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Sovereign Debt Standstills

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Abstract

As a response to economic crises triggered by COVID-19, sovereign debt standstill proposals emphasize debt payment suspensions without haircuts on the face value of debt obligations. We quantify the effects of standstills using a standard default model. We find that a one-year standstill generates welfare gains for the sovereign equivalent to a permanent consumption increase of between 0.1% and 0.3%, depending on the initial shock. However, except when it avoids a default, the standstill also implies capital losses for creditors of between 9% and 27%, which is consistent with their reluctance to participate in these operations and indicates that this reluctance would persist even without a free-riding or holdout problem. Standstills also generate a form of "debt overhang" and thus the opportunity for a "voluntary debt exchange": complementing the standstill with haircuts could reduce creditors' losses and simultaneously increase welfare gains. Our results cast doubts on the emphasis on standstills without haircuts.

JEL Classification Numbers: F34, F41

Keywords: Debt relief, Standstill, Haircuts, COVID-19, Default, Debt Overhang, Voluntary Debt Exchange

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[1] The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

1 Introduction

As a response to COVID-19, the Group of 20 leading economies agreed to a temporary debt service standstill on bilateral official loan repayments from a group of 76 of the poorest countries. Other proposals emerged suggesting to extend standstills to private creditors and other low and middle-income countries (Bolton et al., 2020). It is often emphasized that standstills should not be accompanied by haircuts on the face value of debt obligations, to avoid the perception of creditors' losses.[1] This paper presents a quantitative evaluation of standstills that provide debt relief after the sovereign suffers a large shock. Our findings cast doubts on the emphasis of standstills without face value haircuts.

Motivated by recent proposals to extend standstills as a respond to COVID-19, we focus on a model of private creditors calibrated to a typical emerging economy. We study a sovereign default model à la Eaton and Gersovitz (1981). Following Aguiar and Gopinath (2006) and Arellano (2008), this framework is commonly used for quantitative studies of sovereign debt crises.[2] A small open economy receives a stochastic endowment stream of a single tradable good. At the beginning of each period, when the government is not in default, it decides whether to default on its long-term debt. A defaulting government faces an income cost and is temporarily prevented from issuing debt. Before the period ends, the government may change its debt positions, subject to the constraints imposed by its default decision. Bonds are priced by competitive foreign risk-neutral investors.

We evaluate the effects of a post-COVID-19 standstill by studying a suspension of debt payments after a negative endowment shock (the only shock in our stylized model) calibrated to mimic the effects of COVID-19 on the sovereign access to debt markets, as reflected in sovereign spreads (we also consider a more temporary shock to the mean endowment and that the sovereign is temporarily excluded from debt markets after the shock).[3] We find that a debt standstill would produce welfare gains for the sovereign. However, except when the standstill avoids a default, it would also produce capital losses (i.e., a decline of the market value of debt holdings) for creditors. For example, for a shock that increases sovereign spreads by 1000 basis points, we find that a one-year standstill achieves a welfare gain for the sovereign equivalent to a permanent consumption increase of 0.3% but produces a capital loss of 21% for creditors. This is consistent with the creditors' reluctance to participate in standstills, and indicates that this reluctance would persist even without a free-riding or holdout problem.

Standstills generate capital losses because debt levels are higher after the standstill (because postponed payments earn interest). Therefore, the default probability is lower during the standstill, but it is higher after the

[1] Sovereign debt restructurings have also favored the postponement of payments over haircuts. Even before COVID-19, it was proposed to require standstills (or the "reprofiling" of debt payments) before the implementation of IMF programs and to include standstills triggered by liquidity shocks in sovereign bond covenants (Barkbu et al., 2012; Brooke et al., 2011; Buiter and Sibert, 1999; Consiglio and Zenios, 2015; IMF, 2017a; IMF, 2017b; Weber et al., 2011). Hatchondo et al. (2020c), Mallucci (2020), and Phan and Schwartzman (2020) study sovereign default models that allow for debt relief after a negative shock. This debt relief affects bond prices at the time bonds are issued. In contrast, motivated by current discussions, we study one-time unanticipated debt relief policies triggered by extraordinary circumstances.

[2] This model is also used in studies of household default (Athreya et al., 2007; Chatterjee et al., 2007; Hatchondo et al., 2015; Li and Sarte, 2006; Livshits et al., 2008).

[3] Arellano et al. (2020) present a rich model of the COVID-19 pandemic and its effect on sovereign default risk. They study the effects of debt relief in the form new non-defaultable loans. We focus on the simpler standard default model and study standstills and haircuts.

standstill, and even higher than it would have ever been without a standstill. Bondholders suffer capital losses because they are not properly compensated for the increase in the default probability not only of postponed payments but also on all other payments. Creditors' losses after a standstill may be significant because after large negative shocks, the price of debt becomes very sensitive to changes in the debt level.[4]

We also find that standstills generate a form of "debt overhang" and thus the opportunity for a "voluntary debt exchange" (Hatchondo et al., 2014). This is, when implementing a standstill, including also a haircut produces a Pareto improvement for the sovereign and creditors (as a group).[5] For the example presented above, adding to the one-year standstill a haircut of 21%, eliminates creditors' losses, while increasing the sovereign's gains from 0.3% to 0.8%. Compared with the standstill without haircuts, adding to the standstill a haircut of 47% would increase the sovereign's gains to 1.8% without creating additional losses for creditors. Pareto gains from haircuts are larger when the economy is hit by a larger shock. For a large enough shock, these Pareto gains are possible even without standstills, and haircuts can simultaneously achieve welfare gains for the sovereign and capital gains for creditors. Both the negative shock and standstills contribute to the debt overhang. Overall, our results cast doubts on the emphasis on avoiding haircuts during standstills, and even more so after large shocks such as COVID-19.

The intuition behind the possibility of Pareto gains from haircuts is simple. The price of debt is very sensitive to the debt level, not only because of the negative shock but also because of the expected increase in indebtedness implied by the standstill. Thus, the decline in indebtedness implied by haircuts brings bond price increases that are significant enough to overcome the direct effect of haircuts and create capital gains.

1.1 Related literature

Since standstills are a form of debt maturity extension and debt relief can be thought of as debt restructuring, our results are related to those in studies of optimal maturity choices in debt restructurings. Aguiar et al. (2019) present a model in which it is optimal to shorten debt maturity in debt restructurings. Their result is explained by a time-inconsistency (debt dilution) problem that arises in default models with long-term debt (Arellano and Ramanarayanan, 2012; Chatterjee and Eyigungor, 2012, 2015; Hatchondo and Martinez, 2009; Hatchondo et al., 2020a, 2016; Sanchez et al., 2018): the government would like to commit to lower indebtedness and thus higher

[4] This is a standard feature of default models. While it is challenging to test empirically how the effect of debt on the bond price (or the sovereign spread) changes in crises, existing evidence is consistent with this feature. Jaramillo and Tejada (2011) document that the spread is more sensitive to increases in external public debt in countries without investment grade (which is correlated with higher spreads that are in turn correlated with lower levels of aggregate income). David et al. (2019) find the decline in spread after the announcement of fiscal consolidations is larger when the spread was already high prior to the announcement. Hatchondo et al. (2020a) document that the spread increases more with debt in years with high spread. Bi and Traum (2020) find a more significant effect of fiscal information on bond prices during crises. Gu and Stangebye (2018) present similar findings.

[5] The possibility of Pareto improvements in a situation of debt overhang due to the negative effect of debt on investment has long being recognized (Froot, 1989; Krugman, 1988a; Krugman, 1988b; Sachs, 1989). In this paper, there is a form of debt overhang even without investment, because a debt reduction (haircut) lowers default risk and thus increases the market value of debt claims. In Hatchondo et al. (2014), we show that this is consistent with changes in debt market values during debt restructuring episodes. Note that while introducing haircuts would benefit creditors as a group (and thus, creditors as a group would accept voluntarily these haircuts), this does not mean that individual creditors would accept these haircuts. This is because of the well-known free-riding or holdout problem (Wright, 2011).

bond prices in the future because (with long-term debt) this would imply it can sell bonds at a higher price today. This problem is worse with longer-maturity debt. Therefore, (at the moment of the restructuring) it is optimal to choose shorter maturities.

Dvorkin et al. (2020) and Mihalache (2020) show that in spite of the government's time inconsistency problem, it is possible to account for the extensions of maturity in the restructurings data with a richer model in which: (i) there is risk of loosing access to debt markets, (ii) there is a regulatory cost of haircuts, and (iii) restructurings occur after the economy recovers from the shock that triggered the default. Our analysis differs from theirs in several dimensions: difficulties in market access in our exercises are given by the endogenous borrowing constraint, we do not consider a regulatory cost of haircuts, and we focus on preventive debt relief at the moment the economy is hit by an adverse shock. Furthermore, Aguiar et al. (2019), Dvorkin et al. (2020), and Mihalache (2020) model the bargaining between creditors and the government and focus on restructurings that do not generate capital losses for creditors. We evaluate standstill proposals that could generate losses for creditors and study how the outcomes of these proposals could be improved with haircuts.[6]

We show that haircuts tend to be superior to standstills, which is consistent with the findings of Aguiar et al. (2019), Dvorkin et al. (2020), and Mihalache (2020). However, the mechanism behind our findings is somewhat different from the overindebtedness due to time inconsistency they highlight. We show that debt issuances are not significant during the standstill, but debt still increases because it is automatically rolled over. This distinction is important, because while limiting borrowing through conditionality or fiscal rules (Hatchondo et al., 2020b) mitigates the time inconsistency problem emphasized by Aguiar et al. (2019), Dvorkin et al. (2020), and Mihalache (2020), it would not mitigate the shortcomings of standstill (because debt issuances are not significant during standstills). In our model, the relief implied by the standstill is short-lived, and market access conditions are not favorable when the government needs to start rolling over debt after the standstill (in part because of higher debt levels due to the standstill). Therefore, the government does not want to increase its indebtedness during the standstill.

Instead of the time inconsistency problem, we emphasize that standstills and haircuts move indebtedness in the opposite direction. Standstills increase indebtedness, and thus tend to increase the default probability and the expected deadweight loss from defaults. In turn, the higher default probabilities create losses for creditors. In contrast, haircuts lower indebtedness, and thus tend to lower expected deadweight losses from defaults, and to create gains for creditors. Moreover, the combination of negative shocks and standstills generates opportunities for Pareto gains from haircuts. To the extent that the reluctance to use haircuts is due to regulation (Dvorkin et al., 2020) or to the doctrine of necessity (Bolton et al., 2020), our results indicate that the inefficiencies implied by these legal frameworks are significant. Furthermore, while our results on the advantages of haircuts over standstills

[6] Analyzing why creditors including official creditors and multilateral organizations could accept capital losses (or how losses could be imposed to private creditors, for instance, through financial repression) is beyond the scope of this paper. Bolton et al. (2020) explain that the "doctrine of necessity" in public international law recognizes that sovereigns may sometimes need to respond to exceptional circumstances that are unforeseen, unpredictable, and unavoidable, by suspending the normal performance of their contractual obligations.

are consistent with the findings against maturity extensions, we show that losses from combining haircuts with a standstill are not always significant, and are less significants for larger haircuts.

The rest of the article proceeds as follows. Section 2 introduces the model. Section 3 presents the results. Section 4 concludes.

2 The model

We present the simplest version of the default model with long-term debt and a standard calibration.

2.1 Environment

The government has preferences given by

$$\mathbb{E}_t \sum_{j=t}^{\infty} \beta^{j-t} u\left(c_j\right),$$

where $\mathbb{E}$ denotes the expectation operator, β denotes the subjective discount factor, and c_t represents consumption of private agents. The utility function is strictly increasing and concave. The government cannot commit to future (default and borrowing) decisions.

The timing of events within each period is as follows. First, the government learns the economy's income. After that, the government chooses whether to default on its debt. Before the period ends, the government may change its debt positions, subject to the constraints imposed by its default decision.

The economy's endowment of the single tradable good is denoted by $y \in Y \subset \mathbb{R}_{++}$. This endowment follows a Markov process.

As in Hatchondo and Martinez (2009), a bond issued in period t promises an infinite stream of coupons, which decreases at a constant rate δ. Hence, debt dynamics can be represented as follows:

$$b_{t+1} = (1-\delta)b_t + l_t,$$

where b_t is the number of coupons due at the beginning of period t, and l_t is the number of long-term bonds issued in period t. Bonds are priced in a competitive market inhabited by a large number of risk-neutral foreign investors that discount future payoffs at the risk-free rate, r.

When the government defaults, it does so on all current and future debt obligations. A default event triggers exclusion from the debt market for a stochastic number of periods. Furthermore, income is given by $y - \phi\left(y\right)$ in every period in which the government is excluded from debt markets. Starting the first period after the default period, with a constant probability $\psi \in [0,1]$, the government may regain access to debt markets. The government exits default without debt (Appendix A shows that our findings are robust to relaxing this standard assumption in the literature).

2.2 Recursive formulation

Let b denote the number of outstanding coupon claims at the beginning of the current period, and b' denote the number of outstanding coupon claims at the beginning of the next period. Let d denote the current-period default decision. We assume that d is equal to 1 if the government defaulted in the current period and is equal to 0 if it did not. Let V denote the government's value function at the beginning of a period, that is, before the default decision is made. Let V_0 denote the value function of a sovereign not in default. Let V_1 denote the value function of a sovereign in default. Let F denote the conditional cumulative distribution function of the next-period endowment y'. For any bond price function q, the function V satisfies the following functional equation:

$$V(b,y) = \max_{d\epsilon\{0,1\}} \{dV_1(y) + (1-d)V_0(b,y)\}, \tag{1}$$

where

$$V_1(y) = u\left(y - \phi\left(y\right)\right) + \beta \int \left[\psi V(0,y') + (1-\psi)\, V_1(y')\right] F\left(dy' \mid y\right), \tag{2}$$

and

$$V_0(b,y) = \max_{b' \geq 0} \left\{ u\left(y - b + q(b',y)\left[b' - (1-\delta)b\right]\right) + \beta \int V(b',y') F\left(dy' \mid y\right) \right\}. \tag{3}$$

The bond price is given by the following functional equation:

$$q(b',y) \quad = \quad \frac{1}{1+r}\int \left[1 - \hat{d}\left(b',y'\right)\right] F\left(dy' \mid y\right) + \frac{1-\delta}{1+r}\int \left[1 - \hat{d}\left(b',y'\right)\right]\, q(\hat{b}(b',y'),y')F\left(dy' \mid y\right), \tag{4}$$

where $\hat{d}$ and $\hat{b}$ denote the future default and borrowing rules that lenders expect the government to follow. The default rule $\hat{d}$ is equal to 1 if the government defaults, and is equal to 0 otherwise. The function $\hat{b}$ determines the number of coupons that will mature next period.

2.3 Equilibrium definition

A Markov Perfect Equilibrium is characterized by

1. a default rule $\hat{d}$ and a borrowing rule $\hat{b}$,
2. a bond price function q,

   such that:

(a) given $\hat{d}$ and $\hat{b}$, the bond price function q is given by equation (4); and

Table 1: Benchmark parameter values.

Risk aversion	γ	2	Standard
Risk-free rate	r	1%	Standard
Discount factor	β	0.9745	Standard
Probability default ends	ψ	0.083	$\mathbb{E}$(exclusion) = 3 years
Debt duration	δ	0.033	Debt duration = 5 years
Income autocorrelation coefficient	ρ	0.94	Mexico GDP
Standard deviation of innovations	σ_ϵ	1.5%	Mexico GDP
Mean log income	μ	(-1/2)σ_ϵ^2	Mexico GDP
Calibrated to match targets			
Income cost of defaulting	λ_0	0.183	Average debt =44%
Income cost of defaulting	λ_1	1.343	Average spread =3.4%

(b) the default rule $\hat{d}$ and borrowing rule $\hat{b}$ solve the dynamic programming problem defined by equations (1)-(3), when the government can trade bonds at q.

2.4 Calibration

We use the standard calibration presented by Hatchondo and Martinez (2017). The utility function displays a constant coefficient of relative risk aversion, i.e.,

$$u(c) = \frac{c^{1-\gamma} - 1}{1-\gamma}, \text{ with } \gamma \neq 1.$$

The endowment process follows:

$$\log(y_t) = (1-\rho)\mu + \rho \log(y_{t-1}) + \varepsilon_t,$$

with $|\rho| < 1$, and $\varepsilon_t \sim N\left(0, \sigma_\epsilon^2\right)$. As in Chatterjee and Eyigungor (2012), we assume a quadratic loss function for income during a default episode $\phi(y) = \max\{y[\lambda_0 + \lambda_1[y - \mathbb{E}(y)]], 0\}$.

Table 1 presents the benchmark values given to all parameters in the model. A period in the model refers to a quarter. The coefficient of relative risk aversion, the risk-free interest rate, and the discount factor β take standard values. We assume an average duration of sovereign default events of three years ($\psi = 0.083$), following Dias and Richmond (2007).

For choosing the parameters that govern the endowment process, the level and duration of debt, and the mean spread, the calibration uses data from Mexico, a common reference for studies on emerging economies. Unless we explain otherwise, we compare simulation results with data from Mexico from the first quarter of 1980 to the fourth quarter of 2011. The parameter values that govern the endowment process are chosen to mimic the behavior of GDP in Mexico during that period.

We set $\delta = 3.3\%$. With this value and our target for the average spread, bonds have an average duration of

Table 2: Business Cycle Statistics

	Model	Data
Targeted moments		
Mean Debt-to-GDP	44	44
Mean spread (r_s)	3.4	3.4
Non-Targeted moments		
$\sigma(c)/\sigma(y)$	1.4	1.2
$\sigma(tb)$	0.8	1.4
$\sigma(r_s)$	1.5	1.5
$\rho(tb, y)$	-0.8	-0.7
$\rho(c, y)$	0.99	0.93
$\rho(r_s, y)$	-0.7	-0.5
$\rho(r_s, tb)$	0.9	0.6

Note: Debt levels in the simulations are calculated as the present value of future payment obligations discounted at the risk-free rate ($b(1+r)(\delta+r)^{-1}$) and reported as a percentage of annualized income. The standard deviation of x is denoted by $\sigma(x)$. The coefficient of correlation between x and z is denoted by $\rho(x, z)$. Moments are computed using detrended series. Trends are computed using the Hodrick-Prescott filter with a smoothing parameter of $1,600$. Moments for the simulations correspond to the mean value of each moment in 250 simulation samples, with each sample including 120 periods (30 years) without a default episode. Simulation samples start at least five years after a default. Default episodes are excluded to improve comparability with the data. Consumption and income are expressed in logs.

5 years in the simulations, which is roughly the average debt duration observed in Mexico according to Cruces et al. (2002). The parameters of the income cost of defaulting λ_0 and λ_1 are calibrated targeting an average debt-to-GDP ratio of 44 percent and a mean spread of 3.4 percent. We solve the model using value function iteration and interpolation (Hatchondo et al., 2010).

2.5 Simulations

Table 2 shows that the model simulations match the targeted levels of debt and spread. The model also does a good job in mimicking other non-targeted moments.

2.6 The shock

The main purpose of this paper is to present a quantitative evaluation of proposals to use a sovereign debt standstill to mitigate the economic effects of COVID-19. The only shock in our stylized model is a shock to the endowment. And the key for evaluating the benefits of a standstill is how the shock impacts the government's access to debt markets, which is reflected in the sovereign spread. Thus, we study debt relief after the economy suffers a large endowment shock that produces a sizable increase in the sovereign spread.

We focus on an economy that starts with debt and endowment levels equal to the respective mean values in the simulations, and is hit with one of three possible endowment shocks. The "small" shock is such that the sovereign spread increases by 250 basis points ($y = 0.9681$), which is consistent with the increase of the Emerging Market Bond Index (EMBI) spread between December 2019 and April 2020 in Mexico and other economies that preserved market access after COVID-19. The "large" shock is such that the spread increases by 1000 basis points ($y = 0.9475$). This represents the shock faced by sub-investment grade borrowers that had more difficulties accessing debt markets after COVID-19. For example, in Sub-Saharan Africa, sovereign spreads increased 1,000 basis points, on average, with COVID-19 (IMF, 2020). This shock could also become the more common shock if the COVID-19 crisis is not resolved soon enough. The "default" shock is the smallest shock that would trigger a default ($y = 0.934$) and thus is such that a standstill would prevent the default.[7] We refer to these three shocks as our "baseline" shocks.

To illustrate the robustness of our findings, we also consider two other sets of shocks. First, one could argue that our baseline shocks are relatively small and more persistent than the COVID-19 shock, and that this could be important for evaluating standstills that attempt to deal with COVID-19 with a temporary debt relief. To address these concerns, we also study a set of "temporary" shocks such that mean income declines by χ for four quarter and then recovers by $\chi/4$ in the next four quarters (coming back to its benchmark value in two years). The criteria for finding the size of our three baseline shocks (spread increases of 250 and 1000 basis points, and default) implies $\chi = 5.7\%$, $\chi = 8.9\%$, and $\chi = 9.5\%$.

Second, one could think that the temporary payment suspension implemented through a standstill is particularly useful when the shock is accompanied by a complete loss of access to debt markets (a market freeze of sorts). To address this concern, we add to the baseline shocks defined above a constraint that does not allow the government to borrow during the first four periods after the shock hits (this constraint has been used in the literature to model sudden stops).

2.7 Standstills

A standstill consists of the following:

1. The period of the shock, lenders and the government enter in an debt standstill agreement that lasts for T^{DS} periods.

2. During each of these T^{DS} periods, the government is exempt from making debt payments and the stock of debt grows at the rate r^{DS}.

3. The government can issue debt during the standstill, and as the payments of pre-standstill debt, new debt payments start after the standstill is over (this allows us to analyze standstills without incorporating different

[7] There is a narrow set of income levels for which the government would choose to default without a standstill but would choose to repay with a standstill (between 0.9207 and 0.934 for a one-year standstill).

debt instruments and thus additional endogenous state variables).

4. A default ends the standstill.

We assume that $r^{DS} = 1.85\%$, which is equal to the risk-free rate plus the average (quarterly) spread. This assumption is consistent with the stated intention of implementing standstills that do not produce losses to creditors in present value terms. Analyzing different values of r^{DS} is equivalent to introducing haircuts (which we do later).

3 Results

This section evaluates the effects of standstills after the economy suffers a large shock.

3.1 Sovereign's gains and creditors' losses

Figure 1 summarizes the effects of introducing a standstill to mitigate the effects of adverse shocks. As expected, the sovereign enjoys welfare gains from the standstill and welfare gains are increasing with respect to the duration of the standstill. The government gains from standstills because payments that were due during the standstill are replaced by future payments, and creditors are not properly compensated for the default probability of these future payments (after large negative shocks, the spread is higher than the average reflected in r^{DS}; Figure 3).

Figure 1 also shows that except when they avoid a default (right panels), standstills generate capital losses for creditors, with these losses defined as the decline in the market value of debt holdings:

$$MV(b, y) = b\left[1 - \hat{d}(b, y)\right]\left[1 + (1 - \delta)q(\hat{b}(b, y), y)\right]$$

without standstills, and

$$MV^{DS_j}(b, y) = b\left[1 - \hat{d}^{DS_j}(b, y)\right](1 + r^{DS})q^{DS_j}(\hat{b}^{DS_j}(b, y), y)$$

with a standstill, where $\hat{d}^{DS_j}$, $\hat{q}^{DS_j}$, and $\hat{b}^{DS_j}$ denote the equilibrium function in period j of the debt standstill. There are two sources of the creditors' losses triggered by the standstill. First, as explained before, creditors are not properly compensated for the payments postponed during the standstill. Second, standstills increase debt levels and thus the default probability after the standstill (Figure 3). Creditors' losses underscore a possible limitation of standstill proposals: while a standstill would be beneficial for the sovereign, it may be difficult to convince private creditors to accept the standstill, even without considering free-riding or holdout problems. The right panels of Figure 1 illustrate how standstills can only generate capital gains when they prevent a default.

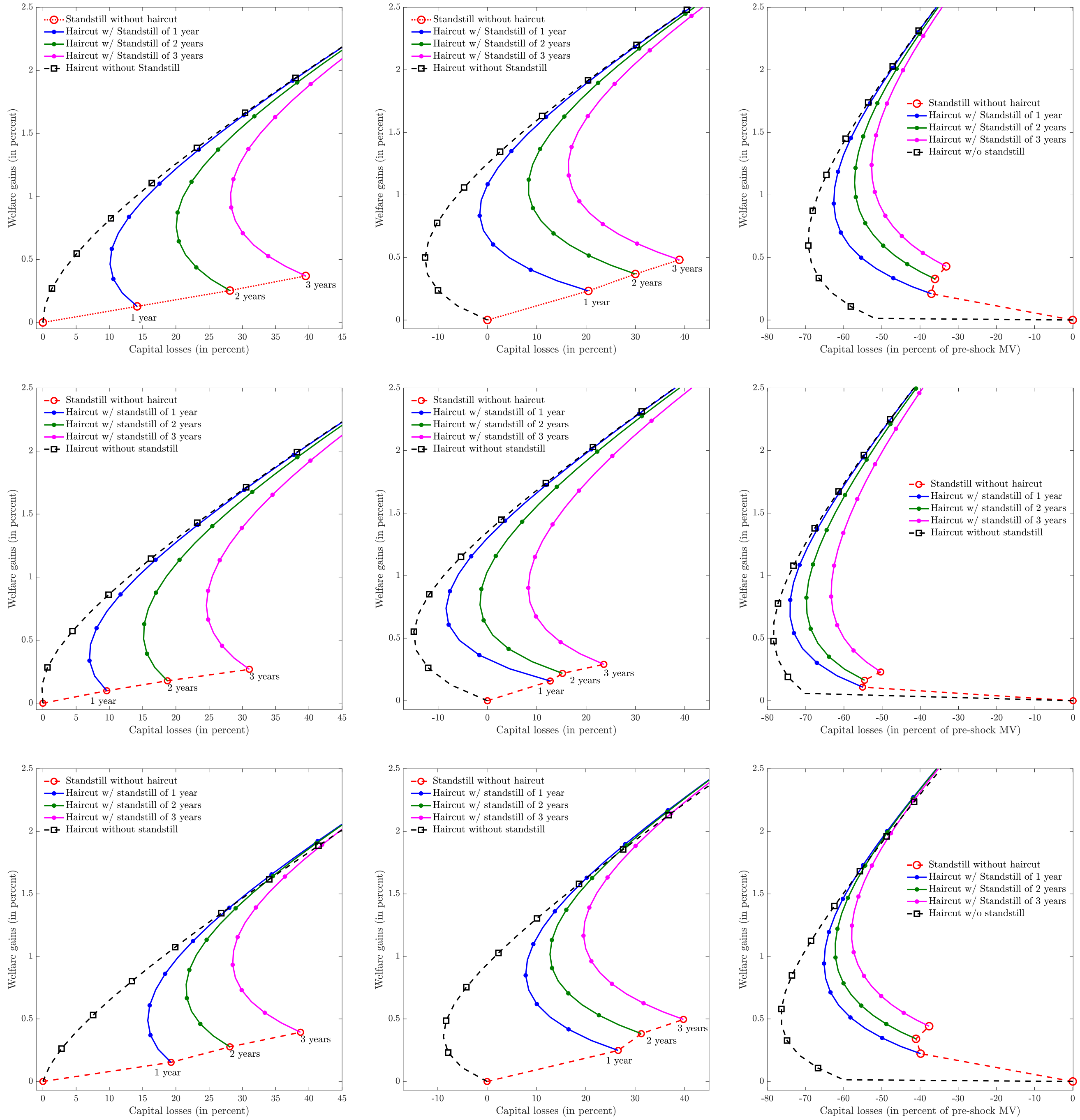

Figure 1: Sovereign's welfare gains and creditors' capital losses from implementing debt relief. Welfare gains are measured as the equivalent per-period permanent consumption increase. The red curve corresponds to standstills without haircuts. In the other curves, from bottom to top, each mark represents an increase in haircuts of 7%. From left to right, panels corresponds to the small, large, and default shock. Top panels are for our baseline shocks. Middle panels are for the more temporary shocks. Bottom panels include the sudden stop shock.

3.2 Combining standstills with haircuts

The previous subsection established that standstills, a form of debt relief, can produce welfare gains for the sovereign but at the same time they produce capital losses for creditors (except for the situations in which they avoid a default). Following existing proposals we assumed that there is no haircut in the face value of sovereign debt. In this subsection, we focus on the possibility of combining standstills with haircuts (a reduction of the nominal level of indebtedness of the sovereign).

Figure 1 also presents gains from introducing standstills combined with haircuts. As expected, the sovereign enjoys welfare gains if its debt is reduced, and these gains are increasing with respect to the size of the haircut.

Furthermore, in contrast with standstills, haircuts may generate capital gains for creditors, even after shocks that would not trigger a default. In particular, haircuts could mitigate capital losses triggered by standstills. This occurs because, as illustrated in the top panels of Figure 2, standstills trigger a form of sovereign debt overhang in that a debt reduction would benefit creditors by increasing the probability of repayment and then the market value of their debt holdings (recall the initial debt level is 44%). The market value increases with the debt stock until additional debt produces a large enough decline in bond prices (because of a large enough increase in the default probability), which occurs for high enough debt levels. Both a negative shock and standstills contract the debt market value curve. After a standstill, the initial debt level is in the declining portion of the market value curve, even for the small shock. This gives room for haircuts that increase the market value. For the large shocks, this possibility arises even without a standstill (note that the sovereign and the creditors' gains from haircuts would be more pronounced in a model in which the decline of sovereign risk implied by haircuts has a positive effect on aggregate income).

The bottom panels of Figure 2 illustrate how bond prices typically decline more with an increase in the debt level when default risk is higher, which occurs when income is lower or when the debt level is higher. Therefore, both the negative shock and the standstill (that is expected to increase the debt level; Figure 3) increase the sensitivity of the bond price to the debt level. In particular, with standstills, the price of debt starts declining sharply for lower debt levels and, thus, the market value curve peaks at lower debt levels. This makes more likely that the initial debt level is on the decreasing section of the curve, creating room for market-value-increasing haircuts.

The hump shape of the debt market value curves implies that capital losses (or gains) triggered by haircuts are non-monotonic with respect to the size of the haircut. For instance, for the baseline large shock combined with a one-year standstill, there is an agreement zone for haircuts up to 21%: both the sovereign and creditors (as a group) benefit from higher haircuts. This is, any haircut lower than 21%, including the standstill without a haircut, would be an inefficient debt relief from the perspective of the sovereign's welfare and the creditor's capital losses. While haircuts are often referred to as a measure of creditors' losses, our analysis illustrates that haircuts are a measure of debt relief for the sovereign, but could produce (capital) gains for creditors.

For haircuts between 21% and 47%, there is a disagreement zone: while the sovereign prefers higher haircuts,

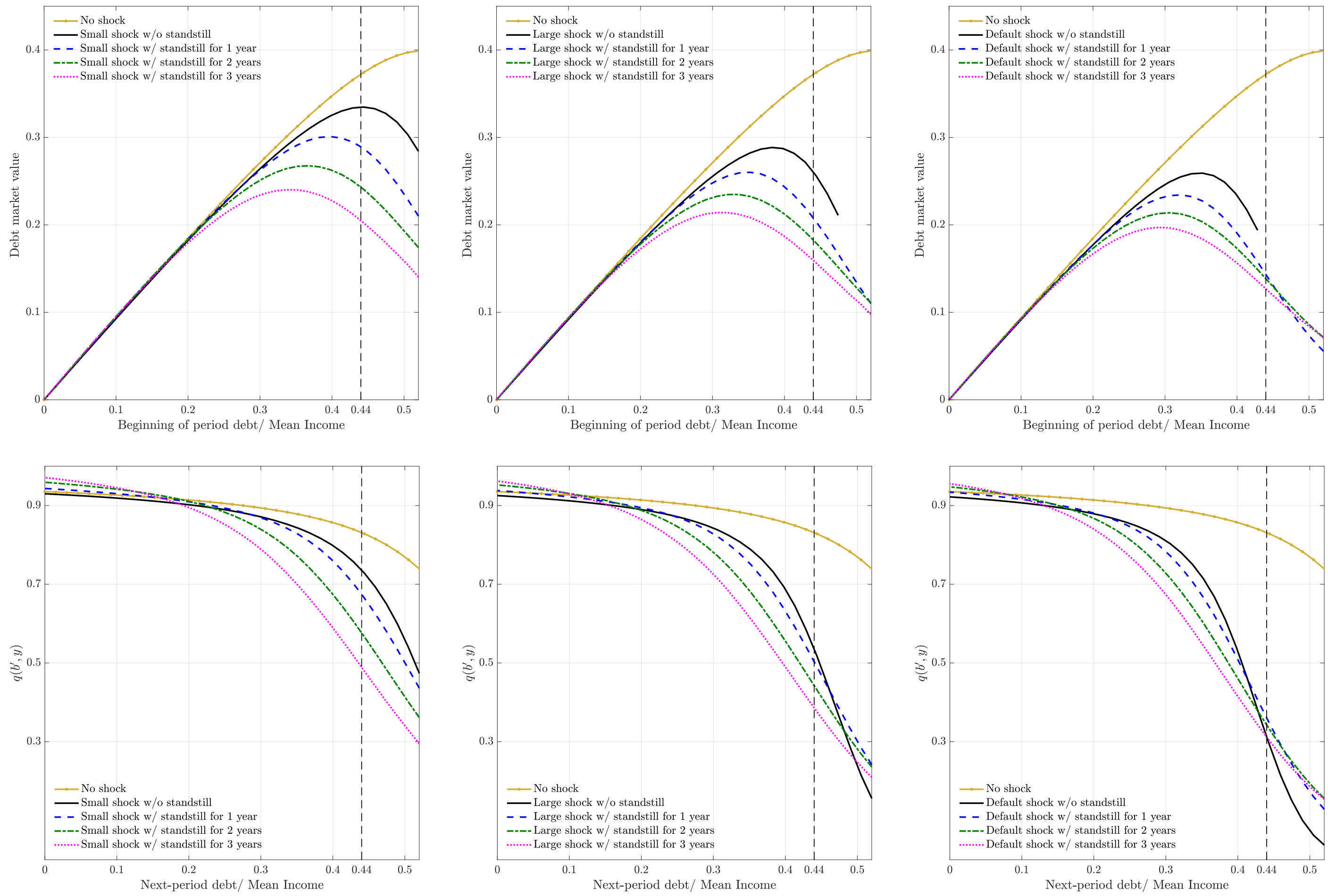

Figure 2: Debt market value and debt price. The dashed vertical line marks the initial debt level. The figure focuses on our baseline shocks.

lenders prefer lower haircuts, but lenders still have capital gains from haircuts compared with the standstill-only debt relief. This disagreement zone includes all possible efficient outcomes of a debt relief with a one-year standstill. Only for haircuts higher than 47% there are creditors' losses in addition to those triggered by the standstill.

Figure 1 shows that except when we incorporate the sudden stop shock (bottom panels), haircuts dominate standstills as instruments of debt relief: for any level of capital losses that could be imposed to creditors, implementing the debt relief only with a haircut produces a larger welfare gain than combining the haircut with a standstill. After the large shocks, haircuts can even achieve simultaneously capital gains for creditors and welfare gains for the sovereign. This cannot be achieved with standstills alone and is more difficult to achieve combining standstills with haircuts. With the sudden stop shocks, the government cannot borrow and thus one could expect that a standstill that suspends all debt payments could be a more adequate form of debt relief than haircuts that only reduce debt payments. However, the bottom panels of Figure 1 illustrate that the comparative advantage of haircuts over standstills remains significant: adding a standstill to haircuts can only improve welfare slightly, and does so only for haircuts of more than 30% (this is the case even when we assume that the debt reduction implied by haircuts does not improve market access during the sudden stop).

Haircuts dominate standstills because while the former reduce indebtedness and thus the default probability, the latter increase indebtedness and the default probability (Figure 3). Thus, while haircuts tend to lower expected deadweight losses from defaults and to create creditors' gains, standstills tend to increase expected deadweight losses from defaults and to create creditors' losses. Appendix B presents a stylized model that illustrates this mechanism.

Figure 1 also shows that while haircuts appear superior to standstills, losses from combining haircuts with a standstill are not always significant, and are less significant for debt reliefs that include large haircuts. Consider again the baseline large shock (top middle panel) and the one-year standstill, which without haircuts would trigger a 21% capital loss. For this loss, the inefficiency of combining haircuts with a one-year standstill is negligible: almost the same welfare gain can be obtained with either a 47.3% haircut alone or combining a 47.1% haircut with a one-year standstill. For the low debt levels implied by such large haircuts, the standstill is not expected to produce a significant increase in indebtedness (Figure 3), and therefore, standstills do not produce significant inefficiencies in the debt relief.

3.3 Dynamics after the shock

Figure 3 presents impulse response functions for key variables after the baseline large shock (this is the only non-zero shock throughout the simulations presented in the figure). We consider five sets of simulations: (i) without debt relief, (ii) with a one-year standstill only, (iii) with the one-year standstill and the 20.9% haircut that minimizes creditor losses given the standstill, (iv) with the one-year standstill and the 47.1% haircut that maximizes the government's gains without additional creditor losses given the standstill, (v) without standstill and with the 47.3% haircut that produces the same capital losses as option (iv).

The figure shows that the standstill worsens the government's market access: on top of the spread increase because of the shock, the spread increases by and additional 800 basis points because of the standstill, and is higher than without debt relief throughout the projection period. The higher spread reflects higher post-standstill default probabilities triggered by the standstill, in spite of lower default probabilities during the standstill, and accounts for the significant capital loss triggered by the standstill. Higher default probabilities are explained by higher debt levels. While issuances are lower with the standstill, debt levels are higher because of the debt that is automatically rolled over during the standstill.[8] Relatedly, while borrowing is lower during the standstill, net

[8]The expectation of poor borrowing conditions even leads the government to buy back debt (negative debt issuances) before the standstill is over. It should be noticed that while a debt buyback after the shock may seem counterfactual, it is not an important feature of our exercise. Without the buyback (for example, if we allow the government to save by accumulating assets, or we assume the government needs to face extraordinary expenditures because of the shock), our results would be even stronger: the larger debt increase because of the standstill would lead to an even larger decline of the debt market value. Buybacks are rarely observed in default models because the government does not benefit from the increase in bond prices implied by a buyback (Aguiar et al., 2019;

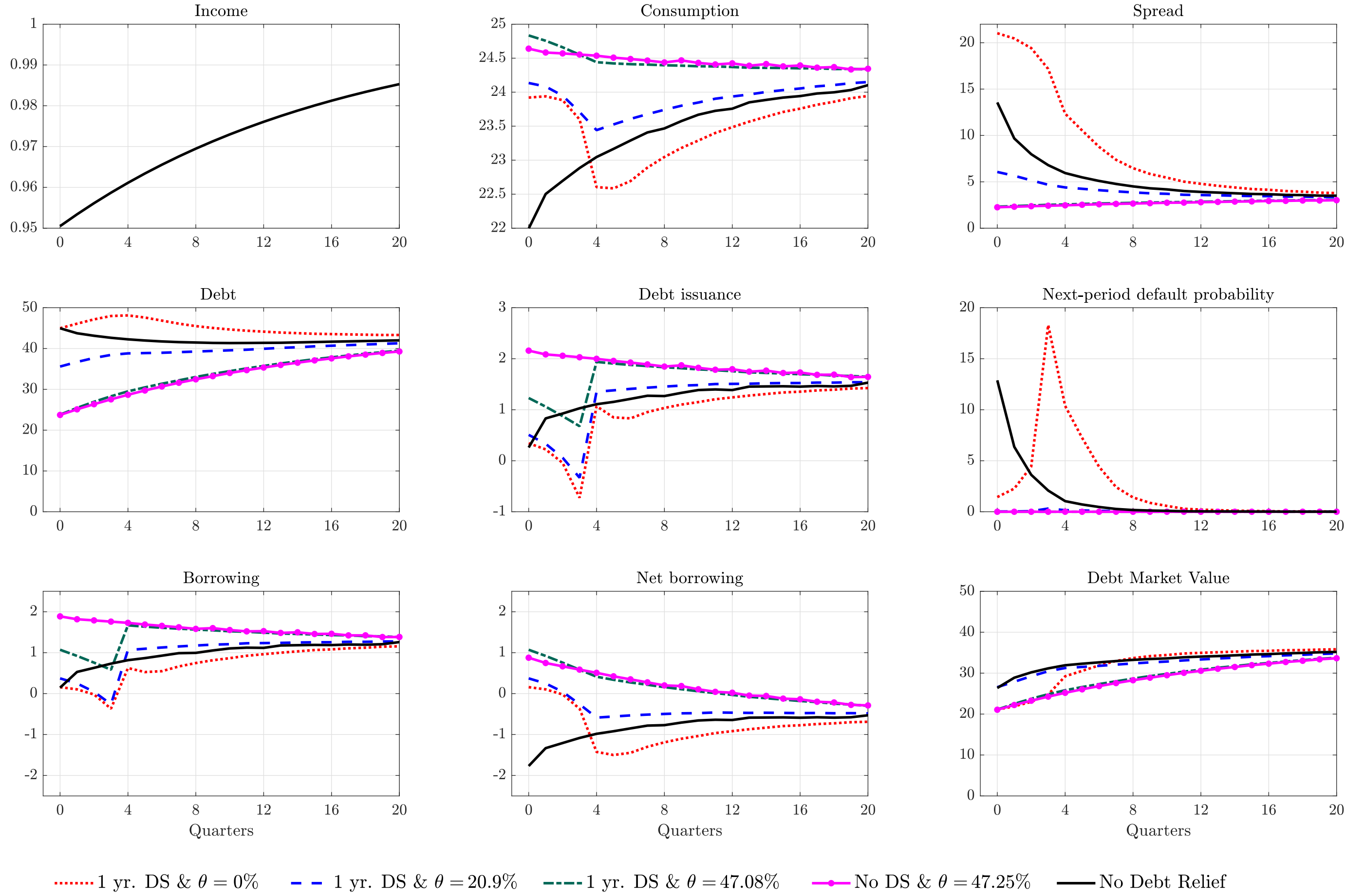

Figure 3: Impulse response functions for the baseline large shock. The size of the haircut is denoted by θ. Consumption, the spread, debt, issuances, and borrowing are presented as percentage points. Consumption, debt issuances, and borrowing are divided by mean annual income. The spread and the bond price corresponds to the end-of-period equilibrium debt level. Beginning-of-period debt is divided by annualized income.

borrowing (net of debt payments) is higher.

During the year of the standstill, all debt relief alternatives mitigate significantly the drop in consumption triggered by the shock. However, by itself, the standstill reduces consumption in every period after the first year. This is the case because of poor borrowing conditions and larger net debt payments (more negative net borrowing) after the standstill.

In contrast, when the standstill is combined with the 20.9% haircut, consumption is even higher during the standstill, and is significantly higher, and higher than without debt relief, throughout the projection period. At the same time, spreads are significantly lower, and the debt market value is close to the one without debt relief. This is the case because the haircut eliminates the debt overhang situation created by the combination of the negative shock and the standstill.

Bulow and Rogoff, 1988, 1991).

Figure 3 also illustrates how including a standstill in the debt relief package does not always generate significant inefficiencies. A one-year standstill with a 47.1% haircut and a 47.3% haircut without a standstill generate almost identical paths for the debt level and the spread (and thus for the debt market value). These two debt relief packages also generate similar paths for consumption and they result in almost identical welfare gains for the sovereign (Figure 1).

4 Conclusions

The findings in this paper cast doubts on the emphasis on sovereign debt standstills without haircuts as the best alternative for providing debt relief to countries suffering because of COVID-19. Standstills produce a sovereign debt overhang and thus the opportunity for a voluntary debt exchange: adding haircuts to standstills can improve the government's welfare while lowering creditors' losses. To the extent that the emphasis on standstills without haircuts is the result of the regulatory cost of reductions in the nominal value of debt holdings (Dvorkin et al., 2020) or the doctrine of necessity (Bolton et al., 2020), our results underscore that these legal frameworks could create significant inefficiencies in debt relief outcomes.

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Appendix

A A positive recovery rate

In this appendix, we show that our main results are robust to assuming a positive recovery rate on defaulted debt. In particular, we assume that after a default event, debt is not vanished but instead is equal to a fraction of the mean debt in the simulations. This specification implies that the recovery rate decreases with debt, as documented by, for example, Sunder-Plassmann (2018).

Formally, the recursive formulation of the model with positive recovery is:

$$V(b,y) = \max_{d\epsilon\{0,1\}} \{dV_1(b,y) + (1-d)V_0(b,y)\},$$

where the value of default is:

$$V_1(b,y) = u\left(y - \phi\left(y\right)\right) + \beta \int \left[\psi V(b_D, y') + (1-\psi)\, V_1(b_D, y')\right] F\left(dy' \mid y\right),$$

and $b_D = \min\{\alpha, b\}$ is the 'recovered' debt level. The value of repayment is:

$$V_0(b,y) = \max_{b' \geq 0} \left\{ u\left(y - b + q(b',y)\left[b' - (1-\delta)b\right]\right) + \beta \int V(b',y')F\left(dy' \mid y\right) \right\}.$$

subject to

$$b' \quad > \quad (1-\delta)b \quad \text{only if} \quad q(b',y) > \underline{q},$$

where the constraint precludes the government from issuing bonds below the price $\underline{q}$.[9] The bond price is given by the following functional equation:

$$\begin{aligned} q(b',y) \quad &= \quad \frac{1}{1+r} \int \left[1 - \hat{d}\left(b',y'\right)\right] \left[1 + (1-\delta)\, q(\hat{b}(b',y'),y')\right] F\left(dy' \mid y\right), \\ &\quad + \frac{1}{1+r} \int \hat{d}\left(b',y'\right) q^D(b',y')F\left(dy' \mid y\right) \end{aligned}$$

where

$$\begin{aligned} q^D(b,y) \quad &= \quad \frac{1-\psi}{1+r} \int \frac{b_D}{b} q^D(b_D,y')F\left(dy' \mid y\right) \\ &\quad + \frac{\psi}{1+r} \int \left[1 - \hat{d}\left(b_D,y'\right)\right] \frac{b_D}{b} \left[1 + (1-\delta)\, q\left(\hat{b}(b_D,y'),y'\right)\right] F\left(dy' \mid y\right) \\ &\quad + \frac{\psi}{1+r} \int \hat{d}\left(b_D,y'\right) \frac{b_D}{b}\, q^D(b_D,y')F\left(dy' \mid y\right) \end{aligned}$$

denotes the price of a bond in default.

[9] With a positive recovery rate and long-term debt, the period before defaulting, the government may want to issue an infinite amount of debt that fully dilutes the value of previous debt claims, financing a consumption boom. As in Hatchondo et al. (2016), in order to avoid this problem, we assume that the government cannot sell bonds with a price lower than $\underline{q}$. We choose a value of $\underline{q}$ that (i) eliminates consumption booms before defaults, (ii) is never binding in the simulations, and (iii) allows for debt issuances at the sovereign spread levels observed in the data.

Calibration and model fit

We need to assign values to two new parameters: α and $\underline{q}$. We assume that $\underline{q} = \frac{0.5}{r+\delta}$, which is never binding in the simulations. This value for $\underline{q}$ implies that the government can never issue debt at a price lower than 50% of the risk-free price. We set $\alpha = 0.62$, which amounts to 35% of the mean debt in the simulations and is thus consistent with the average haircut of 65% reported by Cruces and Trebesch (2013) for debt restructurings with reductions in face value (as the ones we model).

We recalibrate the parameters of the income cost of defaulting, λ_0 and λ_1, to match the same moments we targeted in the main body of the paper: an average debt-to-GDP ratio of 44 percent and a mean spread of 3.4 percent. All other parameter values remain unchanged. Table A.1 reports all the parameter values.

Table A.1: Parameter values.

Risk aversion	γ	2	Standard
Risk-free rate	r	1%	Standard
Discount factor	β	0.9745	Standard
Probability default ends	ψ	0.083	$\mathbb{E}$(exclusion) = 3 years
Debt duration	δ	0.033	Debt duration = 5 years
Income autocorrelation coefficient	ρ	0.94	Mexico GDP
Standard deviation of innovations	σ_ϵ	1.5%	Mexico GDP
Mean log income	μ	(-1/2)σ_ϵ^2	Mexico GDP
Price floor	$\underline{q}$	$0.5/(\delta + r)$	never binding
Recovered debt	α	0.62	35% recovery rate
Calibrated to match targets			
Income cost of defaulting	λ_0	0.15	Average debt =44%
Income cost of defaulting	λ_1	1.33	Average spread =3.4%

Table A.2 shows that the model simulations (with positive recovery) match the targeted levels of debt and spread. The model with recovery also does a good job in mimicking other non-targeted moments.

Table A.2: Business Cycle Statistics

Targeted moments		
	Model (w/ recovery)	Data
Mean Debt-to-GDP	44	44
Mean r_s	3.4	3.4
Non-Targeted moments		
$\sigma(c)/\sigma(y)$	1.3	1.2
$\sigma(tb)$	0.6	1.4
$\sigma(r_s)$	1.3	1.5
$\rho(tb, y)$	-0.8	-0.7
$\rho(c, y)$	0.99	0.93
$\rho(r_s, y)$	-0.8	-0.5
$\rho(r_s, tb)$	0.7	0.6

Robustness of the main results

In this section, we show that the main insights of our paper are robust to assuming a positive recovery rate for defaulted debt. We focus on the more realistic "temporary" shocks defined in the paper (drops of mean income). The "small" shock increases spread by 250 bps (3.6% decline of mean income) and the "large" shock by 1000 bps (7.1% decline). The "default" shock is the smallest decline that triggers a default without standstills (and thus is such that the government repays with a standstill; 7.6%).

Figure A.1 presents the effects of different forms of debt relief when we assume a positive recovery rate. As it was the case in the no-recovery model, standstills produce welfare gains for the sovereign but, except when they avoid a default (right panel), they produce capital losses for lenders.[10] In general, capital losses triggered by a standstill can be mitigated with haircuts that also increase sovereign welfare.[11] Using only haircuts continues to be the best form of debt relief, but losses from combining haircuts with a standstill are less significant for larger haircuts.

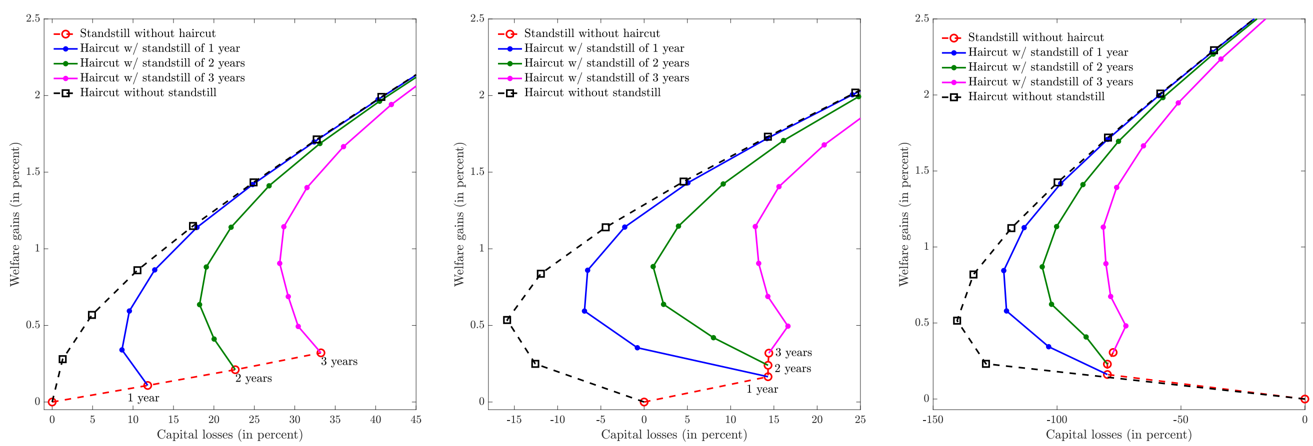

Figure A.1: Sovereign's welfare gain and creditors' capital losses in the economy with positive recovery. This figure is the counterpart to Figure 1's middle row in the main body of the paper.

[10] The debt market value is

$$MV(b,y) = b\left[1-\hat{d}(b,y)\right]\left[1+(1-\delta)q(\hat{b}(b,y),y)\right] + b_D\,\hat{d}(b,y)\,q^D\,(b_D,y)$$

without standstills and

$$MV^{DS_j}(b,y) = b\left[1-\hat{d}^{DS_j}(b,y)\right](1+r^{DS})q^{DS_j}(\hat{b}^{DS_j}(b,y),y)] + b_D\,\hat{d}^{DS_j}(b,y)\,q^D\,(b_D,y)$$

with standstills.

[11] In contrast with the exercises in the paper, Figure A.1 shows that for the larger shocks, haircuts do not mitigate significantly the capital losses triggered by the the 3 years standstill. The expected increase in indebtedness during the 3 years standstill would undo the positive effect of haircuts on the default probability, undermining the possibility of Pareto gains from haircuts. Note however, that haircuts can still increase significantly the sovereign's welfare gains, and that the 3 years standstill is strongly Pareto dominated by other forms of debt relief.

B A two-period model

We next present a stylized two-period model that illustrates why haircuts may be preferable over standstills for providing debt relief.

Environment. There are two periods, 1 and 2. Both the borrower and lenders are risk neutral. The borrower discounts next-period payoffs at rate β. The borrower's initial debt is given by $b > 0$ legacy bonds. Each legacy bond pays a coupon of δ units in period 1 and a principal of 1 unit in period 2. The borrower cannot issue debt (there is a sudden stop in period 1) and there is no income. The borrower can only default in period 2. There is a stochastic resource/utility cost of defaulting ϕ. The pdf for ϕ is denoted by f and its cdf by F. The density f is continuous.

Value under repayment. The government defaults in period 2 if $b > \phi$. Thus, the borrower repays b with probability $1 - F(b)$ and its expected utility in default states is $-\int_{-\infty}^{b} \phi f(\phi) d\phi$. This implies that in period 1, a borrower that starts with b bonds expects a continuation value of

$$V(b) = -\delta b - \beta[1 - F(b)]b - \beta \int_{-\infty}^{b} \phi f(\phi) d\phi.$$

Bond price. The price of a bond at the beginning of period 1 satisfies

$$q(b) = \delta + 1 - F(b).$$

Standstill. A standstill consists on postponing the payment of the δb coupons maturing in period 1. The value of repaying with a standstill satisfies

$$V^S(b) = -\beta \left[1 - F(b(1+\delta))\right] b(1+\delta) - \beta \int_{-\infty}^{b(1+\delta)} \phi f(\phi) d\phi,$$

and the bond price with a standstill satisfies

$$q^S(b) = \left[1 - F(b(1+\delta))\right](1+\delta).$$

Proposition 1 *The borrower is better off and bondholders are worse off with the standstill: $V^S(b) > V(b)$ and $q^S(b) < q(b)$ $\forall b$.*

Proof.

$$\begin{aligned}
V(b)-V^S(b) &= -\delta b-\beta[1-F(b)]b-\beta\int_{-\infty}^{b}\phi f(\phi)d\phi+\beta\left[1-F(b(1+\delta))\right]b(1+\delta)+\beta\int_{-\infty}^{b(1+\delta)}\phi f(\phi)d\phi \\
&= -\delta b-\beta[1-F(b)]b+\beta\left[1-F(b(1+\delta))\right]b(1+\delta)+\beta\int_{b}^{b(1+\delta)}\phi f(\phi)d\phi \\
&\leq -\delta b-\beta[1-F(b)]b+\beta\left[1-F(b(1+\delta))\right]b(1+\delta)+\beta\left[F(b(1+\delta))-F(b)\right]b(1+\delta) \\
&\leq -\delta b-\beta F(b)b\delta+\beta b\delta \\
&\leq -\delta b[1-\beta(1-F(b))]<0,
\end{aligned}$$

where the inequality stems from replacing $\int_b^{b(1+\delta)}\phi f(\phi)d\phi$ with $\left[F(b(1+\delta))-F(b)\right]b(1+\delta)$.

$$\begin{aligned}
q(b)-q^S(b) &= \delta+1-F(b)-\left[1-F(b(1+\delta))\right](1+\delta) \\
&= F(b(1+\delta))-F(b)+\delta F(b(1+\delta))>0.
\end{aligned}$$

■

Intuitively, the borrower is better off with a standstill because it swaps a sure repayment in period 1 with a less-than-sure repayment in period 2 that is also discounted at the rate β. In the region where the government defaults with a standstill but repays without it, i.e., $\phi\in(b,b(1+\delta))$, the cost of defaulting is below $b(1+\delta)$. The value of debt claims at the beginning of period 1 declines with the standstill because the sure coupon payment δ is now exposed to default risk, and the higher debt carried to period 2 increases the default probability.

Haircut. If the borrower receives a haircut that lowers its initial debt to $\hat{b}<b$, it is trivial to verify that $V(\hat{b})>V(b)$ and $q(\hat{b})>q(b)$. The following proposition establishes that it is possible to find a haircut that strictly Pareto dominates the standstill.

Proposition 2 *For any initial debt b, there is a $\underline{\beta}(b)$ such that for all $\beta\in\left[\underline{\beta}(b),1\right]$, there is a haircut that both the borrower and bondholders prefer over the standstill: $\forall b$, there is a $\hat{b}<b$ such that $V(\hat{b})>V^S(b)$ and $q(\hat{b})\hat{b}>q^S(b)b$.*

Proof. Let $\underline{b}$ denote the lowest debt b such that $q(\underline{b})\underline{b}=q^S(b)b$. It is easy to verify that $\underline{b}<b$. We will show there is a range of discount factors at which the borrower is strictly better off with $\underline{b}$ than with a standstill.

$$\begin{aligned}
V(\underline{b})-V^S(b) &= -\delta\underline{b}-\beta[1-F(\underline{b})]\underline{b}-\beta\int_{-\infty}^{\underline{b}}\phi f(\phi)d\phi+\beta\underbrace{\left[1-F(b(1+\delta))\right]b(1+\delta)}_{=q(\underline{b})\underline{b}}+\beta\int_{-\infty}^{b(1+\delta)}\phi f(\phi)d\phi \\
&= -\delta\underline{b}-\beta[1-F(\underline{b})]\underline{b}+\beta\underline{b}\underbrace{\left[\delta+1-F(\underline{b})\right]}_{=q(\underline{b})}+\beta\int_{\underline{b}}^{b(1+\delta)}\phi f(\phi)d\phi \\
&= \delta\underline{b}(\beta-1)+\beta\int_{\underline{b}}^{b(1+\delta)}\phi f(\phi)d\phi. && \text{(A.1)}
\end{aligned}$$

The expression in equation (A.1) is continuous, strictly increasing in β, takes a negative value at $\beta = 0$, and a strictly positive value at $\beta = 1$. Thus, there exists $\underline{\beta}(b) \in (0,1)$ such that $V(\underline{b}) \geq V^S(b)$ for $\beta \in [\underline{\beta}(b), 1]$. Notice that $q(b)b$ strictly increasing at $b = \underline{b}$, and the continuity of V and $q(b)b$ implies that there exists a $\hat{b} > \underline{b}$ with the properties stated in the proposition. ■

Clearly, if $\beta = 0$, there is no debt relief (other than with a haircut of 100 percent) that is better for the borrower than a delay in debt payments. However, for a high enough borrower's discount factor, it is possible to find haircuts that the borrower prefers over a standstill. This is the case because the haircut lowers the default probability and thus the deadweight cost of defaulting. At the same time, for bondholders, this lower default probability compensates the reduction in the face value of debt thus the debt value implied by the haircut in higher than the one implied by the standstill.

This result illustrates a key advantage of haircuts over standstills as instruments of debt relief. While standstills increase debt levels and thus the default probability and the expected deadweight cost of defaulting, haircuts reduce indebtedness and thus the default probability and the expected deadweight cost of defaulting.