):1671–1748, 2014.

Ricardo J Caballero and Mohamad L Hammour. The cleansing effect of recessions. The American Economic Review, pages 1350–1368, 1994.

Timothy N. Cason and Vai-Lam Mui. Uncertainty and resistance to reform in laboratory participation games. European Journal of Political Economy, 21(3):708–737, 2005.

Stefano DellaVigna, Attila Lindner, Balázs Reizer, and Johannes F. Schmieder. Reference-dependent job search: Evidence from Hungary. The Quarterly Journal of Economics, 132(4):1969–2018, 2017.

Jared Diamond. Jared Diamond: lessons from a pandemic. https://www.ft.com/content/71ed9f88-9f5b-11ea-b65d-489c67b0d85d, 2020. Accessed: 2021-03-29.

Ed Diener, Richard E. Lucas, and Christie Napa Scollon. Beyond the hedonic treadmill. revising the adaptation theory of well-being. American Psychologist, 61(4):305–314, 2006.

Alistair Dieppe, Neville Francis, and Gene Kindberg-Hanlo. Productivity: Technology, demand, and employment trade-offs. In Alistair Dieppe, editor, Global Productivity, Trends, Drivers, and Policies, chapter 6, pages 135–164. Washington, DC: World Bank, 2020.

Anthony Downs. An economic theory of political action in a democracy. Journal of political economy, 65(2):135–150, 1957.

Allan Drazen and William Easterly. Do crises induce reform? Simple empirical tests of conventional wisdom. Economics and Politics, 13(2):129–157, 2001.

Allan Drazen and Vittorio Grilli. The benefit of crises for economic reforms. The American Economic Review, 83(3):598–607, 1993.

Esther Duflo, Michael Kremer, and Jonathan Robinson. Nudging farmers to use fertilizer: Theory and experimental evidence from kenya. American Economic Review, 101(6):2350–2390, 2011.

Raquel Fernandez and Dani Rodrik. Resistance to reform: Status quo bias in the presence of individual-specific uncertainty. The American Economic Review, pages 1146–1155, 1991.

Shane Frederick and George Loewenstein. Hedonic adaptation. In Daniel Kahneman, Ed Diener, and Norbert Schwarz, editors, The foundations of hedonic psychology, chapter 16, pages 302–329. Russel Sage Foundation, New York, NY, 1999.

Harry Helson. Adaptation level as frame of reference for prediction of psychophysical data. American Journal of Psychology, 60(1):1–29, 1947.

Harry Helson. Adaptation level as a basis for a quantitative theory of frames of reference. Psychological Review, 55(6):297–313, 1948.

Harry Helson. Adaptation-level theory. An experimental and systematic approach to behavior. Harper and Row, New York, NY, 1964.

Daniel Kahneman and Amos Tversky. Prospect theory: An analysis of decision under risk. Econometrica, 47(2):263–291, 1979.

Daniel Kahneman, Jack L. Knetsch, and Richard H. Thaler. Experimental tests of the endowment effect and the coase theorem. Journal of Political Economy, 98(6): 1325–1348, 1990.

Botond Köszegi and Mathew Rabin. A model of reference-dependent preferences. The Quarterly Journal of Economics, 121(4):1133–1165, 2006.

Paul Krugman. A model of balance of payments crises. Journal of Money, Credit, and Banking, 11(3):311–325, 1979.

Ben Lockwood and James Rockey. Negative Voters? Electoral Competition with Loss-Aversion. The Economic Journal, 130(632):2619–2648, 2020.

George Loewenstein, Ted O'Donoghue, and Matthew Rabin. Projection bias in predicting future utility. The Quarterly Journal of Economics, 118(4):1209–1248, 2003.

Mounir Mahmalat and Declan Curran. Do crises induce reform? A critical review of conception, methodology and empirical evidence of the 'crisis hypothesis'. Journal of Economic Surveys, 32(3):613–648, 2018.

Ulrike Malmendier and Stefan Nagel. Depression babies: do macroeconomic experiences affect risk taking? The Quarterly Journal of Economics, 126(1):373–416, 2011.

César Martinelli and Raúl Escorza. When are stabilizations delayed? Alesina-Drazen revisited. European Economic Review, 51(5):1223–1245, 2007.

Paul Oyer. Initial labor market conditions and long-term outcomes for economists. Journal of Economic Perspectives, 20(3):143–160, 2006.

Nattavudh Powdthavee and Alois Stutzer. Economic approaches to understanding change in happiness. In Kennon M. Sheldon Sheldon and Richard E. Lucas, editors, Stability of Happiness. Theories and Evidence on Whether Happiness Can Change, chapter 11, pages 219–244. Elsevier, Amsterdam, 2014.

Carlo Prato and Stephane Wolton. Rational ignorance, populism, and reform. European Journal of Political Economy, 55:119–135, 2018.

Romain G Rancière and Aaron Tornell. Why do reforms occur in crises times? USC-INET Research Paper, (16-19), 2016.

Jason Riis, George Loewenstein, Jonathan Baron, Christopher Jepson, Angela Fagerlin, and Peter A. Ubel. Ignorance of hedonic adaptation to hemodialysis: A study using ecological momentary assessment. Journal of Experimental Psychology: General, 134(1):3–9, 2005.

Dani Rodrik. The limits of trade policy reform in developing countries. The Journal of Economic Perspectives, 6(1):87–105, 1992.

Dani Rodrik. Understanding economic policy reform. Journal of Economic Literature, 34(1):9–41, 1996.

William Samuelson and Richard Zeckhauser. Status quo bias in decision making. Journal of Risk and Uncertainty, 1:7–59, 1988.

Hannes Schwandt and Till von Wachter. Unlucky cohorts: Estimating the long-term effects of entering the labor market in a recession in large cross-sectional data sets. Journal of Labor Economics, 37(1):125–159, 2019.

Tali Sharot. The optimism bias. Current Biology, 21(23):R941–R945, 2011.

Rani Spiegler. Placebo reforms. The American Economic Review, 103(4):1490–1506, 2013.

Alois Stutzer and Bruno S. Frey. Stress that doesn't pay: The commuting paradox. Scandinavian Journal of Economics, 110(2):339–366, 2008.

Richard Thaler. Toward a positive theory of consumer choice. Journal of Economic Behavior and Organization, 1(1):39–60, 1980.

Richard H. Thaler and Shlomo Benartzi. Save more tomorrow: Using behavioral economics to increase employee saving. Journal of Political Economy, 112(1):S164–S187, 2004.

M Tommasi and A Velasco. Where are we in the political economy of reform? The Journal of Policy Reform, 1(2):187–238, 1996.

Mariano Tommasi. Crisis, political institutions, and policy reform: The good, the bad, and the ugly. In Bertil Tungodden, Nicholas Stern, and Ivar Kolstad, editors, Toward Pro-Poor Policies: Aid, Institutions, and Globalization; Annual World Bank Conference on Development Economics, Europe, pages 135–164. 2003.

Amos Tversky and Daniel Kahneman. The framing of decisions and the psychology of choice. Science, 211:453–458, 1981.

Amos Tversky and Daniel Kahneman. Loss aversion in riskless choice: A reference-dependent model. The Quarterly Journal of Economics, 106(4):1039–1061, 1991.

Kurt Weyland. Risk taking in latin american economic restructuring: Lessons from prospect theory. International Studies Quarterly, 40(2):185–207, 1996.