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Restructuring Sovereign Bonds: Holdouts, Haircuts and the Effectiveness of CACs

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ABSTRACT

RESTRUCTURING SOVEREIGN BONDS: HOLDOUTS, HAIRCUTS AND THE EFFECTIVENESS OF CACS

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Sovereign debt crises are difficult to solve. This paper studies the "holdout problem", meaning the risk that creditors refuse to participate in a debt restructuring. We document a large variation in holdout rates, based on a comprehensive new dataset of 23 bond restructurings with external creditors since 1994. We then study the determinants of holdouts and find that the size of creditor losses (haircuts) is among the best predictors at the bond level. In a restructuring, bonds with higher haircuts see higher holdout rates, and the same is true for small bonds and those issued under foreign law. Collective action clauses (CACs) are effective in reducing holdout risks. However, classic CACs, with bond-by-bond voting, are not sufficient to assure high participation rates. Only the strongest form of CACs, with single-limb aggregate voting, minimizes the holdout problem according to our simulations. The results help to inform theory as well as current policy initiatives on reforming sovereign bond markets.

Keywords: Sovereign default, debt restructuring, international financial architecture, creditor Coordination

JEL: F34, G15, H63, K22

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1 Introduction

Sovereign defaults are a recurrent feature of international capital markets, but their resolution is challenging. A major obstacle to resolving debt crises is the coordination problem among large and dispersed groups of bondholders, since debtor governments need to convince a sufficiently large share of creditors to participate in a debt exchange at a loss (or haircut) to generate meaningful debt relief. At the same time, each individual investor has an incentive to free-ride, reject the haircut suffered by other creditors, and hold out for a better offer, possibly by going to court. This could result in less effective debt relief and the risk of disruptive litigation. The well-known "holdout problem" became evident in recent restructurings in Argentina in 2005 and Greece in 2012, which both resulted in large-scale holdout rates and, in the case of Argentina, a messy and protracted legal dispute with these creditors. Thus far, the main policy response to solve this type of creditor coordination problems has been the introduction of *Collective Action Clauses* (CACs) in sovereign bond contracts, which can bind in minority holdouts via majority voting. This paper compiles a new dataset on sovereign debt restructurings and bond exchange outcomes to explore the drivers of creditor participation rates and the efficacy of CACs in eliminating holdouts for the first time.

Our analysis is motivated by an ongoing debate on how to reform sovereign debt markets and their legal framework. The IMF, the European Union, and the United Nations have all recognized that the risk of strategic holdout behavior and litigation by specialized distressed debt funds has increased in recent years.[1] To react to this development and protect the interest of both debtor countries and the majority of creditors, the International Capital Market Association (ICMA) recommended the introduction of a new generation of CACs with aggregation features, an initiative that was supported by the IMF and the U.S. Treasury (for a detailed discussion see Gelpern et al., 2016; Sobel, 2016; International Monetary Fund, 2017). These "single-limb" CACs no longer require bond-by-bond voting and have since been adopted in new bond issues by many emerging economies, and have also been part of the discussions about the reform of the European Stability Mechanism. The debate has been accompanied by a large theory literature, reviewed below, with contradicting results on whether CACs help to solve creditor coordination problems or not. This body of theoretical work has not been brought to the data so far.

Despite the policy relevance of these issues, empirical evidence on the holdout problem and the effectiveness of CACs is scarce. One reason has been a lack of data on the characteristics and outcomes of bond exchanges. In particular, we are not aware of previous work collecting participation rates for a broad sample of restructured bonds. With a view to CACs, there is now a large and influential literature that explores their pricing effects, meaning the impact of CACs on sovereign bond yields and borrowing costs.[2] However, thus far, no empirical paper has

[1] The policy debate is summarized in Krueger (2002); United Nations (2012, 2016); International Monetary Fund (2013, 2014, 2016); Buchheit et al. (2013a,b). Relatedly, Schumacher et al. (2015, 2018) show that more than half of recent sovereign debt restructurings involved creditor litigation.

[2] See, for example, Becker et al. (2003); Eichengreen and Mody (2004); Bardozzetti and Dottori (2014); Bradley and Gulati (2013); Carletti et al. (2017); Picarelli and Erce (2018); Chung and Papaioannou (2020).

actually tested whether and how CACs work in practice, i.e. whether they succeed in raising participation rates in sovereign debt restructurings and if the type of CACs matters for the outcome.[3]

This paper aims to fill this gap in the literature by studying the holdout problem with a comprehensive bond-level dataset covering 418 instruments in 23 debt exchange deals with external bondholders since 1994, when Panama became the first country to default on modern-era sovereign bonds. The dataset builds on a large number of sources, including exchange prospectuses, policy documents, news archives as well as financial market databases. From these sources we gather detailed data on bond features, participation rates, and also compute haircuts on the instrument level. The result is a new empirical resource on modern-era sovereign bond exchanges.

The data reveal a large variation in restructuring outcomes. In the cross-section of bonds, the share of holdouts varies from 0 to 100%, with a standard deviation of 24.7 percentage points. There is also a large heterogeneity within restructuring events. In cases like Uruguay 2003, Argentina 2005, and Greece 2012, a considerable share of bonds did not reach 75%, which has been a common participation threshold in classic bond-by-bond CACs. The data also reveal a large variation in haircuts: the average range of haircuts within the same deal is 17.7 percentage points, indicating considerable discrimination across bondholders.

What explains the large observed variation in holdouts? Why do some bond exchanges fail due to low participation? And what are the characteristics that make a bond more prone to holdout patterns? Our estimates show that the size of the haircut is an important predictor of holdouts at the bond level. According to our baseline estimate, a one-standard-deviation increase in haircut size (25 percentage points) is associated with a 9 percentage point higher holdout rate, after controlling for bond and deal characteristics. Importantly, this result is driven by the variation of haircuts within the same restructuring, rather than by the variation in aggregate haircuts (size of debt relief) across deals, mitigating concerns about their possible endogeneity. In addition, we find that smaller bonds (low outstanding amount), bonds issued under foreign law (such as New York or English law), bonds with high coupons, and more actively traded bonds (those with regularly quoted prices on Bloomberg) see lower participation rates. These results are relevant for distressed governments who want to know which bonds could become a target of strategic holdout investors in a sovereign debt restructuring.

Our results further suggest that CACs help reduce final holdout rates, on average. According to our baseline result with deal-fixed effects and controls, bonds with CACs see final holdout rates that are between 10 and 20 percentage points lower than those without. We also find an interaction effect of CACs and haircuts, meaning that CACs can help to reduce the impact of haircuts on the likelihood that investors hold out. More specifically, CACs significantly reduce holdout rates for haircuts of about 30% or higher, but there are barely any effects for low-haircut bonds.

[3]Schumacher et al. (2015) examine the determinants of sovereign debt litigation, but do not explore the role of CACs or the size of holdouts due to a lack of data on these.

These average results mask a large heterogeneity. The data show that "classic" CACs are not sufficient to achieve high participation, since they typically require a 75% majority in each individual series irrespective of the aggregate acceptance rate. In Greece 2012, in particular, more than half of the foreign-law bonds that had this type of bond-by-bond clauses did not reach the necessary voting threshold, resulting in large-scale holdout volumes despite the presence of CACs (€6.4 billion in total). In comparison, Greece achieved full participation for the 75 local-law sovereign bonds after de facto retrofitting CACs the bonds with aggregation features. Legislative action before the exchange allowed a 66 2/3% overall majority of local-law bondholders across bonds to bind in all holdouts. The "Greek Bondholder Act", passed shortly before the exchange, thus effectively introduced a statutory "single-limb" CAC into the Greek-law bonds (for details, see Zettelmeyer et al., 2013; Buchheit and Gulati, 2010).

On the other hand, CACs are not a good predictor for initial holdout rates (ex-ante participation). Bonds with CACs are associated with slightly lower pre-CACs holdout rates, but the difference is not statistically significant conditional on deal-fixed effects and other control variables. This implies that CACs do not necessarily change the *ex ante* behaviour of investors when deciding whether or not to participate in an exchange.

To explore the efficacy of CACs further, we conduct a simple simulation exercise for three of the largest restructuring deals in our sample – Argentina, Uruguay, and Greece – which all had a substantial variation in holdout rates across bonds. We focus on three types of CACs that are at the center of the ongoing policy debate and estimate counterfactual participation rates for each type, respectively:

- *Classic CACs* with bond-by-bond voting and a 75% acceptance threshold (like those that have become widespread under New York law since 2003).
- *Two-limb CACs* with a bond-by-bond voting threshold of 50% provided that there is an aggregate majority of 66 2/3% (also used in the euro area since 2013).[4]
- *Single-limb CACs* that require only a single vote across all bonds and have an aggregate threshold of 66 2/3% (as in Greece 2012) or 75% (as in the ICMA standard clause).

We find that only the latter type of strong CACs would have assured full participation, in particular for the high haircut bonds that saw large-scale holdout rates in the data.

In sum, our findings indicate that the recent proliferation of bonds with single-limb CACs with aggregation will make the implementation of future sovereign bond restructurings easier. However, CACs are no panacea to resolve coordination problems in sovereign debt restructurings under all circumstances. Their specific contractual design, especially the strength of the aggregation features, plays a crucial role for the outcome. Hence, our results are consistent with theoretical papers that raise doubts about the unambiguous effectiveness of CACs.

[4]These majority thresholds apply if the issuer seeks consent by creditors by means of a "written resolution." Alternatively, a physical bondholder meeting can be called, at which the majority thresholds are higher (75% on aggregate and 66 2/3% at the bond level), and attendance at the meeting needs to reach a quorum of 66 2/3%.

Related Literature: Only few theoretical papers study the effect of CACs on participation rates. Bi et al. (2016) consider a continuum of small creditors and show that CACs can induce full participation. However, the effect is not necessarily stronger compared to other restructuring features such as minimum participation thresholds or exit consents. In contrast, Engelen and Lambsdorff (2009) find that CACs can aggravate the holdout problem. In their model, CACs increase the payoff of unilateral litigation, and therefore result in more incentives to hold out. Similarly, Pitchford and Wright (2012) show that CACs create incentives to free-ride on others' negotiation efforts and therefore lead to longer settlement delay. In the data, such delay often goes hand in hand with higher holdout rates.

In other theory papers, the effectiveness of CACs in reducing holdouts is an assumption, e.g. in Haldane et al. (2005), who study the optimal CACs threshold, in Bolton and Jeanne (2007, 2009), who explore the ex ante effects of CACs, or in Ghosal and Miller (2003), who focus on debtor moral hazard and compare CACs to a statutory bankruptcy regime.

On the empirical side, a comprehensive instrument-level study on holdouts is missing, despite improved data availability on sovereign bond restructurings in recent years.[5] Sturzenegger and Zettelmeyer (2006, 2008) provide detailed narratives of restructurings in the 1990s and early 2000s and study haircuts in detail. The investor reports by Moody's (2013a,b) show estimates on haircuts and holdouts, but only at the aggregate deal-level. Cruces and Trebesch (2013) also focus on the deal-level and study the link between haircut size and subsequent bond yields and the time to re-access international capital markets. Asonuma et al. (2020) compile instrument-level haircuts using two different approaches for more than 500 bonds in 43 sovereign debt restructuring episodes between 1999 and 2019 (32 external-law and 11 domestic-law cases). Their main finding is that creditor losses are larger for bonds with short-term maturity. Finally, International Monetary Fund (2003), Zettelmeyer et al. (2013), and Schumacher (2014) provide detailed instrument-level case studies on the restructurings in Uruguay 2003, Argentina 2005, and Greece 2012, respectively. We integrate their data into our own data collection on 23 sovereign bond restructuring deals.

[5] Perhaps surprisingly, there is also little evidence on the use of CACs in the corporate context. To some extent, this might be driven by the fact that CACs cannot be included in most corporate bonds issued under US law following the enactment of the statutory bankruptcy regime under Chapter 11 in the US and the 1939 Trust Indenture Act (Buchheit and Gulati, 2004, 2020; Weidemaier and Gulati, 2014). English-law corporate bonds usually contain CACs. Yet, to our knowledge there is no research analyzing the effectiveness of CACs on creditor participation in English-law corporate debt workouts.

2 The Dataset: Restructured Sovereign Bonds, 1994-2015

2.1 Sample, Sources and Variables Used

Sample: We reviewed all sovereign debt restructurings with foreign bondholders of the past four decades and until 2015, using Cruces and Trebesch (2013) as a starting point.[6] During the 1970s and 1980s most developing countries borrowed from major commercial banks in the form of syndicated bank loans, while the rise of bond financing only started in earnest with the Brady deals of the early 1990s and the subsequent issuance of so-called "Brady Bonds."[7] The modern history of sovereign bond defaults and restructurings is therefore rather short. More precisely, it begins in the late 1990s, when Ecuador became the first country to default on the Brady bonds, as well as with the defaults of Russia and Ukraine in 1998/1999. The only earlier known case of a modern-era bond restructuring occurred in Panama 1994, but this was a minor side-deal to the much bigger Brady deal of 1996.[8]

We do not include purely domestic bond restructurings in our sample, in particular the restructurings by Paraguay 2006, Jamaica 2010 & 2013, and Cyprus 2013. This reflects the fact that the data quality on entirely domestic deals is significantly less reliable and that governments can more easily use means of financial repression to engineer high participation rates. We make an exception for Russia's exchange of the MinFin III bond and the 2012 exchange by St. Kitts and Nevis. Because the bondholders in these cases were predominantly foreign, it has become standard in the literature to consider them in the analysis of external sovereign debt restructurings (Sturzenegger and Zettelmeyer, 2008; Cruces and Trebesch, 2013). We follow these precedents to maximize the comparability of our sample with the literature. In contrast, we exclude Russia's restructuring of GKOs in 1999, Ukraine's restructuring of OVDPs in 1999 and Ukraine's restructuring of Gazprom bonds in 2000 where bond-level information is not available.

Since our analysis focuses on bonds and coordination problems with dispersed creditors, we also drop loans as well as loan-like bonds from our sample. This applies to the Chase-Manhattan Bonds and the ING Barings Bond in Ukraine 1999-2000, the SB Debt Claims and the Sphynx Debt Claims in Cote d'Ivoire 2012, and the $3 billion bond owned entirely by the government of Russia in Ukraine 2015. In addition, there are 55 bonds with unusual features that we deem as outliers. 23 are strip bonds that were part of the restructuring in Argentina 2005 and Belize 2006. These zero-coupon securities derive from the payments of their original underlying bonds and were treated in different ways.[9] We identify two additional outliers in Argentina 2005: a

[6] We exclude restructurings of bonds that went into default in the interwar years (some bond defaults of Communist countries were settled only decades afterwards). See Meyer et al. (2019) for an overview of historical sovereign debt restructurings.

[7] U.S. Treasury Secretary Nicholas Brady advocated the exchange of non-performing bank loans into bonds to resolve the Latin American debt crisis of the 1980s. These bonds were typically collateralized by U.S. Treasury bonds. See, for example, Cruces and Trebesch (2013) or Federal Reserve System (1998) for more details on the Brady deals.

[8] Panama's 1994 bond exchange restructured only USD 452 million compared to the USD 3,936 million in sovereign bank loans that were restructured in the 1996 Brady agreement.

[9] Argentina in 2005 allowed some strip bonds to be tendered just like stand-alone bonds but others had to be tendered together with the remaining parts of the original bonds. Belize in 2006 allowed all strip bonds to be

perpetuity bond as well as the Floating Rate Accrual Notes (FRANs) with a coupon indexed to the yield to maturity of another government bond (the Global Benchmark Bond) and hence a pre-exchange coupon rate of more than 100%.[10] Greece in 2012 exchanged three CPI-indexed bonds with very long maturities, for which we did not find a credible CPI projection at the time of exchange to compute their present values. In addition, the Greek restructuring in 2012 included 22 government-guaranteed local-law bonds which were received a separate treatment from the domestic-law bonds issued by the central government as well as the foreign-law titles, and which we thus exclude from our baseline specification (Zettelmeyer et al., 2013, for details see). Finally, the five Brady bonds in Uruguay 2003 were held by a small number of local banks that were disincentivized to participate for accounting reasons (International Monetary Fund, 2003). Because the participation rates in these bonds were not determined by the same incentives as for the rest of the bonds in our sample, we exclude them from our baseline sample. We drop these 55 special cases in our main analysis, but conduct robustness checks with all bonds included.

The final sample includes 23 sovereign debt restructurings of 418 bonds issued by 16 countries. We could gather holdout information on almost all of these cases, except for Panama 1994 and Dominica 2004, for which we miss bond-by-bond participation results. For Grenada 2005, we could only obtain initial participation results, i.e. the share of outstanding debt tendered into the exchange, but not the final exchange results. In contrast, for Greece 2012 we could only locate post-CACs participation rates, i.e. the final exchange results, but not the initial share of holdouts before CACs voting took place. For all cases we could compute haircuts on the bond-level (as described below) and gather financial characteristics of each bond, in particular issued and outstanding amount, currency denomination, maturity, coupon size and interest rate structure, and legal characteristics such as the type of collective action clauses (if any) and the bond's governing law.

Sources: The dataset is coded on the basis of a large number of sources. The bond-level information is collected from official sources and press releases, financial data providers including Bloomberg and Thomson Reuters, bond prospectuses, news archives, IMF country reports and academic papers. The data appendix to our paper contains the detailed sources for each restructuring. We put particular emphasis on collecting complete data on the three largest bond restructurings, namely Argentina 2005, Uruguay 2003 and Greece 2012.[11] Wherever possible, we cross-checked multiple sources to ensure data integrity. Particularly useful academic references in this context include Sturzenegger and Zettelmeyer (2006, 2008), Cruces and Trebesch (2013) and Zettelmeyer et al. (2013).

tendered separately but only reported participation outcome on the original bond level.

[10] This was because the last fixing of the yield to maturity on the benchmark bonds to which the coupon rate was indexed spiked after the default. For more information on these FRANs, see Levine (2016).

[11] For Uruguay 2003, International Monetary Fund (2003) has a detailed anatomy on bond-level participation and Sturzenegger and Zettelmeyer (2006, 2008) offers additional details on the domestic bonds. For Argentina 2005, we derived bond-level holdout rates from the difference in eligible amounts between the 2005 exchange offer and the 2010 exchange offer (Schumacher, 2014) and cross-checked our haircut and other calculations with Sturzenegger and Zettelmeyer (2006, 2008) and Cruces and Samples (2016). For Greece, we use the holdout information from Zettelmeyer et al. (2013) and cross-checked our haircut and other calculations with it.

Measuring Holdouts: The response variable of interest is the holdout rate (or non-participation rate) at the instrument level. Specifically, the holdout rate ($Holdout$) is defined as

$$Holdout = 1 - \frac{\text{Tendered Principal Amount}}{\text{Outstanding Principal Amount}}.$$

We study both initial holdout rates *before* the application of CACs (if any) and post-CACs holdout rates as of the final settlement date, meaning *after* the activation of CACs (if any).

Measuring Creditor Losses: Our measure of creditor losses builds on earlier literature, in particular Sturzenegger and Zettelmeyer (2006, 2008), Cruces and Trebesch (2013) and Zettelmeyer et al. (2013).[12] In a typical bond restructuring, the old bond is swapped with a new bond or a portfolio of new bonds.[13] For each old bond, the creditor loss ($Haircut$) is defined as

$$Haircut = 1 - \frac{\text{Present Value of New Bond(s)}}{\text{Present Value of Old Bond + Arrears}},$$

where the present value is calculated as the sum of future cash flows discounted based on the "exit yields", i.e., yields on the new bonds immediately at the completion of the exchange.[14] For the new bond, the discount rate is simply its own yield, and the present value equals to its market trading price. For the old bonds, there are usually multiple exit yields to consider.[15] As our main specification, the discount rate is chosen as the average of all exit yields, so the discount rate is the same for all old bonds in a restructuring. We call the resulting haircut measure the "Uniform Rate Haircut". For robustness, we also use bond-specific discount rates, which are interpolated from exit yields based on average maturity, currency denomination, and governing law. The approach is similar to Sturzenegger and Zettelmeyer (2006, 2008) and Zettelmeyer et al. (2013), and we call this resulting haircut measure the "Yield Curve Haircut".[16] For restructurings where no exit yield was observable, e.g. St. Kitts and Nevis, we use the imputed discount rates from Cruces and Trebesch (2013).

As discussed in more detail in Cruces and Trebesch (2013), this haircut measure is best suitable to capture the wealth loss suffered by investors participating in the exchange. For intuition, imagine 99% of creditors agree while 1% hold out and continue to be paid. The formula above compares the present value loss by the 99% compared to the 1% holdouts that avoided a haircut

[12] Recently, Asonuma et al. (2020) have proposed the concept of the sovereign "exchange recovery rate", captured by the ratio of the price of the new instrument immediately after the exchange to the price of the old instrument prior to the exchange. This approach is in the spirit of Moody's and S&P who measure corporate bond recovery values using market prices (see Meyer et al. (2019) for a discussion).

[13] Cash payments can be generalized as zero-coupon bonds without a maturity date.

[14] We focus on a window of seven days from the settlement day and take the earliest available price and yield for the new bond(s) using either Bloomberg or JP Morgan database of bonds underlying the EMBI. When there are multiple new bond series, we use the same pricing source for all of the new bonds in each restructuring. The only exception is Argentina 2005, where no single source covers all new bonds and we use a combination of Bloomberg and EMBI as well as prices and yields in Sturzenegger and Zettelmeyer (2006, 2008). These three sources are consistent with each other for the bonds in overlap.

[15] For example, Argentina 2005 had nine series of new bonds, each with a different exit yield, ranging from 9.353% to 10.602%. Moreover, following Sturzenegger and Zettelmeyer (2006, 2008), we look at exit yields on not only the new bonds but also the existing bonds that are serviced throughout and excluded from the restructuring.

[16] For restructurings where only one exit yield is observed, we follow Sturzenegger and Zettelmeyer (2006, 2008) and adjust the discount rate by maturity using the U.S. Treasury yield curve.

but still face the risk of a renewed default. The measure is preferable to what is often called the "market haircut," which compares the present value of the new bonds to the face value (principal) of the old bonds, thus disregarding changes in the maturity or coupon structure of the debt.

We account for past due interests based on remaining principal at the time of default. For bonds that mature prior to the maturity date, we follow Meyer et al. (2019) and calculate post-maturity interests using the coupon rates on the matured debt in default. Specifically, we continue adding up interest arrears for bonds in default that have already matured up to the point in time when settlement occurs. This is line with Cruces and Samples (2016), who make clear that New York law recognizes post-maturity interests. For robustness, however, we also compute a haircut measure that only accounts for interest arrears until the maturity date but not thereafter.

For instruments with unusual contractual features we need to make additional assumptions, as explained in more detail in the Appendix (Section 1). In case of multiple exchange options ("exchange menu"), we use issuance amounts of the new securities to infer creditor choices.

Comparing our Holdouts and Haircuts to Previous Work: We compare our results on holdouts and haircuts to those of earlier work in the Appendix (Sections 2 and 3). In particular, we benchmark against the results reported in Sturzenegger and Zettelmeyer (2006, 2008), Das et al. (2012), Cruces and Trebesch (2013) and Moody's (2013a,b). The comparisons are made at the deal-by-deal level, because previous research does not measure holdouts or haircuts at the bond-level. One exception is the bond-level haircut dataset of Sturzenegger and Zettelmeyer (2008), which we use to make more more granular comparisons. The main take-away from this comparison is that our haircut estimates are very similar to Sturzenegger and Zettelmeyer (2008), who rely on the same methodological approach. The haircut differences are larger when compared to Cruces and Trebesch (2013), who also include loans, and largest when comparing to Moody's (2013a), who estimate losses at the entry into default. Regarding holdouts, the comparison shows that the aggregate rates are almost identical, which suggests that our bond-level data are accurate.

Collective Action Clauses: For each bond, we gather information on whether collective action clauses were included and, if so, whether they were used. Except for the single-limb CACs retrofitted in the local-law bonds in Greece 2012, all other CACs that were activated in our sample are bond-by-bond with majority thresholds varying from 66% (e.g. the Samurai Bond in Uruguay 2003) to 98% (IANs in Russia 1999).

2.2 Holdouts and Haircuts: A Large Variation

Table 1 gives an overview of the 23 sovereign bond restructurings in our sample. At the aggregate level, most bond restructurings were successful in the sense that final participation rates generally exceeded 90%, i.e. less than 10% of creditors held out.

Only four restructuring operations achieved a final participation rate of below 90%, as illustrated in Figure 1. Argentina's messy restructuring in 2005 achieved only about 80% participation, with many of the holdout creditors filing suit in New York. The other cases are Ukraine's add-on deal of Merrill Lynch bonds in 1999 (participation of 50%), Dominica in 2004, as well as the restructuring of foreign-law bonds in Greece which resulted in an initial holdout rate (pre-CACs) of 39% and a final holdout rate (post-CACs) of 29%. For illustrative purposes the exchange of foreign-law bonds in Greece is shown as a separate deal in Figure 1.[17]

In three other cases the initial (pre-CACs) holdout rate was above 10%, but the application of CACs achieved full participation (Seychelles 2009, Cote d'Ivoire 2012 and Belize 2013).

We also observe a wide variation in holdout rates at the bond level within the same restructuring deal, as illustrated in Table 2 (left panel, post-CAC rates) and Figure 2 (pre-CACs rates, except in Greece 2012). More than 133 bonds had non-participation rates higher than 10% and in 33 bonds holdouts exceeded 50%. Uruguay 2003, Argentina 2005 and Greece 2012 saw the largest within-deal variation, with holdouts ranging from 0 to 100%.

Uruguay 2003 involved 18 international bonds, 28 domestic bonds and one Japanese-law bond which were offered three separate restructuring deals. Four of the five Brady bonds and both of the two EUR-denominated bonds mostly held by retail investors had holdouts exceeding 25%. The Brady New Money Notes had a holdout rate of 75%. All other bonds had less than 10% holdouts.

Argentina 2005 is probably the most well-known sovereign bond restructuring that suffered from large-scale holdouts (Cruces and Samples, 2016). Of the 145 bonds for which we could obtain bond-level participation information, 17 were completely tendered, 63 had more than 25% holdouts and 9 bonds had more than 50% holdouts. Most of these high-holdout bonds were heavily litigated (Weidemaier and Gelpern, 2014; Schumacher, 2014).

Greece 2012 involved a total of 117 eligible securities, of which 75 were local-law, 35 English-law, five Japanese-law, one Swiss-law and one Italian-law. The 53 government-issued local-law bonds were retrofitted with single-limb CACs that increased the participation from initially 82.5% to full. The participation rate across 22 government-guaranteed local-law instruments was very high (95%) even without the retrofitted CACs. In contrast, foreign-law bonds became the main target for holdouts (Gelpern et al., 2016; Zettelmeyer et al., 2013). Half of the 42 foreign-law bonds saw holdouts above 50% and 9 bonds had 100% holdouts, meaning that not a single holder of the bonds agreed to participate. In aggregate, the final (post-CACs) participation rate for Greece's foreign-law bonds was 71%.

Figure 2 also reveals that some of the bonds with large-scale holdouts had CACs. This is true not only in Greece 2012 but also in Ukraine 1999 and Grenada 2005. This suggests that CACs alone do not assure full participation, also because investors can buy blocking minorities in

[17] In the regression analysis, we treat the Greek restructuring in 2012 as a single case comprising both the foreign and domestic-law bonds.

individual series, as happened in Greece 2012.

Equally striking is the variation in haircuts, as shown in Table 2 (right panel) and Figure 3. On the instrument level, haircuts go from negative (meaning the present value of the new bonds exceeds the present value of the old bonds) up to a present value loss of 90% for the FRAN bond in Argentina 2005. Within the same deal, the range between the maximum and minimum haircuts across bonds averages 17 percentage points, but in some cases the haircut distribution has been much more dispersed and was highest in Argentina 2005 with a difference of 54 percentage points between the bond with the lowest and highest haircuts. These numbers show that inter-creditor equity is often violated *ex post*.

The main reason for this finding is that bond exchanges are often conducted as one-size-fits-all offers. As a result, bonds with shorter maturity and higher coupon rates usually receive higher present value haircuts (this confirms the main finding in Asonuma et al. (2020)).[18]

[18]The fact that offers are more-or-less uniform also follows the bankruptcy logic – all debt is reduced to "claims" after the bankruptcy filing, without regard to pre-bankruptcy financial terms. Bankruptcy classification of creditors tends to follow legal and functional classifications (e.g., seniority of the claim), not financial features of the claims. Similarly-situated creditors are put in the same class and receive the same treatment.

Table 1: Sovereign Bond Restructurings 1994-2015 – Main Characteristics

Restructuring	Number of Old Bonds	Number of New Bonds	First Missed Payments	Launch Date	Settlement Date	Principal Amount (bn US$)	Holdout Rate (final)	Average Haircut	Average Maturity (before)	Average Maturity (after)	Average Coupon Rate (before)	Average Coupon Rate (after)	Average Exit Yield	Share of Foreign Law Bonds
1994 Panama	7	2	01/23/88	01/31/94	05/10/94	0.43	no data	27.01	0.00	5.00	6.75	7.13	12.70	100%
1999 Pakistan	3	1	preemptive	11/15/99	12/13/99	0.61	0.04	31.60	0.25	4.50	8.88	10.00	22.90	100%
1999 Ukraine	1	1	preemptive	07/16/99	08/20/99	0.50	50.61	37.72	1.08	1.50	0.00	16.00	80.60	100%
2000 Ecuador	6	2	10/25/99	07/27/00	08/23/00	6.09	3.95	22.72	16.71	23.72	6.50	10.15	22.90	100%
2000 Russia MinFin3	1	2	05/14/99	02/01/00	11/30/00	1.30	9.10	54.92	0.00	6.50	3.00	3.00	22.00	0%
2000 Russia PRINs/IANs	2	2	12/02/98	07/18/00	08/25/00	29.00	1.28	53.48	10.48	15.60	6.93	7.02	15.36	100%
2000 Ukraine	4	2	01/01/00	02/14/00	04/14/00	1.54	1.92	33.15	0.49	4.42	13.01	10.51	30.75	100%
2002 Moldova	1	1	preemptive	01/01/02	10/29/02	0.04	0.00	31.35	0.00	4.36	9.88	8.78	19.30	100%
2003 Uruguay	65	34	preemptive	04/10/03	05/29/03	5.56	8.53	14.48	7.03	15.00	6.15	7.08	13.55	71%
2004 Dominica	2	3	07/16/03	04/06/04	08/01/06	0.05	no data	63.52	11.47	14.56	9.00	3.50	9.20	100%
2005 Argentina	145	9	12/01/01	01/14/05	06/10/05	77.21	19.70	74.03	6.87	28.84	9.27	4.53	9.42	88%
2005 Dominican Republic	2	2	preemptive	04/20/05	05/11/05	1.10	6.36	1.09	4.79	7.57	9.25	9.25	9.55	100%
2005 Grenada	16	2	01/01/98	09/09/05	11/15/05	0.23	no data	37.46	6.63	19.83	8.36	5.95	9.30	44%
2006 Belize	7	1	preemptive	12/18/06	02/20/07	0.35	3.04	17.07	4.70	17.25	9.65	7.69	9.10	65%
2009 Ecuador (buy-back)	2	none	11/15/08	04/20/09	06/11/09	3.21	9.03	43.22	18.21	buy-back	10.32	buy-back	21.70	100%
2009 Seychelles	2	2	07/01/08	12/07/09	02/11/10	0.30	0.00	69.50	1.38	11.17	6.88	6.63	14.20	100%
2010 Cote d'Ivoire	6	1	09/30/00	03/15/10	04/16/10	2.30	0.38	40.57	5.18	15.72	3.53	5.38	10.40	100%
2012 Cote d'Ivoire	1	1	12/31/10	10/18/12	11/06/12	2.33	0.00	0.27	13.13	13.13	3.75	5.89	7.70	100%
2012 Greece	117	24	preemptive	02/24/12	03/12/12	276.52	3.12	54.99	8.15	20.20	4.37	1.75	15.43	11%
2012 St. Kitts and Nevis	12	2	01/01/11	02/27/12	04/18/12	0.20	0.00	43.60	2.59	20.92	6.18	2.95	7.88	0%
2013 Belize	1	1	08/20/12	02/15/13	03/20/13	0.55	0.00	31.86	11.17	15.67	8.50	6.45	10.20	100%
2015 Grenada	2	2	03/15/13	10/05/15	11/12/15	0.26	0.00	43.10	9.83	8.55	6.00	6.95	13.00	74%
2015 Ukraine	13	10	10/13/15	09/23/15	11/12/15	15.00	0.00	13.02	3.44	10.96	7.67	6.21	9.46	100%

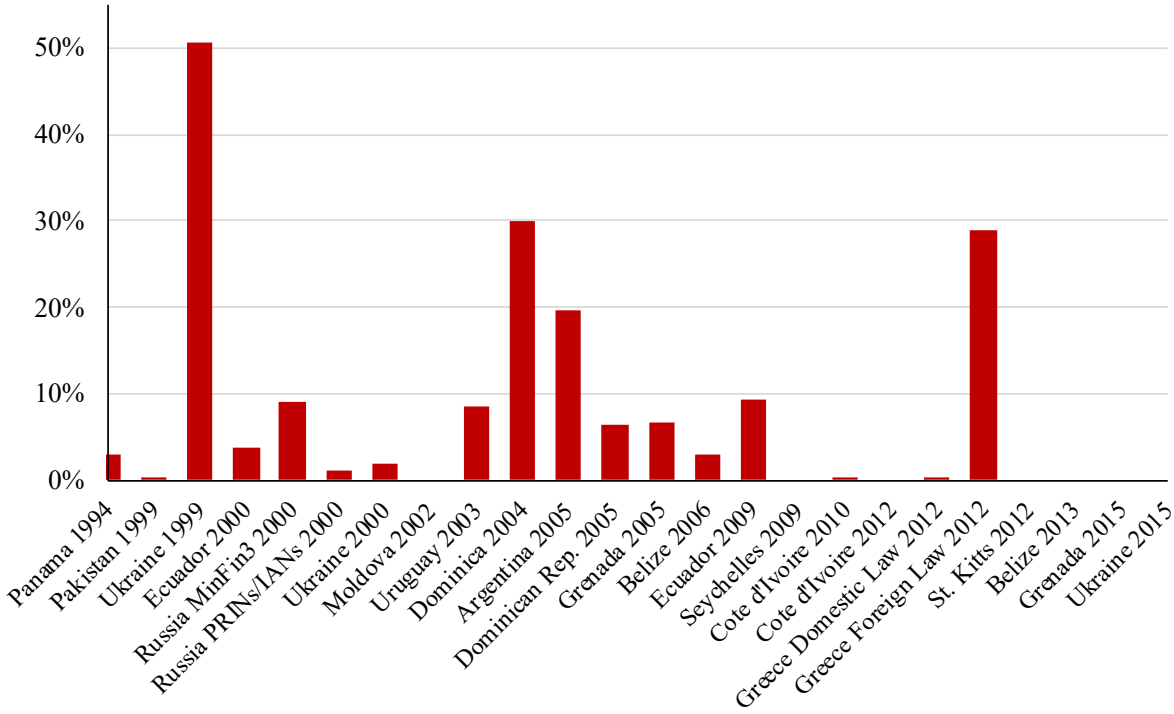
Note: All averages are weighted by principal amounts of the bonds. For Argentina 2005, we only include the bonds where financial terms and governing law are not missing.

Table 2: Variation in Holdouts and Haircuts - Summary Statistics

Restructuring	Number of Bonds	**Holdouts** (post-CACs)				**Haircuts**			
		Mean	SD	Min	Max	Mean	SD	Min	Max
1994 Panama	7	no data				25.4	9.9	16.7	45.4
1999 Pakistan	3	0.0	0.1	0.0	0.1	31.3	3.1	27.8	33.6
1999 Ukraine	1	50.6		50.6	50.6	37.7		37.7	37.7
2000 Ecuador	6	4.6	1.8	2.3	7.9	30.4	12.6	17.7	50.0
2000 Russia MinFin3	1	9.1		9.1	9.1	54.9		54.9	54.9
2000 Russia PRINs/IANs	2	1.4	0.3	1.2	1.6	53.5	0.1	53.4	53.6
2000 Ukraine	4	1.0	2.0	0.0	4.0	34.6	2.9	30.4	36.8
2002 Moldova	1	0.0		0.0	0.0	31.4		31.4	31.4
2003 Uruguay	65	7.0	14.2	0.0	74.5	17.9	7.2	0.3	34.4
2004 Dominica	2	no data				63.3	0.9	62.7	64.0
2005 Argentina	145	22.4	18.9	0.0	82.1	72.6	7.8	36.0	90.2
2005 Dominican Republic	2	6.6	3.1	4.3	8.8	0.8	3.8	-1.8	3.5
2005 Grenada	16	no data				38.4	7.5	24.6	57.5
2006 Belize	7	1.2	3.2	0.0	8.5	17.5	5.1	10.0	24.0
2009 Ecuador	2	12.9	8.1	7.2	18.7	51.9	18.0	39.2	64.6
2009 Seychelles	2	0.0	0.0	0.0	0.0	67.8	4.7	64.5	71.1
2010 Cote d'Ivoire	6	0.3	0.3	0.0	0.7	39.3	5.6	32.8	46.4
2012 Cote d'Ivoire	1	0.0		0.0	0.0	0.3		0.3	0.3
2012 Greece	117	17.1	34.7	0.0	100.0	59.0	18.5	-28.6	76.1
2012 St. Kitts and Nevis	12	0.0	0.0	0.0	0.0	49.1	18.1	10.5	60.1
2013 Belize	1	0.0		0.0	0.0	31.9		31.9	31.9
2015 Grenada	2	0.0	0.0	0.0	0.0	41.8	3.9	39.1	44.5
2015 Ukraine	13	0.0	0.0	0.0	0.0	13.1	3.1	7.5	18.2

Note: For Argentina 2005, we only include the bonds where financial terms and governing law are not missing.

Figure 1: Aggregate Holdout Rate by Restructuring (final, post-CACs, in %)



Note: The aggregate holdout rate is calculated using post-CACs bond-level holdout rates except for Panama 1994, Dominica 2004, and Grenada 2005, for which no bond-level post-CACs holdout data is available.

Figure 2: Distribution of Holdout Rates (initial, pre-CACs, in %)

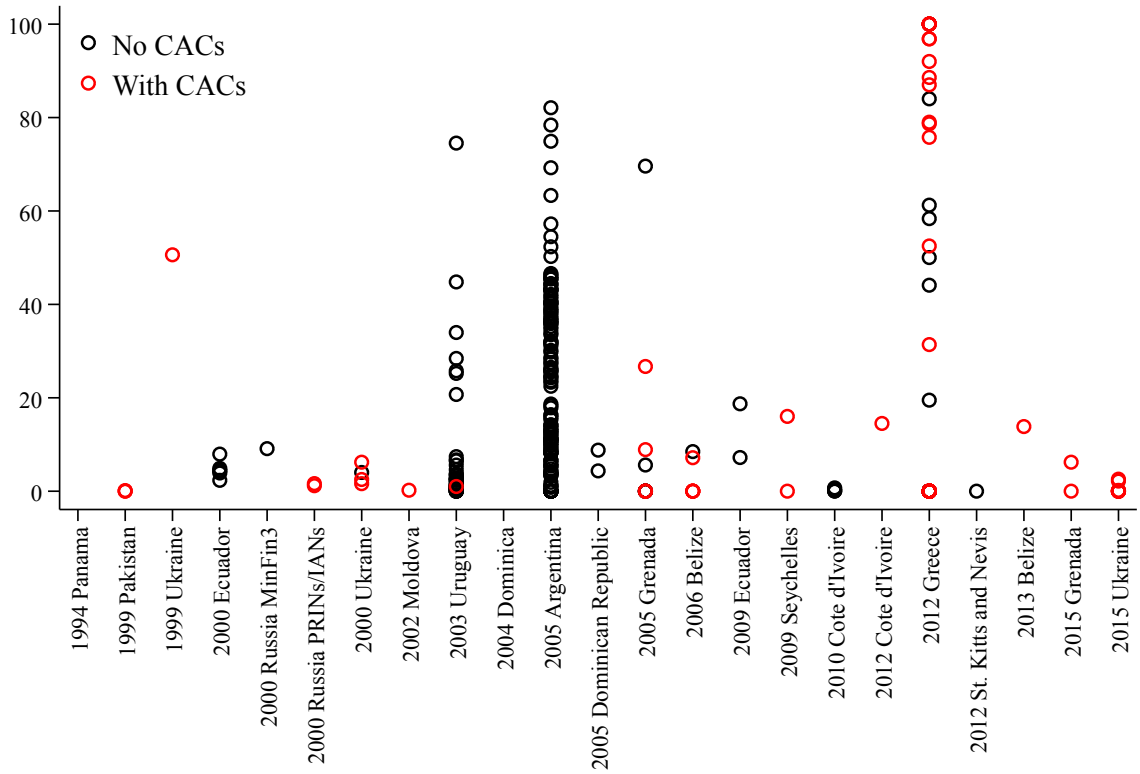
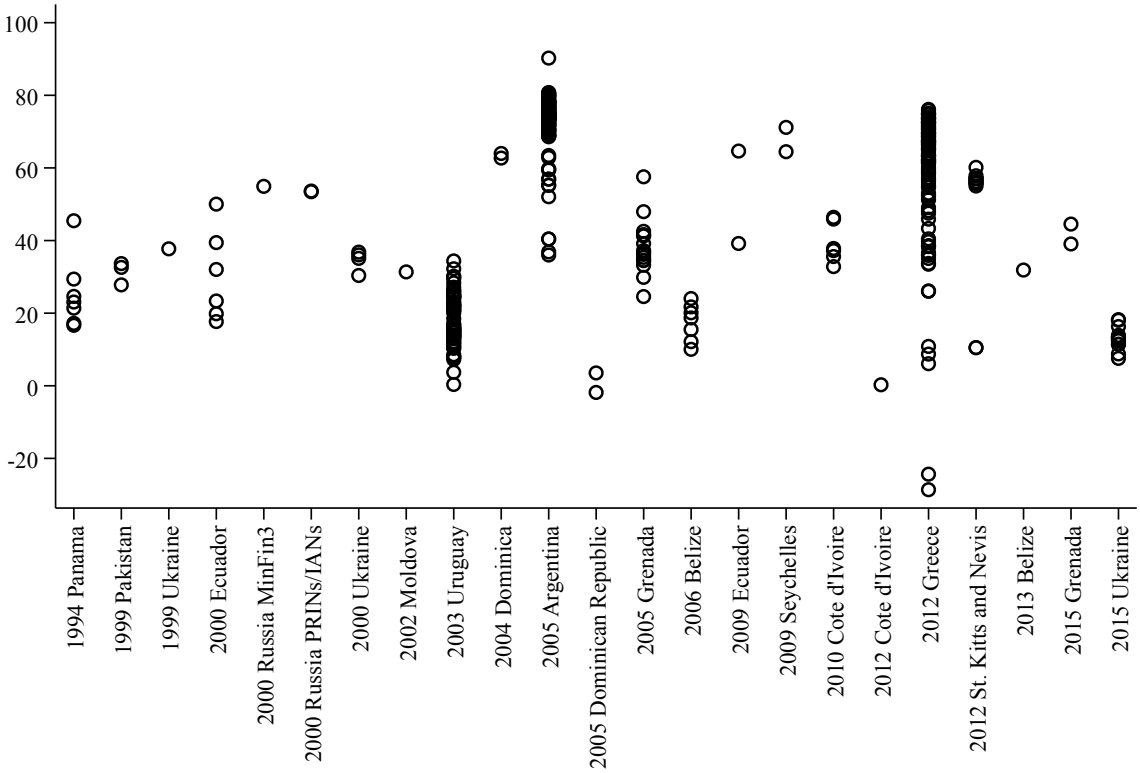


Figure 3: Distribution of Haircuts (in %)



3 Determinants of Holdouts

3.1 Theoretical Considerations: Explaining the Distribution of Holdouts

What explains the distribution of holdouts in the data? To frame our empirical analysis, this section reviews the related theoretical literature and summarizes the relevant mechanisms at work, both on the aggregate deal-level and across individuals bonds in the same restructuring. We develop a set of theoretical priors and check whether they are consistent with the data, using preliminary descriptive evidence. The next section then tests the determinants of holdouts more systematically using regression analysis.

Theories such as Bi et al. (2016) predict that **aggregate participation should be high in general**. This is because low participation would result in inadequate debt relief for the sovereign and a higher probability of default in the future, which means a lower bond value for creditors. Moreover, if the mass of holdouts surpasses a critical level, the exchange offer is likely to fail, making a default more likely, so that all creditors, including holdouts, are worse off compared to the option of participating. Indeed, in practice, countries usually keep negotiating with their creditors until a large majority of bondholders is likely to accept the resulting exchange offer. The data summarized in Section 2 above confirm this prior, as the aggregate holdout rate is typically below 10%. Among the 23 restructurings in the sample, there are only a few high-holdout outliers such as Ukraine 1999 or Argentina 2005.

Section 2 further shows that there is large variation in holdout rates within a typical restructuring deal. Why do some bonds have a large proportion of holdouts whereas others achieve full participation? From the literature, three channels help to explain the observed bond-level dispersion: (i) haircut size, (ii) bond size and (iii) legal features such as CACs and the bond's governing law.

The size of creditor losses (haircuts) is a key ingredient in essentially all theories on holdout behavior, e.g. Engelen and Lambsdorff (2009), Schumacher et al. (2015), and Pitchford and Wright (2012).[19] The bigger the haircut, the more incentive there is for the creditor to reject the restructuring offer, simply because there is more to gain from holding out and hoping for full repayment instead. A common assumption behind this prediction is that the creditor's utility is an increasing function of debt value, i.e. the creditor benefits from higher bond prices. Moreover, the probability of successfully holding out, i.e. of continuing to be paid in full, should be independent of the level of the haircut. This is most likely if the investment of the holdout creditor is small relative to the total outstanding debt, i.e. if she holds only a small mount of the total outstanding principal. In sum, all else equal, **a higher haircut should result in a higher holdout rate**. Figure 4 confirms this hypothesis. It shows a clear positive relationship between haircut size and the share of holdouts on a bond-level. A simple OLS regression yields a positive and statistically significant coefficient of 0.35.

[19] As illustrated in the Appendix, the size of losses is driven by face value reduction, coupon reduction, maturity extension, or other ways of reducing the present value of the exchanged bonds.

The size of the loss imposed on creditors is likely determined in part by the relative bargaining power of the government. If CACs affect the bargaining power of the government and creditors, with stronger clauses allowing the country to ask for more debt relief, the haircut would be endogenous in a regression. However, this kind of endogeneity concern is mitigated in our setting because we study the within-deal variation in haircuts across different bonds. Since the bargaining power of creditors and the debtor likely applies to all defaulted bonds of the same restructuring in a similar way, such aggregate sources of endogeneity (whether a government has high or low bargaining power) can be accounted for by including deal fixed effects. In addition, as documented by Sturzenegger and Zettelmeyer (2006), sovereigns rarely breach basic principles of inter-creditor equity by explicitly discriminating between creditors and bond types.[20]

Second, we expect financial characteristics of a bond to matter, in particular bond size. In a restructuring with multiple bonds, **we expect holdouts to target bonds with small size** (low principal amount), especially if the bonds contain CACs. This prediction is in line with Bi et al. (2016), in which free-riding creditors are only successful if they are small and do not jeopardize the restructuring as such. At the same time, countries can impose exit consents or use CACs to bind in any minority holdouts on the bond level. Holdouts have incentives to acquire blocking positions to prevent these legal steps to succeed. In sum, the ideal setting for strategic holdouts is to remain small in the aggregate but reach a blocking position in individual bond series, so that no majority vote can force them into accepting a haircut. Of course, this free-riding strategy is only possible with classic bond-by-bond or two-limb CACs, while it is eliminated with the strongest forms of CACs with single-limb aggregation. In line with our second prior, Figure 5 illustrates that small bonds tend to have higher holdout rates than large ones. In fact, all the major bonds in our sample (except a few large Argentinean ones) have zero or almost zero holdout rates.

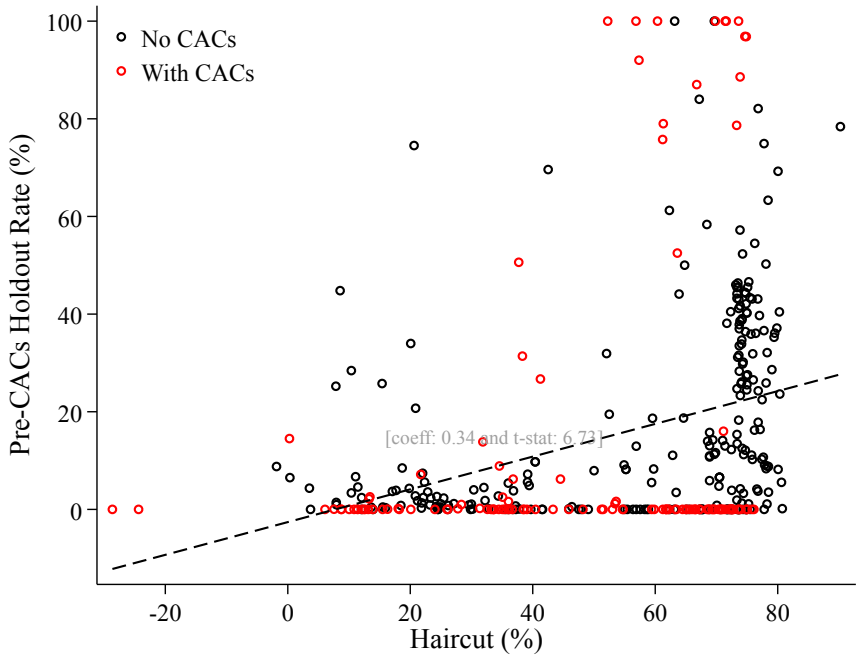
A third channel explaining high or low holdouts are the bond's legal characteristics, in particular voting clauses such as CACs and the bond's governing law. The effectiveness of CACs is of high interest to policymakers, but theories come to contradictory results. Bi et al. (2016) consider a continuum of small creditors and show that CACs can induce full participation. In contrast, Engelen and Lambsdorff (2009) find that CACs can aggravate the holdout problem. In their model, CACs increase the payoff of unilateral litigation, and therefore result in more incentives to hold out. Similarly, Pitchford and Wright (2012) show that CACs create incentives to free-ride on others' negotiation efforts and therefore lead to longer settlement delays, which means higher holdout rates for the same restructuring duration. Therefore, the relationship between CACs and holdouts is a question to be answered by the data. This being said, the very purpose of CACs in practice is to increase participation and force minority holdouts into a deal. Therefore, our baseline prediction is that **bonds with CACs will see lower holdout rates than bonds without**. This prediction is clearly confirmed in the whisker plot below (Panel A of Figure 6).

Furthermore, in line with Chamon et al. (2018), **we expect foreign-law bonds to see higher**

[20]To check this point more explicitly, we estimated a regression using haircuts as dependent variable and a binary indicator of CACs as the explanatory variable, controlling for deal fixed effects. We find that the coefficient is small and insignificant, further alleviating concerns that CACs drive haircut size within the same deal.

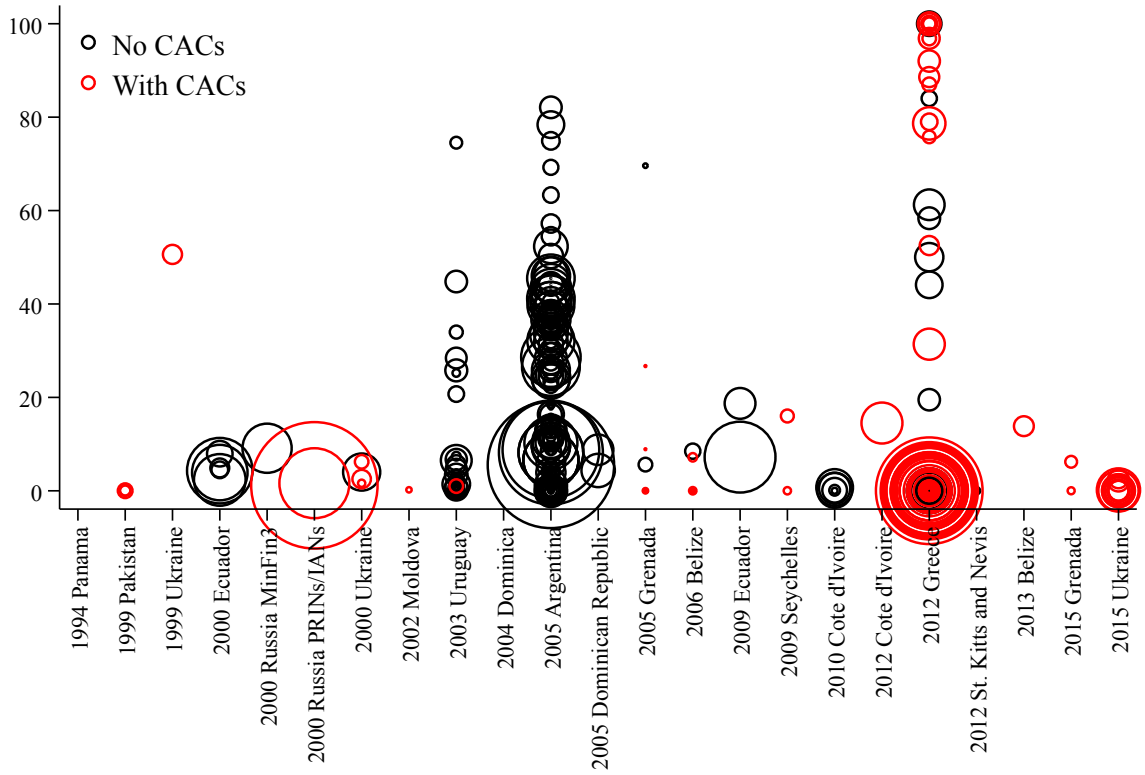
holdout rates than local-law bonds. This is because foreign-law bonds enjoy a higher degree of creditor protection and are therefore more attractive to potential holdout investors. Foreign-law bonds are subject to the rule of law abroad (e.g. in US or English courts), while the bond covenants of local-law bonds can be altered by new legislation in the debtor country. This happened in Greece in 2012, for example, where the terms of local-law bonds were altered via a bill passed in parliament that retroactively introduced single-limb aggregation CACs. This allowed a majority of bondholders to force minority holdouts into the deal, resulting in 100% participation for the local-law bond debt (for more details see Zettelmeyer et al., 2013). Debtor governments have no possibility to enact such ad hoc legislation on foreign-law bonds. In addition, creditors holding a foreign-law bond keep the option to file suit in a foreign court in the respective jurisdiction (see Schumacher et al., 2018). Panel B of Figure 6 confirms that foreign-law bonds have significantly higher holdout rates, on average.

Figure 4: Holdouts vs. Haircuts – Scatter Plot



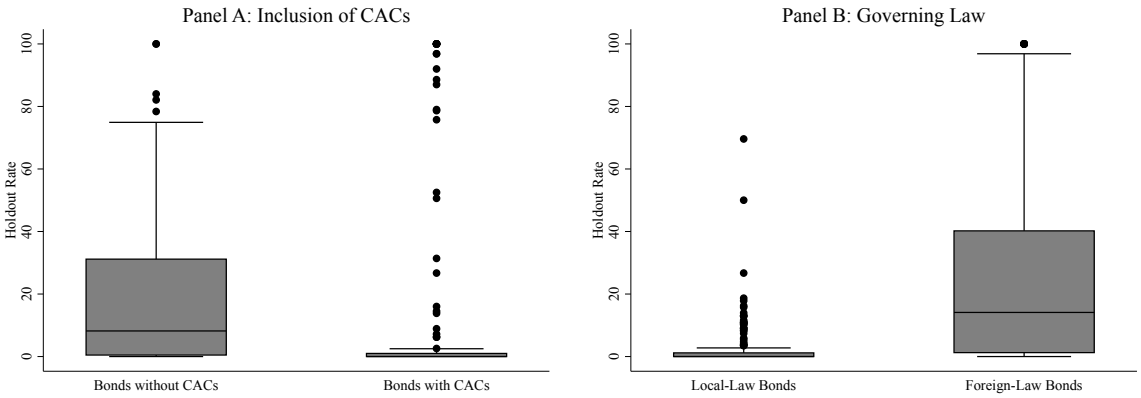
Note: This figure plots the bond-level holdout rate against the size of haircuts for all restructuring deals in our sample. We use initial, pre-CACs holdout rates, except in the case of Greece 2012 for which only data on post-CACs rates exist.

Figure 5: Small Bonds Have Higher Holdout Rates



Note: This figure shows the holdout rate by bond across restructuring deals in our sample. Compared to Figure 2 we also show the size of the bonds in million USD principal, captured by the size of the circles. We use initial, pre-CACs holdout rates, except in the case of Greece 2012 for which only data on post-CACs rates exist.

Figure 6: CACs and Governing Law Predict the Share of Holdouts



Note: This figure shows a a whisker plot on the dispersion of bond-level holdout rates for bonds with and without CACs (Panel A) as well as for bonds governed by local and foreign law (Panel B). We use initial, pre-CACs holdout rates, except in the case of Greece 2012 for which only data on post-CACs rates exist.

3.2 Empirical Model

Building on the theoretical considerations in Section 3.1, we now introduce our empirical model:

$$Holdout_{i,j} = \alpha_i + \beta_1 Haircut_{i,j} + \beta_2 CAC_{i,j} + \beta_3 ForeignLaw + X_{i,j}\gamma + \epsilon_{i,j}.$$

where i denotes the restructuring deal and j denotes the individual restructured bonds. α_i captures deal fixed effects and is used to eliminate differences across restructuring deals.

$Holdout$ indicates the holdout outcome of a bond. We consider the holdout rate (share of non-participating principal, see Section 2) as our main dependent variable. In addition, we also check binary indicators for whether the bond had more than a 10% holdout rate and therefore represents a participation failure.

$Haircut$ captures the level of creditor losses. Section 2.1 and the Appendix describe in detail how we measure the haircut in our baseline specification and various alternatives that we examine for robustness. However, it is still possible that our measures of the haircut do not fully capture the specific form of present value reduction that creditors care about. For example, Levine (2016) documents the exorbitant present value reduction for the FRAN notes in Argentina 2005 which arose due to their unusual floating interest rate structure leading to a very high present value during the crisis. To account for this, we also directly examine the effects of coupon rate and maturity, the key variables in the determination of present value.

$CACs$ and $ForeignLaw$ capture the legal characteristics. $CACs$ is an indicator of whether the bond contains collective action clauses. We also consider indicators of different types of CACs, i.e. bond-by-bond CACs vs. those with aggregation features. $ForeignLaw$ is an indicator of whether the bond was issued under a foreign jurisdiction.

X is the set of bond characteristics that may help to identify holdout-prone creditors, including size, liquidity, and currency. We measure size by *Log Principal Amount,* the log of the outstanding principal amount in million U.S. dollar. We also include a proxy for market liquidity termed *Traded Bond* , an indicator of whether the bond had active bid and quote prices during the launch of the restructuring using Bloomberg price data. With a view to the above, we expect more holdouts in liquid bonds. This in line with Buchheit (1999), who argues that liquid secondary markets make it easier for specialized investors to buy defaulted bonds and then litigate for full repayment. In contrast, Pitchford and Wright (2012) show that the effects of secondary markets on debt renegotiation are ambiguous. Finally, we include a currency indicator termed *U.S. Dollar Bond* for whether the bond is denominated in U.S. dollar or not. This variable captures the fact that bonds in other currencies are frequently designed to target retail investors and therefore have a more fractured creditor base (see Schumacher, 2014).

Our baseline specification is a linear probability model. For robustness, we also estimate a generalized linear model with a probit link function, a method well suited for fractional dependent variables that vary between 0 and 1, as is the case here (we follow Papke and Wooldridge, 2008).

3.3 Regression Results

Table 3 shows our main regression results. Panel A focuses on the initial, pre-CACs holdout rate, meaning the share of holdouts in each bond before any CACs could be voted upon. In contrast, Panel B uses final, post-CACs holdout rates at the closure of the restructuring. Note that, in Panel B we start with a restricted sample (Column 4) and then add Greece 2012 (Column 5), for which we have final, post-CAC participation rates but no pre-CACs ones.

The results confirm the descriptive findings we documented above. First, higher haircuts are associated with higher holdout rates. This is true both before (Panel A) and after the application of CACs (Panel B) and both with and without deal fixed effects that purge any restructuring-specific differences from the estimated coefficients. The coefficient of haircut is also large and quantitatively meaningful. Focusing on post-CACs holdouts, in the cross-sectional OLS model without Greece (Column 4), a one-standard-deviation increase in the haircut (27.2 percentage points) is associated with a 6.3 percentage point increase in holdouts, while in the fixed effects model with Greece (Column 6) holdout rates are estimated to be 17.3 percentage points higher, ceteris paribus. The results on haircuts are robust to different measures of haircut, as shown in Table 4.

With a view to legal characteristics, we confirm that the jurisdiction of a bond plays an important role. The foreign-law dummy shows a significant, large and positive coefficient throughout.

Regarding CACs, we do not find a meaningful correlation with holdout rates in the pre-CACs specifications of Columns 1-3, with quantitatively small coefficients that are not significant at conventional levels. This suggests that investors do not behave strategically, i.e. that they appear not to change their participation behavior *ex ante* depending on the presence of CACs in the debt stock.

To explore the effectiveness of CACs on eventual outcomes, it is more informative to study final (post-CACs) holdout rates, as done in Panel B. Here, the estimated effect of CACs is significant throughout, expect for the OLS specification in Column (5) which adds Greece to the sample but does not control for deal-specific fixed effects. This result is due to the fact that most of the foreign-law bonds in Greece's 2012 restructuring saw large holdouts, regardless of whether they contained CACs. These deal-specific effects are an important reason for us to consider deal-fixed effects in all our baseline specifications.

Regarding magnitudes, the results suggest that CACs reduce bond-specific holdout rates by between 9.1% (OLS result without Greece in Column 4) and 19.4% (baseline result in Column 6). This is a very large impact given that the average final bond-level holdout rate is less than 6%. Column (7) further distinguishes by type of CACs and provides evidence that single-limb CACs (which in our sample were only used in Greece 2012) are much more effective in reducing holdout rates than bond-by-bond CACs, with a coefficient more than five times larger.

Moreover, we find that CACs have a bigger impact on bonds with high haircuts. Figure 7

illustrates this, by plotting the marginal effect of CACs on holdout rates at different haircut levels, based on the estimation results of Column (8). At a low haircut of 10 or 20 percentage points, the effect of CACs is not significantly different from zero (red line), but for haircuts of 30 percentage points or higher, CACs are associated with a significant reduction in holdouts - of 10 to 40 percentage points. In other words, CACs make more of a difference in holdout-prone bonds, i.e. those with high haircuts.

Besides the size of the financial losses for investors (haircuts) and legal characteristics of the bonds (CACs), the regression results confirm that bonds with lower outstanding amounts and those actively traded on secondary markets are more likely to see significantly higher participation rates. This is in line with the view that specialized distressed debt investors could concentrate on such bonds in which acquiring a blocking minority is relatively easier (Buchheit, 1999).

When comparing the results with and without deal fixed effects, it is evident that our findings on haircuts and on the other main variables of interest are mainly driven by the variation within restructurings rather than by aggregate differences at the deal level, such as differences in the average haircut across restructurings. As discussed earlier, deal-level factors such as the government's bargaining power are unobservable and can lead to omitted variable bias, so deal fixed effects are an important way to address such aggregate sources of endogeneity.

The results do not depend on the econometric choice of a linear probability model. Columns (9) report results from a fractional response model with a probit link function, and Columns (3) and (10) are based on a probit model in which the dependent variable is defined as 1 when the holdout rate is higher than 10%, i.e. the restructuring attempt could be seen as "failed".[21] Both the fractional response model as well as the probit model do not lead to meaningfully different estimation results.

We estimate a number of alternative specifications to check the robustness of our results, shown in Table 4. First, we investigate whether there are non-linear effects in our main regressors of interest. Namely, the smallest bonds (in terms of principal amount) and the most financially impaired bonds (in terms of haircut) could be particularly attractive for distressed debt investors, and could thus have more holdouts than a linear model would predict. To test this prior, we extend our baseline regression specification to include polynomials of outstanding principal amount and haircut. The results are reported in Columns (1) to (6). For haircuts, the coefficients on higher-order terms are not significant, indicating that the non-linear effect is not salient. For principal amounts, we do find a non-linear effect. Specifically, we find that a third-degree polynomial with respect to size has the best fit in terms of R2, which means that smaller bonds have higher holdout rates compared to a linear model while large bonds have lower holdout rates. However, the quantitative difference between the linear and non-linear model is negligible for the range of actually observed values of principal amounts.

[21] We also used alternative cut-off values in the probit regressions, ranging from 5% to 25%. The results on the haircut and CACs variables are robust to these alternative definitions of the outcome variable.

Second, we confirm that the sample restrictions outlined in Section 2.1 do not drive the key results. In particular, we include Uruguay's Brady bonds (Column 7); excluding the domestic instruments in Russia and St. Kitts and Nevis (Column 8); and including all outlier bonds in our sample (Column 9). While the size of some of the coefficients changes, the key results hold.

Finally, we check if our results are robust to different haircut measures described in detailed in Section 2.1 and the Appendix. Specifically, we check results with haircut estimates using bond-specific discount rates drawn from linearly interpolated yield curves (Column 10), as well as the so-called market haircut (Column 11). The coefficients on haircuts and CACs remain statistically and economically similar to the results in our baseline specification.

Table 3: Determinants of Holdouts – Main Regression Results

	Panel A			Panel B						
	***Pre*-CACs Holdout Outcome**			***Post*-CACs Holdout Outcome**						
	(1) OLS (Cross-Section)	(2) With Deal Fixed Effects	(3) Probit Model	(4) OLS (without Greece)	(5) OLS (with Greece)	(6) Baseline (with FE & Greece)	(7) CAC Types	(8) Interaction (CACs x Haircut)	(9) Fractional Response Model	(10) Probit Model
Haircut Size	0.252***	0.337***	0.041***	0.231***	0.350***	0.634**	0.779***	0.847**	0.043*	0.042***
	(0.032)	(0.059)	(0.005)	(0.027)	(0.106)	(0.256)	(0.262)	(0.324)	(0.023)	(0.006)
CACs Included	-5.107*	1.481	0.246	-9.119***	-0.787	-19.431***		-5.445	-0.566**	-0.539**
	(2.871)	(4.170)	(0.379)	(2.192)	(4.889)	(3.806)		(9.004)	(0.257)	(0.228)
Bond-by-Bond CACs							-9.256***			
							(3.140)			
Single-Limb CACs (Greece)							-54.194***			
							(4.278)			
CACs x Haircut								-0.271**		
								(0.129)		
Foreign-Law Bond	7.149**	8.315**	0.644***	7.686***	23.193**	32.397**	11.277***	32.338**	1.975**	1.738**
	(2.606)	(3.257)	(0.123)	(2.670)	(10.462)	(11.720)	(1.970)	(11.684)	(0.811)	(0.679)
Log Principal Amount	-1.260***	-1.235***	-0.188***	-1.251***	-1.044***	-1.447***	-0.936**	-1.372***	-0.046***	-0.152***
	(0.204)	(0.135)	(0.054)	(0.175)	(0.343)	(0.381)	(0.391)	(0.393)	(0.004)	(0.054)
Traded Bond	9.542***	9.189***	1.331***	9.635***	-1.483	0.672	7.624***	0.772	0.085	0.558
	(1.368)	(1.374)	(0.148)	(1.303)	(6.465)	(4.409)	(2.321)	(4.398)	(0.145)	(0.388)
U.S. Dollar Bond	-5.504***	-6.289***	-0.519***	-5.478***	-7.044***	0.914	-5.999***	0.836	-0.026	-0.455**
	(1.010)	(0.834)	(0.159)	(1.168)	(1.364)	(3.203)	(0.871)	(3.135)	(0.039)	(0.200)
Coupon Rate	0.607	0.817***	-0.007	0.514	-0.094	0.206	0.334	0.121	0.006	-0.018
	(0.412)	(0.223)	(0.028)	(0.460)	(0.532)	(0.498)	(0.268)	(0.440)	(0.021)	(0.021)
Years To Maturity	0.011	0.031	-0.020	0.001	-0.005	0.098	0.281	0.128	0.002	-0.017
	(0.071)	(0.081)	(0.019)	(0.065)	(0.127)	(0.294)	(0.287)	(0.294)	(0.010)	(0.014)
Constant	-0.961		-2.202***	0.584	-7.156					-2.922***
	(3.147)		(0.293)	(3.153)	(12.288)					(0.889)
Deal Fixed Effects	No	Yes	No	No	No	Yes	Yes	Yes	Yes	No
Obs (Nr. of Bonds)	233	233	233	228	320	320	320	320	320	320
Nr. of Restructurings	20	20	20	19	20	20	20	20	20	20
R2	0.510		0.509	0.555	0.302				0.302	0.533
R2 (within)		0.367				0.401	0.499	0.405		
R2 (oveall)		0.494				0.283	0.304	0.274		

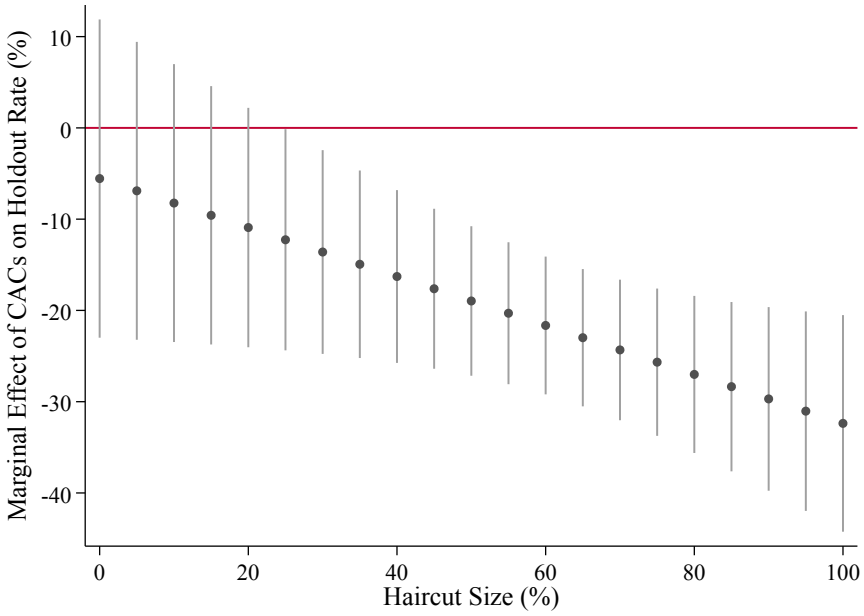
Note: Panel A focuses on the initial (pre-CACs) holdout rate, while Panel B uses the final (post-CACs) holdout rate. The post-CACs results include the case of Greece 2012, for which we miss pre-CACs particpation rates. Columns (1), (4) and (5) use plain OLS on holdout rate, which assumes that $\alpha i = \alpha$ for all restructurings i. In Column (2) and Columns (6)-(9), we introduce deal fixed effects and hence purge out any deal-specific differences. Column (7) differentiate between bond-by-bond CACs and super CACs with aggregation feature. Column (8) adds the interaction between haircuts and CACs, which allows differential response to CACs depending on the level of haircuts. In Column (9) we estimate a generalized linear model with a probit link function as suited for fractional response variables that vary between 0 and 1 (see Papke and Wooldridge 2008). Columns (3) and (10) uses a probit regression model and the dependent variable is an indicator of restructuring failure (holdout rate > 10%). R2 refers to pseudo R2 in the case of probit model and fractional response model. Deal-clustered standard errors are shown in parenthesis. *, **, and *** denote significance on the 1, 5 and 10 percent level, respectively.

Table 4: Determinants of Holdouts – Robustness

	Post-CACs Holdout Rates										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Non-Linear Effect: Quadratic Haircut	Non-Linear Effect: Cubic Haircut	Non-Linear Effect: Highest Haircut	Non-Linear Effect: Quadratic Size	Non-Linear Effect: Cubic Size	Non-Linear Effect: Smallest Size	Including Uruguay Brady Bonds	Excluding Russia MinFin3 SKN 2012	Including All Outliers	Alternative Haircut: Yield Curve	Alternative Haircut: Market Haircut
Haircut	0.385	0.407*	0.715***	0.639**	0.642**	0.637**	0.652**	0.705***	0.432*	0.665**	0.424**
	(0.280)	(0.210)	(0.207)	(0.257)	(0.266)	(0.258)	(0.255)	(0.225)	(0.208)	(0.269)	(0.151)
CACs Included	-19.911***	-19.960***	-18.293***	-18.175***	-17.761***	-19.060***	-19.342***	-21.214***	-2.480*	-18.466***	-20.734***
	(3.633)	(3.368)	(3.872)	(4.454)	(4.235)	(4.458)	(3.800)	(3.958)	(1.243)	(3.762)	(3.857)
Foreign Law	32.363**	32.365**	32.752**	29.569**	30.055**	30.044**	33.611***	32.512**	30.886**	34.666**	29.495***
	(11.908)	(11.905)	(11.477)	(13.339)	(13.281)	(13.812)	(10.581)	(11.698)	(11.956)	(13.020)	(9.724)
Log Principal Amount	-1.446***	-1.444***	-1.502***				-1.359***	-1.454***	-1.463***	-1.472***	-1.783***
	(0.395)	(0.391)	(0.381)				(0.354)	(0.348)	(0.481)	(0.353)	(0.281)
Traded	0.674	0.650	1.001	4.092	4.459	2.667	0.307	0.146	0.742	0.491	1.437
	(4.387)	(4.306)	(4.212)	(6.193)	(6.064)	(6.643)	(4.322)	(4.602)	(4.613)	(4.374)	(4.026)
USD Denominated	0.686	0.676	2.017	0.853	1.464	0.354	1.097	0.893	2.663	1.635	2.929
	(3.089)	(3.174)	(3.137)	(3.293)	(3.448)	(3.289)	(2.955)	(3.564)	(3.813)	(3.343)	(4.694)
Coupon Rate	0.041	0.034	0.277	0.155	0.170	0.135	0.136	0.373	0.529***	0.108	1.030**
	(0.566)	(0.565)	(0.471)	(0.532)	(0.553)	(0.496)	(0.526)	(0.334)	(0.171)	(0.579)	(0.459)
Years To Maturity	0.130	0.126	0.187	0.201	0.183	0.183	0.128	0.126	-0.016	0.157	-0.573
	(0.329)	(0.356)	(0.213)	(0.219)	(0.229)	(0.211)	(0.305)	(0.306)	(0.139)	(0.349)	(0.409)
Haircut ^ 2	0.003	0.002									
	(0.003)	(0.013)									
Haircut ^ 3		0.000									
		(0.000)									
Highest 5 Haircut			-0.474								
			(6.503)								
Highest 5 Haircut * Haircut			-0.158								
			(0.136)								
Principal Amount ($ bn)				-3.800	-6.626***	-1.623					
				(2.319)	(1.775)	(1.705)					
Principal Amount ^ 2				0.175*	0.652***						
				(0.087)	(0.150)						
Principal Amount ^ 3					-0.018**						
					(0.007)						
Smallest 5 Principal						1.991					
						(3.838)					
Smallest 5 Principal * Amount						1.457					
						(1.602)					
Deal Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (Nr of bonds)	320	320	320	320	320	320	325	307	375	320	320
Number of Restructurings	20	20	20	20	20	20	20	18	20	20	20
R2 (within)	0.403	0.403	0.410	0.414	0.418	0.406	0.410	0.415	0.378	0.421	0.400
R2 (overall)	0.284	0.283	0.296	0.288	0.290	0.282	0.278	0.270	0.314	0.294	0.277

Note: This table shows robustness of our main regression results. Columns (1)-(6) examine non-linear effects with respect to haircut and size by including polynomials (quadratic and cubic terms) and indicators of tail observations. Columns (7)-(9) address sample selection by including outliers and excluding certain deals. Columns (10)-(11) show robustness with respect different haircut measures – specifically, Column (10) uses haircut where each bond has a specific discount rate calculated using a linearly interpolated exit yield curve, and Column (11) uses the so-called market haircut which is calculated based on face value of the old bond. Deal-clustered standard errors are shown in parenthesis. *, **, and *** denote significance on the 1, 5 and 10 percent level, respectively.

Figure 7: Interaction: CACs Are Most Effective when Haircuts Are High



4 The Effectiveness of CACs

This section zooms further into the use and effectiveness of CACs, drawing on the data collected in developing country sovereign debt restructurings plus Greece 2012.

4.1 The Impact of CACs on Holdout Rates – Descriptive Evidence

Table 5 identifies the number of restructured bonds that contained CACs in our sample of restructurings, as well as details on the respective voting thresholds and procedure. We also show whether the new bonds issued as a result of the exchange contained CACs.

We find that 16 restructurings involved bonds with some types of CACs. In total, 143 of the 418 bonds that were restructured contained CACs. Most of the CACs were of the classic type, i.e. with bond-by-bond voting. This includes 62 English-law bonds (with mostly a 66.67% threshold), four New-York-law bonds (all with a 75% threshold and issued after 2003), one Japanese-law bond, one Swiss-law bond, and 23 local-law bonds. In Greece, the only advanced-country default in our sample, CACs were retroactively added to the 53 outstanding government-issued local-law bonds through legislative action, in the form of statutory single-limb CACs with an aggregate threshold of 66 2/3%. The fact that the single-limb CACs were retroactively legislated make them somewhat incomparable to CACs that have been in the bond contracts since issuance. For instance, the voting thresholds could be set once the deal had already been largely negotiated and the preferences of creditors were known to the issuer.[22]

In terms of usage, 112 of the 143 bonds triggered their CACs in the restructuring process. CACs were used for the first time during Ukraine's exchange of Eurobonds in 2000. Then in Moldova 2002, CACs were used to amend the payment terms after an agreement was reached with the single largest bondholder, which held 78% of the outstanding bonds against a required 75% threshold. In Uruguay 2003, CACs were used in the Samurai bonds – the first use of CACs under Japanese law. In 2006, Belize used the CACs in one of its New-York-law bonds to bind the 12.5% holdouts to accept the terms of the exchange – this was the first usage of CACs under New York law in more than 70 years (Moody's, 2013b). Since then, CACs have been triggered in the Seychelles 2009, Cote d'Ivoire 2012, Greece 2012, St. Kitts and Nevis 2012, Belize 2013, and most recently Grenada 2015 and Ukraine 2015.[23]

As already indicated by the regression results, the overall track record of CACs in reducing holdouts appears positive, except for the important case of Greece 2012. This can be seen in the box plot in Figure 8, which compares the initial aggregate holdout rates (pre-CACs), i.e. after the participation deadline closed, with the final holdout rate after CACs were voted upon, if at all (post-CACs). The coloured boxes summarize the median, upper and lower quartile, respectively.

[22] Because our baseline regression contains deal fixed effects, any unobserved country-specific effects should be accounted for in the regression analysis in the previous section.

[23] We could not find information on whether CACs were triggered in Dominica 2004 or Grenada 2005.

When looking at averages, across all restructurings in our sample, CACs reduced the holdout rate by half, from about 15% holdouts pre-CACs to an average final holdout rate of 7.6% post-CACs. We get a similar result once we consider only bonds that contained CACs and for which we have both pre-CACs and post-CACs holdout data on the bond-level. On average, for bonds with CACs, holdout rates were reduced by half, from 4% pre-CACs to 2% post-CACs (note that this result excludes Greece for which no pre-CACs bond-level data is available).

CACs were most successful in Seychelles 2009, Cote d'Ivoire 2012 and Belize 2013, which had pre-CACs holdout rates of 12%, 15% and 14%, respectively, and ended up with zero holdouts post-CACs (100% participation).

Table 5 shows that there are only two restructurings in which CACs "failed", in the sense that the voting threshold was not reached and holdouts were not bound in. One example is Ukraine 1999 which failed to reach the 75% CACs threshold in the Merrill Lynch bonds in 1999 and never convened a bondholder meeting. More importantly, Greece failed to restructure half of the foreign-law bonds with CACs in 2012, as 18 out of 35 bonds with CACs missed the voting threshold (either 66.67% or 75%). This case clearly illustrates the weaknesses of classic bond-by-bond CACs. Distressed debt funds focused heavily on the Greek foreign-law bonds, building blocking majorities and refusing to accept the large haircut shared by the majority of bondholders. The end result was that holders of €6.4 billion in face value held out in Greece (more than 3% of Greek GDP, see Zettelmeyer et al. (2013)). These holdouts have since been paid in full and on time.[24]

There are other cases in which CACs were present but were not used deliberately. This is true for Russia's 2000 restructuring of PRINs and IANs and Pakistan's 1999 restructuring of three Eurobonds. In both cases the necessary thresholds to bind in minority holdouts could have been met but the authorities chose not to make use of CACs to keep the restructuring "voluntary."[25]

Over time, not just the prevalence of CACs in international bonds has increased, but also the voting modalities have changed in a way that has made it comparatively easier to eliminate minority holdouts. For example, in our sample, almost all new bonds issued in the wake of restructurings contain CACs (only the bonds in the earliest deal in our sample, Panama 1994, and the domestic-law Russian MinFin 3 bond were exchanged for new securities without CACs). However, the type of CACs tended to be of the classic type (with bond-by-bond voting and typically 75% or 85% thresholds), allowing investors to build a blocking minority in individual instruments.

Following the precedent of Uruguay in 2003, sovereigns started to include a so-called double-limb option in the CACs of their exchange bonds. Under this voting procedure, a majority of

[24] We report the results for the Greece's foreign-law bonds separately from the domestic-law bonds for illustrative purposes only. In the regression analysis, we treat the Greek 2012 restructuring as a single case.

[25] In Pakistan 1999, despite the legal advisors' suggestion to use CACs, the government was concerned that a bondholder meeting would vocalize opposition and decided to keep the exchange voluntary. See International Monetary Fund (2001, p.30-31). While also Grenada 2005 appears to be a case in which CACs were not used despite reaching the required participation threshold, we could not determine a reliable source to confirm this assumption.

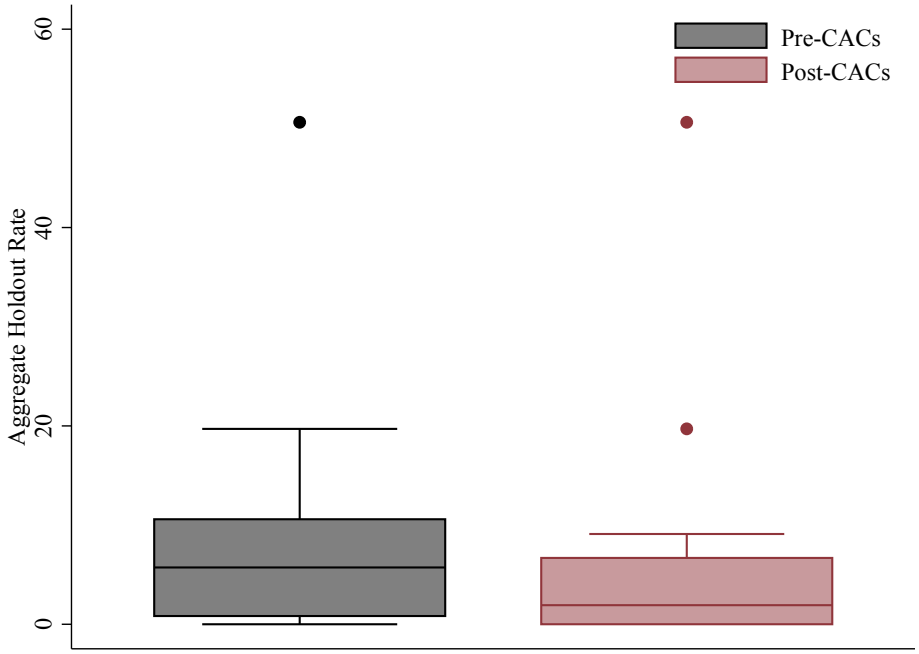
investors must be reached at the aggregate level to impose the deal on holdout creditors, but a lower majority threshold is also still required at the individual bond-by-bond level. Initially, the required majority thresholds varied between countries: while, for example, Uruguay and Argentina exchange bonds contained an aggregate majority requirement of 85% and bond-by-bond consent of at least two-thirds, other countries adopted lower aggregate thresholds, typically at 75% (Stolper and Dougherty, 2017). Since 2014, the industry standard for double-limb CACs foresees a bond-by-bond majority of 50%, and an aggregate (pooled) majority of two-thirds (see e.g. Gelpern, 2014). Overall, the prevalence of double-limb CACs has remained limited: after Uruguay, only Argentina, Dominican Republic, and Greece adopted double-limb CACs in their international bonds in the context of a comprehensive restructuring. In addition, euro area member states have included double-limb CACs in their domestic-law bonds since 2013, in line with the European Stability Mechanism (ESM) Treaty. The euro area model CACs voting thresholds adopt the ICMA levels (if the vote is held in written procedure) but differ substantially from the ICMA model in other respects, such as the definition of holdings that are actually eligible to vote.

More recently, since 2014, countries have started to include a third CAC option: "single-limb" aggregation. Under this option, the votes of bondholders of all eligible bonds are pooled together, and if a sufficient aggregate majority agrees to a restructuring offer, it becomes binding in all series independent of the bond-specific voting result (Gelpern, 2014). The inclusion of this single-limb voting option in international sovereign bonds has been the result of concerted policy efforts by market participants and the official sector (see Sobel (2016) for an overview of the negotiation process). The countries of the euro area are also discussing a single-limb aggregation option as part of the ESM reform negotiations which are still pending at the time of writing. However, only the two latest restructurings contained in our sample (Grenada 2015 and Ukraine 2015) were completed since single-limb aggregation has become a standard provision, limiting the scope for statistical analysis of their effectiveness.

Table 5: CACs in Sovereign Bond Restructurings

Restructuring	CACs in Outstanding Bonds?				Voting Threshold of Old CACs	New CACs
	Total Nr. Old Bonds	With CACs	Voting attempted	Threshold **not** reached		
1994 Panama	9	0	0	0	n.a.	No CACs
1999 Ukraine	1	1	1	1	75%	Bond-by-Bond
1999 Pakistan	3	3	0	0	unknown	Bond-by-Bond
2000 Russia MinFin3	1	0	0	0	n.a.	No CACs
2000 Russia PRINs/IANs	2	2	0	0	95% and 98%	Bond-by-Bond
2000 Ukraine	4	3	3	0	75%	Bond-by-Bond
2000 Ecuador	6	0	0	0	n.a.	Bond-by-Bond
2002 Moldova	1	1	1	0	75%	n.a.
2003 Uruguay	65	1	1	0	66%	Two-Limb
2004 Dominica	3	3	unknown	unknown	unknown	unknown
2005 Argentina	145	0	0	0	n.a.	Two-Limb
2005 Dominican Republic	2	0	0	0	n.a.	Two-Limb
2005 Grenada	16	6	unknown	unknown	unknown	Bond-by-Bond
2006 Belize	5	5	5	0	85%	Bond-by-Bond
2009 Seychelles	2	2	2	0	75%	Bond-by-Bond
2009 Ecuador	2	0	0	0	n.a.	n.a.
2010 Cote d'Ivoire	6	0	0	0	n.a.	Bond-by-Bond
2012 Cote d'Ivoire	1	1	1	0	75%	n.a.
2012 St. Kitts and Nevis	12	11	11	0	75%	Bond-by-Bond
2012 Greece (Foreign Law)	42	35	35	18	75% for 14 bonds 66% for 20 bonds	Two-Limb
2012 Greece (Local Law)	75	53	Retrofitted Single-Limb	0	Retrofitted Single-Limb	Two-Limb
2013 Belize	1	1	1	0	75%	Bond-by-Bond
2015 Grenada	2	2	2	0	75%	Single-Limb
2015 Ukraine	13	13	13	0	75%	Single-Limb

Figure 8: Holdout Rates across Restructurings - Pre-CACs vs. Post-CACs



4.2 Preventing Holdouts via CACs – A Simulation Exercise

In this section we conduct a simple simulation exercise to evaluate the efficacy of different types of CACs. For this purpose, we focus on the three largest restructurings in our sample, which also had a large variation in holdout rates across bonds: Uruguay 2003, Argentina 2005, and Greece 2012. For Greece, we focus particularly on the foreign-law bonds, since the local-law bonds all achieved 100% participation.

In this simulation exercise, we use pre-CACs bondholder participation rates as observed in the data and then simulate what the participation rates would have been if the bonds had contained different types of CACs. The simulation is naive in that we assume pre-CACs participation is unchanged, i.e., we assume that there is no strategic response to CACs ex-ante. This assumption can be justified with a view to the results in the regression analysis: the difference in initial holdout rate between bonds with CACs and bonds without is statistically insignificant.

Following Gelpern et al. (2016), we examine three types of CACs for this exercise:

- *Bond-by-Bond CACs*, which allow a supermajority of typically either 66.2/3% or 75% to amend the financial terms of individual bond series. They are traditionally included in most English-law bonds (mostly with a 66.2/3% threshold) and starting in 2003 in most New-York-law bonds (mostly with a 75% threshold). However, bond-by-bond voting can be ineffective to overcome coordination problems, because in a restructuring with many series, holdouts can concentrate their capital and still manage to block a few series. In contrast, recent model CACs emphasize aggregate participation across series.

- *Two-Limb CACs*, which were included in the new bonds issued in the restructurings of Uruguay 2003, Argentina 2005 and Dominican Republic 2005 and more recently in all euro area sovereign securities issued since 2013, typically have a lower bond-by-bond threshold but in addition also require a supermajority across all series. The precise majority requirements have varied across countries and over time, with the aggregate threshold as high as 85% e.g. in the Argentine case. Since 2014, the ICMA standard clause foresees a bond-by-bond threshold of 50% and an aggregate threshold of two-thirds.[26] Two-limb CACs initially seemed to strike a balance between mitigating the holdout problem and limiting the risk of abuse by governments trying to impose excessively harsh terms. However, the bond exchanges in Argentina (2005) and Greece (2012) exemplified that holdouts can build significant blocking positions in specific individual bonds even in large-scale debt restructurings. This showed that an effective application of two-limb CACs could still be strategically blocked.

- *Single-Limb CACs*, which allow an aggregate supermajority across all series to restructure the entire stock of debt. Single-limb aggregation was used by Greece in its 2012 restructuring with a majority requirement of 66 2/3%. Following a proposal by the industry

[26] The same thresholds are applied in written resolutions in the euro area version, even though higher thresholds apply in case of physical bondholder meetings, see footnote 6.

body ICMA to use single-limb CACs with a majority threshold of 75% (ICMA 2014) and a recommendation by the IMF (IMF 2014), they have been quickly adopted by market issuers (Gelpern et al., 2016).

Specifically, we start with initial participation rates without the use of any CACs. Then, we calculate participation rates assuming that every bond contained the weak-form CACs with a bond-by-bond threshold at 75%. Next, we simulate participation results assuming that every bond had two-limb CACs with a bond-by-bond threshold at 50% if the aggregate participation across all bonds reaches 66 2/3%. Finally, we compute participation results assuming that all bonds contained single-limb CACs with only an aggregate threshold at 66 2/3%. Figure 9 shows the results for aggregate participation rates for different scenarios, while Figure 10 shows results on the bond-level. The findings can be summarized as follows:

- **Uruguay 2003** had an aggregate participation rate of 91.3% with a majority of bonds surpassing 90%. If we assume that all bonds had contained traditional New York CACs with 75% threshold, participation would have improved only slightly, namely by 2 percentage points to an aggregate rate of 93.8%. When we assume two-limb CACs we find that many of the high-holdout bonds would have been bound into the restructuring, bringing total participation close to 100%. In a last step, we find that single-limb CACs would have done little to the aggregate participation rates, when comparing to two-limb CACs. However, they would have brought the Brady New Money Notes, which had a meager 25% participation rate, to full participation, resulting in a 100% rate overall.

- **Argentina 2005** had an aggregate participation rate of 80.3% based on the bonds in our sample, but this aggregate figure hides a large variation at the bond-level.[27] Most of the small issues, accounting for half of the bonds, had less than 75% initial participation. As a result, classic New York law CACs would have only improved the participation by 5 percentage points, bringing the aggregate to a rate of 85.2%. Two-limb CACs would have been much more effective, since all but 9 bonds had at least 50% participation, bringing the total participation to 98.1%. Nevertheless, even the two-limb CACs could not have prevented holdout tactics and litigation on a subset of bonds largely held by distressed-debt investors. Only single-limb CACs would have brought participation to 100%, i.e. forced all bondholders into the exchange. In other words, only the strongest type of CACs would have shielded Argentina from the dozens of holdout lawsuits and the subsequent legal drama.

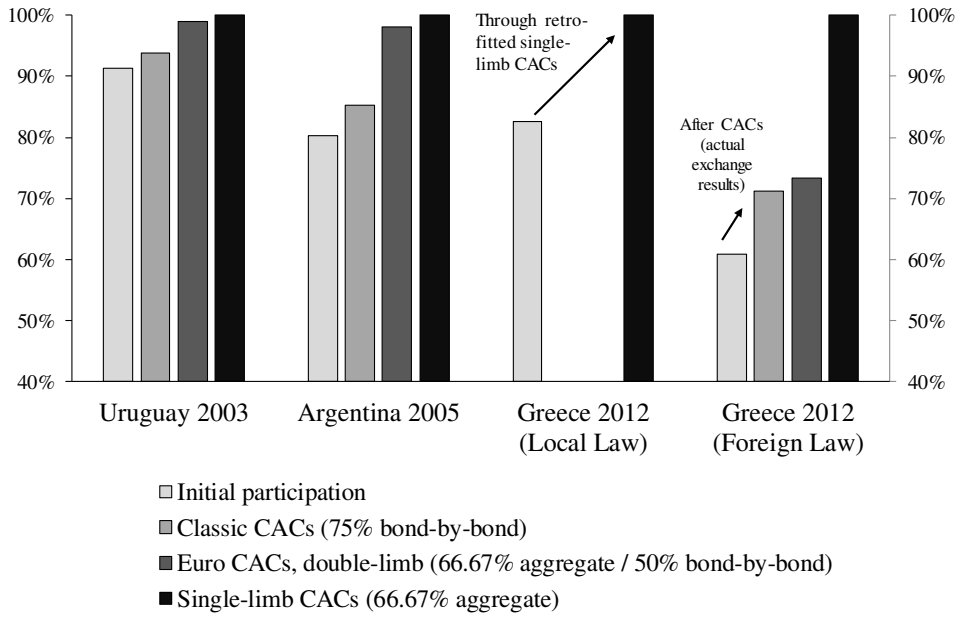
- **In Greece**, the initial aggregate participation rate without the use of any CACs was

[27]The aggregate participation rate at 80.3% in our sample is slightly higher than what is reported in other sources such as Sturzenegger and Zettelmeyer (2006, 2008), and Moody's (2013). The reason is that, as mentioned in Section 2, we exclude coupon and principal strips for which crucial contractual information (such as governing law) is missing. We cover 145 of the 315 eligible securities listed in the exchange offer, and the coverage is comparable to Schumacher (2014) and Cruces and Samples (2016) and twice as large as Sturzenegger and Zettelmeyer (2006, 2008).

82.5% for the domestic-law bonds and a mere 61% for the foreign-law bonds.[28] In the actual exchange, 35 of 42 foreign-law bonds contained classic CACs and 18 failed to reach their respective voting thresholds. Unfortunately, we do not have bond-level participation rates pre-CACs, so we ignore Initial Participation in the bond-level simulation (Figure 10). When assuming that all 42 foreign-law issues had classic CACs with 75% thresholds, only 21 have or would have reached 100% participation, while 23 have or would have failed this threshold, resulting in an aggregate participation rate of only 71%. Two-limb CACs would not have made much of a difference either, since the majority of foreign-law bonds had large-scale holdouts, achieving less than 50% participation. The hypothetical participation rate with two-limb CACs would have increased by only two percentage points, to 73%. Only single-limb CACs with aggregation across *all* securities – including foreign-law and local-law bonds – would have achieved full participation. One could argue, however, that a single-limb CAC may not have been applicable to both local-law and foreign-law bonds, since these are two very distinct asset classes. In that case, even single-limb CACs with an aggregate 75% threshold would not have sufficed to increase participation in the Greek foreign-law bonds.

[28] We treat domestic-law and foreign-law bonds separately in this simulation exercise for illustrative purposes. We treat Greece 2012 as a single deal in the regression exercise.

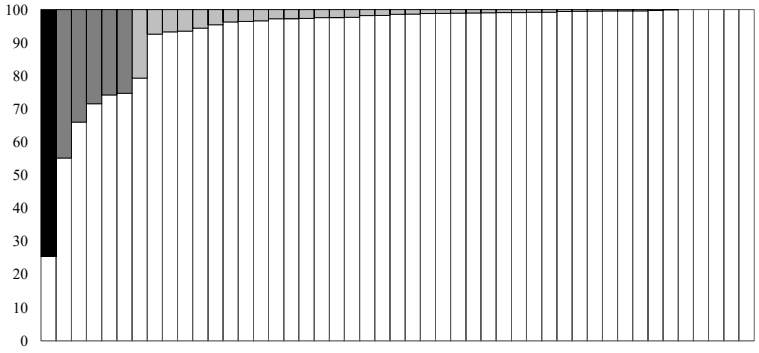
Figure 9: Participation Rates with Different CAC Types – Simulation Results



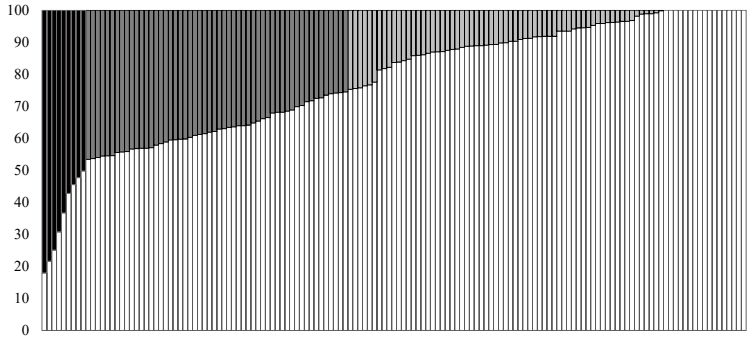
Note: Based on the observed pre-CACs bondholder participation rates, the chart shows the simulated participation rates that would have occurred if the bonds had contained different types of CACs. An important assumption underlying this exercise is that pre-CACs participation are not driven by the presence of CACs, which is in line with our regression results on ex-ante holdout rates in Section 3

Figure 10: Bond-by-Bond Participation Rates – Simulation Results

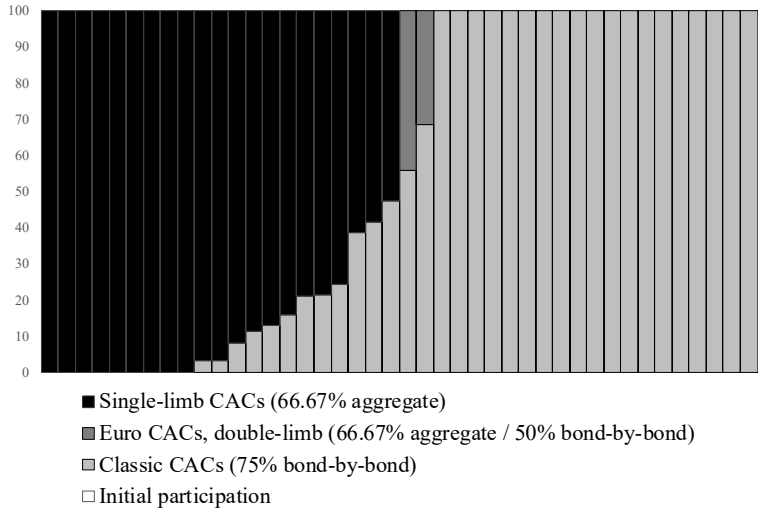
(a) Uruguay 2003



(b) Argentina 2005



(c) Greece 2012 (Foreign-Law Bonds Only)



Note: This Figure shows initial (pre-CACs) participation rates as observed in the data (white areas) and compares these to the final participation rates assuming different types of CACs. We thus ask: what would final participation rates have been for bonds with classic, double-limb, or single-limb CACs, respectively? An important assumption underlying this simulation exercise is that pre-CACs participation are not driven by CACs, which is in line with our regression results on ex-ante holdout rates in Section 3.

5 Conclusion

Creditor coordination problems are a main challenge for the resolution of sovereign debt crises. This paper studies holdout behavior using a novel instrument-level dataset of sovereign restructurings with foreign bondholders since 1994. We find that CACs and the size of haircuts are among the most important determinants of holdout rates. Higher haircuts tend to increase holdout rates at the bond level, while CACs help to significantly reduce them.

At the same time, the data reveal that classic CACs, with bond-by-bond voting, have repeatedly failed to achieve high participation rates. According to our simulations, only the strongest form of CACs, with single-limb aggregate voting, would have eliminated holdout and litigation risks. These findings help to inform theory as well as current policy initiatives on reforming the legal framework of sovereign bond markets, in particular via the dissemination of single-limb CACs. The experience in the most recent sovereign bond restructurings suggests that the presence of a single-limb aggregation option alone could suffice to induce creditor participation, even if it is not actively used. In their 2020 bond exchanges, Argentina and Ecuador employed double-limb voting despite the availability of a single-limb aggregation option. It is conceivable that the high creditor participation rates in these restructurings were achieved only under the "shadow" of more aggressive single-limb aggregation, while foregoing some of its legal complications, notably the requirement to present uniformly applicable offers to all creditors (Buchheit and Gulati, 2020).

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