Braving the zero-leverage unknown: Post-crisis performance and credit dynamics of Portuguese firms

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Dissertation written under the supervision of
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Dissertation submitted in partial fulfilment of requirements for the MSc in Finance, at the Universidade Católica Portuguesa, January 2022.

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Abstract

Debt is not as ubiquitous as classical theories of capital structure would like you to believe. A sizeable slice of firms have no debt in their balance sheets, a phenomenon termed the zero-leverage puzzle. We investigate the performance and credit dynamics of such firms, private and public, in the recovery period following the Sovereign Debt Crisis in Portugal; and conciliate our findings with existing hypotheses on the drivers of this behavior. Our results suggest that zero-leverage firms outperform their unlevered counterparts, namely when conditioning on dividend-paying status. Attesting to the persistence of debt aversion, we find that zero-leverage firms are also likelier to follow a conservative debt policy up to eight years after the zero-leverage event. In aggregate, we extract robust evidence in favor of strategic considerations as the driving force behind firms' hesitancy to take on debt – a boon for the financial flexibility hypothesis. Conversely, the financial constraint hypothesis finds limited support in our data.

Keywords: *zero-leverage*; performance; credit dynamics; financial flexibility; financial constraints; Sovereign Debt Crisis

Desbravando o desconhecido das *zero-leverage*: Desempenho e dinâmicas de crédito de empresas Portuguesas no pós-crise

Bernardo Garcês

Resumo

O recurso à dívida não é tão generalizado como professado pelas teorias de estrutura de capital tradicionais. Um segmento substancial de empresas carece de dívida nos seus balanços, um fenómeno denominado de puzzle das *zero-leverage*. Nós analisamos o desempenho e as dinâmicas de crédito destas empresas, cotadas e não cotadas, no período de recuperação que sucedeu a Crise da Dívida Soberana em Portugal; e tentamos conciliar as nossas conclusões com as teorias vigentes sobre as causas deste comportamento. Os nossos resultados sugerem que empresas *zero-leverage* têm um desempenho superior às suas pares alavancadas, independentemente de distribuírem ou não dividendos. Atestando a persistência desta aversão à dívida, demonstramos também que empresas *zero-leverage* são mais prováveis de adotar uma política de financiamento conservadora até oito anos após o evento *zero-leverage*. Em agregado, extraímos corroboração robusta a favor de considerações estratégicas como móbil desta hesitação em emitir dívida – em linha com a teoria da flexibilidade financeira. Em contraste, a teoria das restrições financeiras não encontra correspondência nos nossos dados.

Palavras-chave: *zero-leverage*; desempenho; dinâmicas de crédito; flexibilidade financeira; restrições financeiras; Crise da Dívida Soberana

Acknowledgements

I do not much care for lonely pursuits. I am happy to report this was not one. To my family and friends, thank you. You are in my heart, always.

I am also obliged to my advisor, Professor Diana Bonfim, for her time and guidance.

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List of abbreviations

EBITDA – Earnings before interest, depreciation, and amortization

GDP – Gross domestic product

NPV – Net present value

ZL – Zero-leverage

nZL – Non-zero-leverage

ZLDP – Zero-leverage dividend-paying

nZLDP – Non-zero-leverage dividend-paying

ZLnDP – Zero-leverage non-dividend-paying

nZLnDP – Non-zero-leverage non-dividend-paying

I. Introduction

Most firms have debt in their balance sheet, as is predicted by classical theories of capital structure. A significant portion of them, however, do not. This stylized fact is termed the zero-leverage puzzle. Several explanatory frameworks for this phenomenon are in-play, but a consensus has yet proved elusive. Like the argonauts of old, we set sail to brave the zero-leverage unknown, charting the performance and credit dynamics of private and public (fittingly) Portuguese firms in the years following the Sovereign Debt Crisis.

Fortunately, we are not wholesale pioneers. Byoun and Xu (2013), Devos et al. (2012) and Strebulaev and Yang (2013) all attest to the prevalence of firms wholly devoid of debt in their balance sheets in the US, with Bessler et al. (2013) and Dang (2013) extending those findings to the international arena. Extrapolating from firm characteristics, various explanatory theories emerge. Of particular interest are the financial flexibility and financial constraint hypotheses – the former driven by strategic considerations and the latter by fiat of supply-side credit restrictions. These hypotheses bear implications on the performance of ZL firms, which is only studied for public US firms in relative isolation (Lee & Moon, 2011; Moon et al., 2014; Zaher, 2010), without overt connection to the potential underlying drivers of zero-leverage status. These theoretical frameworks can also be assessed in the backdrop of the persistence of the zero-leverage phenomenon, namely in the wake of the aggregated results of Bessler et al. (2013) and Dang (2013) – which suggest that ZLDP firms, as the unconstrained few, follow a conservative debt policy for shorter stints than ZLnDP firms.

Our empirical analysis stratifies firms based on their leverage and dividend-paying status in 2010, yielding three ZL cohorts and three associated control cohorts – with the goal of supporting like-for-like comparisons across the aforementioned criteria. We seize on the existing literature on the drivers of the zero-leverage phenomenon and combine it with our findings on performance and persistence, effectively adding two important datapoints to the evaluation of the competing origin hypotheses. Our results tell a story worth reading.

On a first tack, we report that the zero-leverage puzzle is indeed a material empirical feature of the Portuguese corporate sector, on average pertaining to 19% of all firms in the period 2010-2018. This interval comprises the onset and recovery from the Sovereign Debt Crisis. We classify the latter as a period of generalized credit restrictions based on macroeconomic data – and thus, an enriched bedrock on which to quarry for zero-leverage artifacts.

Secondly, we characterize ZL firms as smaller, with fewer tangible assets, more cash on hand, more tax expenses, lower interest tax shields and non-debt tax shields, more dividend payments, and superior profitability and capital allocation bona fides vis-à-vis nZL firms. Our collated findings lend broad support to the financial flexibility hypothesis and haphazard signals on the financial constraint hypothesis. ZLnDP firms, in particular, resonate with the latter, presenting as younger and with a greater degree of perceived financial constraints relative to nZLnDP firms. The classical trade-off and pecking-order theories also display limited predictive power.

Thirdly, we show that ZL firms, regardless of dividend-paying status, match or outperform their respective nZL counterparts in the years following the crisis trough – a result that is robust to different recovery definitions and time windows. ZLDP firms, in particular, brandish an edge when the recovery variable is defined by sales.

Fourthly, we find that up to 8 years following the zero-leverage event, assuming recovery, ZL firms are significantly likelier to stage a creditless recovery than nZL firms, regardless of dividend-paying status, recovery definition, and time window. This remarkable persistence gains extra luster if we the consider circumstances under which it blooms, with a minimum creditless recovery rate of 50% across all cohorts and time windows – in effect validating our macro assessment. Furthermore, in an intra-ZL comparison, ZLDP firms are significantly likelier to eschew debt in their recovery than nZLnDP firms.

Most importantly, as a composite, our performance and persistence yardsticks provide novel clarity on the empirical soundness of the financial constraint and financial flexibility hypotheses. In this regard, the former falters. The on-par to superior recovery performance of ZL firms is not consistent with the bleak outlook of financially constrained firms. Adding kindling to the fire, it is exactly those firms least likely to be financially constrained per our own sample characteristics and performance outputs – the ZLDP group – that more keenly eschew debt, namely when compared to ZLnDP firms. This is also a departure from the combined findings of Bessler et al. (2013) and Dang (2013). The latter hypothesis, however, does not share such a dreary fate. In contrast, the performance and persistence dynamics of ZL firms are consistent with the privileged access to NPV-positive investment opportunities as a downstream effect of the deliberate implementation of a strategy premised on the maintenance of financial flexibility – rather than an ad hoc response to external restrictions. We posit that ZLDP firms represent an especially aggressive breed within the ZL firm continuum, with increased return expectations.

The remainder of the paper wends as follows: Section II expands on relevant literature; Section III characterizes the macroeconomic backdrop, develops the methodology and empirical model, and presents summary statistics; Section IV analyzes the performance and credit dynamics of sample firms; and Section V concludes.

II. Related literature

The study of the zero-leverage puzzle represents a topic of emerging interest in finance academic circles. Related, the stylized fact that firms carry less leverage than predicted by traditional theories of capital structure is well-recognized (Graham & Leary, 2011; Lemmon & Zender, 2001) – though dynamic trade-off models based on contingent claims analysis have made notable inroads in conciliating theory with practice (Ju et al., 2005). Regardless, the low-leverage conundrum remains very much at large – Graham (2000) show that the typical firm could double tax gains by issuing debt until the marginal benefit of debt starts to decrease, with others describing that financial conservatism is indeed a widespread phenomenon (Minton & Wruck, 2001).

The zero-leverage puzzle is an offshoot of this line of research, with several recent studies focusing specifically on such extreme cases of debt aversion. The motivation is two-fold. Firstly, as Strebulaev and Yang (2013) show, explaining the zero-leverage phenomenon is critical in explaining its oft doted on older sibling – the low-leverage puzzle. In detriment of trying to explain average behavior, focusing on the acute cases allows for clarity on the factors determining leverage policy, as they are expected to dominate. Secondly, honing on firms bereft of debt in their balance sheets skirts methodological issues relating to the definition of what constitutes as low or high leverage for a given firm (Devos et al., 2012).

One strand of inquiry focuses on the characterization of ZL firms. Strebulaev and Yang (2013) present intriguing evidence on the existence of a substantial number of large public non-financial US firms with little to no debt in their capital structure going as far back as 1962 – a finding echoed by Devos et al. (2012) and Byoun and Xu (2013) for the US market. Bessler et al. (2013) and Dang (2013) confirm the international pedigree of the zero-leverage phenomenon. The former show that country-level differences exist, however, with countries with a common law origin, stringent creditor protection laws, and favorable dividend tax treatment brandishing a higher percentage of ZL firms.

Several theories are tested on the drivers of zero-leverage events. Strebulaev and Yang (2013) posit management entrenchment and lax governance mechanisms as key determinants. For instance, managers may seek to avoid the pressure of meeting recurring interest payments – one of the suggested agency benefits of debt (Vos & Forlong, 1996). In contrast, however, Devos et al. (2012) conclude that neither internal nor external lax governance mechanisms drive managers' decision to eschew leverage or eventually initiate the use of debt as a ZL firm.

Instead, they present strong evidence in favor of the financial constraint hypothesis – which postulates that ZL firms face supply-side restrictions in accessing credit channels, potentially as a function of information asymmetry, scant tangibility (Diamond, 1991), and limited track record (Holmström & Tirole, 1998). ZL firms are thus found to be smaller, younger, and have fewer tangible assets than their levered peers. Bessler et al. (2013) and Dang (2013) present largely concordant findings, though they distinguish between constrained and unconstrained ZL firms. The unconstrained minority is presumed to abide by the financial flexibility hypothesis – according to which ZL firms conserve debt capacity and hoard cash (i.e., impose a demand-side restriction) to optimally deal with upcoming earnings shortfalls and investment opportunities (de Jong et al., 2012; DeAngelo & DeAngelo, 2007). Dang (2013) argues that this group is accurately proxied by dividend-payers within the ZL spectrum – which are generally mature, profitable, and large; whilst their non-paying ZL counterparts are smaller, in their growth stage, not profitable, and have fewer tangible assets. Bessler et al. (2013) also report that constrained ZL firms, in a manner consistent with a supply-side effect, linger on debtless for longer periods of time than their unconstrained ZL peers, an effect that lasts beyond the eventual levering decision, as these firms then pick lower debt ratios.

The persistence of the zero-leverage puzzle is well-established. Byoun and Xu (2013), Dang (2013), and Strebulaev and Yang (2013) all find evidence that the absence of balance sheet debt is not a fluke for the majority of firms and is rather part of a larger pattern of behavior unfolding over several periods. Bessler et al. (2013) further suggest that zero-leverage behavior is more persistent for constrained firms.

Another strand of research dwells on the performance of ZL firms. More generally, conservative debt policy is positively associated with stronger profitability (Myers, 2001; Wald, 1999) and operating performance (Mikkelson & Partch, 2003). This is consistent with the results of Lee and Moon (2011), who find significant positive abnormal buy-and-hold returns for ZL firms. Importantly, this is maintained regardless of debt capacity, as measured using Fama and French's (1993) three-factor and Carhart's (1997) four-factor models (Moon et al., 2014). When stacked up directly to their nZL counterparts, ZL firms matched on size and industry outperform in both the short-run and long-run (Zaher, 2010). Notably, all these data pertain to public US firms – extant evidence on ZL firms' performance inclusive of private firms and/or outside the US is not readily available.

Lastly, on the relevance of macroeconomic trends, Dang (2013) shows that quiescent to negative GDP growth and a widened term structure of interest rates are both associated with an

increased aversion to corporate borrowing for ZLDP firms. More generally looking at creditless recovery as an enriched testing ground for the aforementioned hypotheses, in the wake of Calvo et al.'s (2006) seminal paper on so-called phoenix miracles – wherein output rises from the ashes of economic ruin without the lending hand of credit markets (which heavily lag the former in their return) – the stylized fact that output can recover with virtually no assistance from domestic and external credit markets is starting to take shape (Bijsterbosch & Dahlhaus, 2011). Furthermore, these phoenix occurrences lack the rarity usually associated to mythical creatures – with 1 out of every 4 recoveries in low-to-middle income countries classifying as creditless (Abiad et al., 2011; Bijsterbosch & Dahlhaus, 2011). In a different approach using firm-level data, however, Ayyagari et al. (2021) posit that phoenix miracles are not as widespread as suggested by Calvo et al. (2006) – which, it could be argued, makes them more miracle-like.

III. Data and methodology

Macroeconomic context in Portugal

To characterize the macroeconomic environment throughout and in the aftermath of the Sovereign Debt Crisis which shook Portugal in the early 2010s, data are sourced from the IMF International Financial Statistics (IFS) database. Entries pertaining to real GDP and real private credit are collected. The latter measure accounts solely for bank credit to the private sector, which, as recognized by Abiad et al. (2011), is an imperfect proxy for flows from the financial sector to the residual economy. For Portugal, however, in light of the residual role of non-bank financial intermediaries in the economy (in comparison to other developed countries) – accounting for 20% of total financial assets in 2017, per Banco de Portugal[1] – this is not a binding restriction.

The economic downturn is identified in conformity with Braun and Larrain (2005), based on fluctuations of annual real GDP. Troughs are defined as years where cyclical GDP is more than one standard deviation below zero. A recession then comprises the period delimited by the year following the preceding peak in cyclical GDP and the trough year.

For the period 2001-2020 in Portugal, troughs occurred in 2013 and 2020 (see appendix 5). Real annual GDP reached a local maximum in 2008, at the onset of the Global Financial Crisis, and though it staged a slight recovery prior to the subsequent Sovereign Debt Crisis, it only surpassed its pre-crisis zenith in 2018. Real private credit, which up until 2010 had been in a consistent if not pronounced upwards trend, entered a dogged downwards spiral between 2010-2019.

Narrowing down on the recovery period following the Sovereign Debt Crisis, we set the trough as year t, and tracking Bijsterbosch and Dahlhaus (2011), we consider various definitions for creditless recovery, per Table 1. Importantly, the recovery from the Sovereign Debt Crisis in Portugal classifies as creditless under all criteria considered. For variable definitions, refer to Appendix 1.

[1] Per EUROMED presentation by Banco de Portugal's Ana Cristina Leal (Financial Stability Department), on the 19th of June of 2019.

Table 1
Definitions of creditless recovery.

#	Definition
1.	3 years of consecutive negative annual real credit growth after the trough
2.	2 years of consecutive negative annual real credit growth after the trough
3.	negative average real credit growth for the 3 years following the trough
4.	negative average real credit growth for the 2 years following the trough
5.	level of real credit is higher in the trough year (t) than in t + 3
6.	level of real credit is higher in the trough year (t) than in t + 2

Sample

To construct our sample, we extract annual balance sheet and income statement data for both private and public Portuguese firms from Moody's Iberian Balance Sheet Analysis System (SABI) over the period 2010-2018. All variables are denominated in euros. We purge financial and utility firms (Standard Industrial Classification [SIC] codes 6000-6999, 4900-4999, respectively) from our dataset, as is standard practice in view of regulatory and capital structure idiosyncrasies. We further require firms to have valid entries for all variables of interest for the period 2010-2018. Micro firms[2] are excluded, removing the unduly influence of sole proprietorships and other small ventures – more reflective of individual behavior than firm behavior – from our results. As a last step, all ratio variables are winsorized at the 1st and 99th percentiles, thereby mitigating the impact of extreme observations. The final sample totals 4,959 unique firms.

Group selection

We segment firms into two main cohorts based on their leverage status in 2010[3]: zero-leverage (ZL) firms, whose total debt (i.e. sum of short-term and long-term book debt) is equal to 0; and non-zero-leverage (nZL) firms, whose total debt is greater than 0. Our approach for defining ZL firms is consistent with that employed by Bessler et al. (2013), Dang (2013), and Strebulaev and Yang (2013). We elect to use 2010 as our reference year, in spite of identifying the recession in Portugal as starting in 2009. This is because 2010 represents both a local maximum in cyclical GDP on the eve of the Sovereign Debt Crisis, and the point at which real private credit

[2] As defined by the European Commission, a micro firm has: (1) less than 10 employees; and (2) total assets lower than or equal to €2 million euros.
[3] The distribution of ZL firms by year is reported in Appendix 2.

entered its downwards trend. Given that for our baseline we want to use the last pre-crisis point of relative economic and credit access normalcy, 2010 emerges as the best compromise when both measures are considered. This also reflects our recognition of a two-tiered recession (Global Financial Crisis; Sovereign Debt Crisis), with the lion's share of the economic and credit impact in Portugal unravelling towards the backend (with the arrival of the bailout triumvirate[4] in 2011).

Finally, we further divide each of the leverage-defined cohorts into subgroups based on firms' dividend-paying status in 2010: dividend-payers (ZLDP; nZLDP), whose amount paid out to shareholders is greater than 0; and non-dividend-payers (ZLnDP; nZLnDP), whose amount paid to shareholders is 0. This is chiefly prompted by the findings of Dang (2013), wherein the zero-leverage phenomenon is described as differing in origin as proxied by firms' dividend policy – with payers driven by strategic considerations and non-payers corralled by financial constraints. Other studies also control for dividend policy (Fama & French, 2002; Lemmon et al., 2008; Strebulaev & Yang, 2013).

We therefore consider a total of six distinct groups of firms stratified by their baseline characteristics in 2010, as depicted in Table 2.

Table 2
Firm groups. Reported are the number of firms in each group, and the corresponding percentages of the sample total (2010 baseline).

	ZL	nZL	ZLDP	nZLDP	ZLnDP	nZLnDP
n	911	4048	242	724	669	3324
% of total	18.4	81.6	4.9	14.6	13.5	67.0

The portion of ZL firms identified is in-line with that reported in other studies (Bessler et al., 2013; Dang, 2013; Devos et al., 2012; Strebulaev & Yang, 2013), corresponding to 18% of our sample, in spite of the novel inclusion of private firms in our analysis. This figure is also undistinguished from the average portion of ZL firms across our sample period (2010-2018), which comes in at 19% (refer to Appendix 2 for by-year granularity). The dividend-paying portion of firms, corresponding to 19.5% of our sample (ZLDP + nZLDP), is lower than expected, which we believe reflects the increased difficulty in collecting dividend data for private firms – unencumbered by the scrutiny and regulatory disclosures we have come to expect for public firms. Dividend-paying firms are thus a minority in general, and within the ZL and nZL groups.

[4] The European Commission, the ECB, and the IMF.

The industry concentration for each cohort is shown in Table 3. In broad strokes, the majority of firms are concentrated in the Manufacturing, Wholesale retail, and Services industry segments. Of note, all ZL groups are positively skewed towards the Services segment vis-à-vis their respective nZL counterparts, with nZL firms displaying a similar bias towards the Construction industry.

Table 3
Industry concentration by cohort. Industries are segmented by the respective SIC divisions. Reported are the percentages of each group's total (2010 baseline).

Industry	ZL	nZL	ZLDP	nZLDP	ZLnDP	nZLnDP
Agriculture, Forestry, and Fishing	2.1	1.9	1.7	1.2	2.2	2.1
Mining	0.1	0.9	0.4	0.7	0.0	0.9
Construction	3.5	6.9	2.9	8.3	3.7	6.6
Manufacturing	31.8	38.4	31.0	37.6	32.1	38.5
Transportation and Communications*	7.5	7.0	8.7	7.7	7.0	6.8
Wholesale trade	25.1	22.2	24.8	22.5	25.3	22.1
Retail trade	9.7	7.1	12.0	7.6	8.8	7.0
Services	20.1	15.6	18.6	14.4	20.6	15.9
Public administration	0.1	0.1	0.0	0.0	0.1	0.1

*also includes Electric, Gas, and Sanitation

Importantly, we can confidently state that the zero-leverage puzzle is indeed a relevant empirical fact across all segments of the Portuguese corporate sector.

Characterization and hypotheses

In describing each group of firms, we refer to variables pertinent to the predictions of the competing hypotheses for the genesis of the zero-leverage phenomenon. A detailed definition of all the variables constructed can be found in Appendix 1.

We consider age, total assets, and employees to test the financial constraint hypothesis. Under information asymmetry, firms without an established reputation (Diamond, 1991) or the ability to credibly pledge future returns to lenders (Holmström & Tirole, 1998) might have difficulties in tapping debt markets (Stiglitz & Weiss, 1981). Both size and age are good proxies (negative relation) for these states of financial exile, as is empirically shown by Hadlock and Pierce (2010). The expectation is thus that ZL firms, if financially constrained, will be both younger and smaller than their nZL counterparts. Furthermore, we include the S-A index (Hadlock & Pierce, 2010) as a combined measure of financial constraints, expecting it to be greater for ZL firms.

Tangibility is considered in the backdrop of the financial constraint hypothesis and trade-off theory. Firms with few tangible assets have hindered access to debt channels and generally bear a higher cost of debt – on account of a dearth of assets eligible for collateral (Benmelech &

Bergman, 2009) and a heightened potential for asset substitution (Jensen & Meckling, 1976). Both theoretical explanations then predict that ZL firms will present a lower level of tangible assets vis-à-vis nZL firms.

Cash is assessed under the aegis of the financial flexibility and financial constraint hypotheses and pecking order theory. In the presence of market distortions, firms choose to preserve their borrowing capacity and hoard cash ex ante to provide ex post flexibility in dealing with unexpected earnings shortfalls and investment opportunities (de Jong et al., 2012; DeAngelo & DeAngelo, 2007). Interestingly, however, this behavior might also be driven by concerns regarding future financial constraints (Almeida et al., 2011), reflecting current financial vulnerability and debt prepositioning for periods of crisis. Additionally, per pecking order theory, cash (as past retained earnings) is preferred over debt as a financing expedient (Myers, 1984). The expectation is then that ZL firms will have a higher level of cash holdings relative to nZL firms.

The tax ratio and interest tax shields are included to quantify the much-vaunted tax benefit of debt (Graham, 2000) – as postulated by trade-off theory. The expectation is that ZL firms will pay more taxes and have lower interest tax shields vis-à-vis nZL firms. As the payment of taxes usually implies the existence of profits, the viability of the financial flexibility and financial constraint hypotheses is also evaluated.

Non-debt tax shields are considered within the realm of trade-off theory. Firms with sizeable non-debt tax shields have a lessened incentive to lean into debt financing (DeAngelo & Masulis, 1980; Mackie-Mason, 1990). As such, we expect ZL firms to display a higher level of non-debt tax shields than nZL firms.

The dividend payout ratio is examined under the financial constraint hypothesis and pecking order theory – both rooted to some extent in frictions driven by information asymmetry. Firms that pay dividends are less likely to be afflicted by high levels of information asymmetry (Lin et al., 2017; Khang & King, 2006). Accordingly, the prediction is that ZL firms will have a lower dividend payout ratio than nZL firms.

Profitability is accounted for in the setting of the financial constraint hypothesis and pecking order theory. On the one hand, firms that are more profitable are less likely to face financing constraints (Ferrando & Mulier, 2013). The expectation is then that ZL firms will be less profitable than nZL firms, per the financial constraint hypothesis. On the other hand, as a firm's profits increase, so generally do its internally generated funds. As stated above, retained

earnings are preferred to debt in financing decisions. This is consistent with Graham's (2000) finding that firms that follow conservative debt policy are more likely to be profitable. Here, the expectation is that ZL firms will be more profitable than nZL firms, per pecking order theory.

Lastly, we consider asset turnover in the scope of the financial flexibility and financial constraint hypotheses. As to the former, firms with increased borrowing capacity and cash savings are better positioned to capitalize on NPV-positive investment opportunities as they arise – which should ultimately be reflected in a more efficient allocation of capital. As such, the expectation is that ZL firms will showcase a higher asset turnover than their nZL counterparts. As to the latter, a consensus on the direction of the effect is elusive. There is evidence that financial constraints improve the quality of the projects undertaken by firms, as managers are faced with scarce resources and survivability incentives (i.e., are forced to run "lean and mean") (Hovakimian, 2011; Musso & Schiavo, 2008). Conversely, constrained firms are documented as being less efficient than their unconstrained brethren, as they are unable to act on profitable investment opportunities (Amos & Zanhouo, 2019; Ferrando & Ruggieri, 2018). Accordingly, under the financial constraint hypothesis, we make no deterministic prediction on ZL firms' profile.

Given that we endeavor to shed light on the provenance of the zero-leverage puzzle, we perform three like-for-like comparisons between ZL and nZL cohorts to isolate divergent characteristics with otherwise similar firms (as conditioned by dividend-paying status). We subsequently make the appropriate suggestions based on the forecasts of the various explanatory frameworks. The following comparisons are considered: ZL vs. nZL; ZLDP vs. nZLDP; and ZLnDP vs. nZLnDP. Results are reported in Table 4.

Empirical model

In our main empirical model, we perform several logistic regressions to measure ZL firms' ability to recover in the wake of the Sovereign Debt Crisis. Importantly, we subsequently parcel out the portion of firm recoveries that classify as creditless and draw conclusions on the persistence and structural drivers of the zero-leverage puzzle.

This analysis takes aim at gaps or points of dissonance within the various strands of literature on ZL firms. Firstly, ZL firms are shown to generate significant positive abnormal returns by Lee and Moon (2011), a finding that remains unaltered when conditioning for debt capacity (Moon et al., 2014). Furthermore, when juxtaposed with nZL firms, ZL firms yield higher levels

of abnormal returns (Zaher, 2010). Notably, however, this performance asymmetry has only been evaluated for US public companies; without specific analysis of firm behavior during or following financial crises, as suggested by Dang (2013); and without sample conditioning on dividend-paying status. We aim to ameliorate these omissions. Materially, our assessment is undertaken during a period of stymied credit supply in Portugal, which should be conducive to the prevalence of zero-leverage behavior in the economy, per the arguments of both the financial flexibility and financial constraint hypotheses. Firms biding their time and keeping their powder dry will now face a higher cost of debt (i.e., a lower set of profitable investment opportunities), whilst financially constrained firms will see their access to credit channels narrowed further. We thus select a rich bedrock on which to prospect and characterize recovery performance and credit dynamics.

Secondly, the persistence of the zero-leverage phenomenon is well documented, with ZL firms following conservative debt policies for several years around the unlevering decision (Dang, 2013) – in effect originating the stable low leverage channel, as shown by DeAngelo and Roll (2015) and Strebulaev and Yang (2013). A distinction is noted between financially constrained and unconstrained firms – with the latter cruising through zero-leverage status as a way of temporarily preserving debt capacity (i.e., remain financially flexible), and the former forced to languish debtless for long periods of time (Bessler et al., 2013). This finding is ostensibly consistent with Dang's (2013) assertion that the zero-leverage puzzle is anchored in two different berths: that of the financial constraint hypothesis, the title of ZLnDP firms; and that of the financial flexibility hypothesis, associated to ZLDP firms. Taken together, these findings suggest that the influence of a zero-leverage event will dissipate faster for ZLDP firms than it will for ZLnDP firms. We endeavor to empirically test this dynamic. More generally, we study the persistence of ZL firms' ostensible aversion to debt during the recovery from an economic crisis in an environment of generalized credit supply constraints.

Thirdly, a plethora of explanatory frameworks for the zero-leverage puzzle have been brought into the fray. The financial flexibility and financial constraint hypotheses stand out as those most frequently postulated (Bessler et al., 2013; Dang, 2013; Devos et al., 2012; Strebulaev & Yang, 2013). Both theories make predictions not only regarding firms' propensity to tap debt markets, but also their performance – and yet, most analyses to date have focused on the former. We attempt to combine both dimensions – the best of both worlds, as a certain North American singer would put it – by comparing the recovery performance and propensity to use debt of ZL firms with that of their nZL peers, conditioning for dividend policy via subgroup analysis. The

latter step aims to expand on Dang's (2013) suggestion regarding the distinct drivers of the zero-leverage decision for ZLDP and ZLnDP firms.

As a starting point, we define three recovery periods following the Sovereign Debt Crisis, all starting at t + 1 (with t as the trough year), and running to t + 3, t + 4, and t + 5. We then obtain the intervals 2013-2016, 2013-2017, and 2013-2018. Note that 2018 corresponds to the first post-crisis year where real GDP exceeds its pre-crisis peak.

To build our first dependent variable, $Recovery_n$, we define:

$$\Delta Sales_{t+1;t+n} = \Delta Sales_{t+1} + \Delta Sales_{t+2} + \ldots + \Delta Sales_{t+n}$$

where $\Delta Sales_{t+1}$ is the change in sales from t to t + 1 for each firm, $\Delta Sales_{t+1;t+n}$ is the sum of changes between t + 1 and t + n, and $n \in \{3,4,5\}$. This is consistent with the approach adopted by Ayyagari et al. (2021) for identifying recoveries (using operating cash flows), though we consider a different underlying variable. We thus construct a distinct specification of our dependent variable for each of the time intervals considered:

$$Recovery_n = 1 \text{ if } \Delta Sales_{t+1,t+n} > 0, \text{ 0 otherwise}$$

where $Recovery_n$ is the recovery flag for each firm during the period comprising n years, and $n \in \{3,4,5\}$.

Sales is chosen as the underlying variable in our construction process in light of evidence that sales growth is positively impacted by uninhibited access to external financial resources, as posited by the financial flexibility hypothesis, and negatively impacted by supply side credit restrictions, as suggested by the financial constraint hypothesis (Musso & Schiavo, 2008).

The logistic regressions undertaken with $Recovery_n$ envisage three different like-for-like comparisons between the designated groups of firms (based on 2010 data): ZL firms vs. nZL firms; ZLDP firms vs. nZLDP firms; ZLnDP firms vs. nZLnDP firms. Accordingly, we create a dummy variable for all but the nZL group of firms. All regressions include baseline firm characteristics – with omissions to avoid collinearity issues – and industry dummies.

For the second stage our empirical analysis, we consider only the firms which staged a recovery within each period. Subsequently, we define:

$$\Delta Debt_{t+1;t+n} = \Delta Debt_{t+1} + \Delta Debt_{t+2} + \ldots + \Delta Debt_{t+n}$$

where $\Delta Debt_{t+1}$ is the change in total book debt from t to t + 1 for each firm, $\Delta Debt_{t+1;t+n}$ is the sum of changes between t + 1 and t + n, and $n \in \{3,4,5\}$. Akin to the process followed for $Recovery_n$, we construct a different specification of our second dependent variable, $Creditless\_Recovery_n$, for each of the time intervals considered:

$$Creditless\_Recovery_n = 1 \text{ if } \Delta Debt_{t+1,t+n} > 0, 0 \text{ otherwise}$$

where $Creditless\_Recovery_n$ is the creditless recovery flag for each firm that recovered during the period comprising n years, and $n \in \{3,4,5\}$. The logistic regressions undertaken with $Creditless\_Recovery_n$ emulate those of $Recovery_n$ – excepting an additional comparison between ZLDP firms and ZLnDP firms.

For robustness, the main empirical analysis is reproduced with EBITDA - an acceptable proxy for operating cash flows - as the underlying variable in the buildout of $Recovery_n$.

Summary statistics

ZL vs. nZL

Panel A of Table 4 reports a range of descriptive statistics for both ZL and nZL firms, alongside the associated t-tests. We find that ZL firms in our sample are smaller than nZL firms – though not at a statistically significant level when measured by employee base. Furthermore, they have fewer tangible assets (i.e., less collateral). Anachronistically, ZL firms are not distinct from nZL firms relative to age and S-A index. In aggregate, these results are a mixed assortment for the financial constraint hypothesis, which postulates that ZL firms are coaxed into going debtless by supply side credit restrictions – the size and tangibility effects are compatible, though the age and S-A index predictions fall short. The tangibility signal is also predicted by trade-off theory.

Table 4
Summary statistics. This table reports the baseline characteristics in 2010 across all six firm groups. Panel A pertains to ZL and nZL firms – with ZL firms defined as having no debt in 2010; and nZL firms comprising the residual sample. The mean and median for each group across the variables considered are displayed alongside the t-statistic for the corresponding difference in means (equivalent-basis, ZL vs. nZL). Panel B pertains to ZLDP, nZLDP, ZLnDP, and nZLnDP firms. ZLDP firms are defined as having no debt and paying dividends in 2010; nZLDP firms are defined as having debt and paying dividends in 2010; ZLnDP firms are defined as having no debt and paying no dividends in 2010; and nZLnDP firms are defined as having debt and paying no dividends in 2010. The mean and median for each group across the variables considered are displayed alongside the t-statistic for the corresponding difference in means (equivalent-basis, ZLDP vs. nZLDP; ZLnDP vs. nZLnDP). The number of firms in each cohort is also reported. See Appendix 1 for variable definitions. *, **, ***, indicate that the differences are significant at the 10%, 5% and 1% levels, respectively.

Panel A: ZL vs. nZL

	(1) ZL firms		*(2)* nZL firms		Diff. in means *(1) – (2)*
Variable	Mean	Median	Mean	Median	T-statistic
Age	299.645	238.000	308.585	259.500	-1.070
Employees	136.652	51.000	160.913	58.000	-1.533
Total assets	9.134	8.898	9.221	8.964	-2.202**
Book debt	0.000	0.000	0.138	0.103	-70.255***
Cash	0.156	0.094	0.072	0.028	14.926***
Tangibility	0.199	0.127	0.290	0.237	-11.306***
Tax	0.021	0.014	0.011	0.006	12.210***
Interest tax shields	0.003	0.000	0.010	0.008	-25.571***
Non-debt tax shields	0.036	0.025	0.040	0.031	-3.075***
Asset turnover	1.503	1.306	1.243	1.046	7.248***
Profitability	0.113	0.095	0.089	0.077	6.310***
Dividend payout	0.030	0.000	0.010	0.000	8.094***
S-A index	-4.094	-3.907	-4.113	-3.981	0.704
Number of observations	911		4048		

(continues)

Table 4 (continued)
Summary statistics.

Panel B: ZLDP vs. nZLDP; ZLnDP vs. nZLnDP

	(1) ZLDP firms		*(2)* nZLDP firms		*(3)* ZLnDP firms		*(4)* nZLnDP firms		Diff. in means *(1) – (2)*	Diff. in means *(3) – (4)*
Variable	Mean	Median	Mean	Median	Mean	Median	Mean	Median	T-statistic	T-statistic
Age	349.570	257.000	346.257	286.500	281.586	232.000	300.379	254.000	0.175	-2.064**
Employees	156.669	75.500	281.942	77.000	129.411	48.000	134.551	55.000	-2.680***	-0.300
Total assets	9.425	9.227	9.609	9.345	9.028	8.796	9.137	8.907	-2.066**	-2.480**
Book debt	0.000	0.000	0.111	0.075	0.000	0.000	0.144	0.108	-27.177***	-65.194***
Cash	0.169	0.106	0.096	0.045	0.152	0.087	0.067	0.026	6.374***	13.011***
Tangibility	0.190	0.138	0.238	0.188	0.202	0.124	0.301	0.249	-3.275***	-10.350***
Tax	0.035	0.028	0.021	0.015	0.016	0.011	0.008	0.005	7.071***	9.045***
Interest tax shields	0.002	0.000	0.007	0.005	0.004	0.001	0.011	0.009	-14.201***	-20.943***
Non-debt tax shields	0.035	0.028	0.040	0.030	0.037	0.024	0.040	0.031	-2.007**	-2.364**
Asset turnover	1.696	1.554	1.398	1.204	1.433	1.242	1.209	1.008	4.139***	5.429***
Profitability	0.169	0.141	0.131	0.110	0.093	0.082	0.080	0.071	4.583***	3.241***
Dividend payout	0.113	0.072	0.055	0.026	0.000	0.000	0.000	0.000	8.044***	n.a.
S-A index	-4.236	-3.972	-4.187	-4.028	-4.042	-3.887	-4.097	-3.969	-0.794	1.808*
Number of observations	242		724		669		3324			

We additionally find that ZL firms hold a significantly larger amount of cash on hand, more than double that of nZL firms – as predicted by the financial constraint and financial flexibility hypotheses and pecking order theory, reflecting firms' prepositioning based on either strategic considerations or current financial vulnerability. ZL firms also pay more taxes and have lower interest tax shields, charting the tax benefit of debt professed by trade-off theory. Non-debt tax shields are lower for ZL firms than nZL firms, contrary to what is predicted by trade-off theory – which suggests that ZL firms do not substitute depreciation & amortization (or other operating expenses) for interest expense.

As it pertains to the dividend payout ratio, ZL firms edge out their nZL peers by a wide margin (though from a low base), in a manner discordant with the financial constraint hypothesis and pecking order theory. The notion that information asymmetry is at the root of the zero-leverage puzzle is thus weakened. Lastly, ZL firms are both more profitable and allocate capital more efficiently (as measured by asset turnover) than nZL firms. The former finding validates pecking order theory's prediction of abundant internal funds driving down firms' propensity to use debt and discredits the conception that financial constraints are keeping profitability quiescent for ZL firms. The latter finding is in keeping with the financial flexibility argument, which anticipates an enhanced ability to capitalize on NPV-positive projects.

To sum up, our representative ZL firm is smaller, has fewer tangible assets, has more cash on hand, pays more taxes, has lower interest tax shields and non-debt tax shields, pays more dividends, and outperforms in both profitability and capital allocation vis-à-vis nZL firms. In this read-out, we unearth robust evidence for financial flexibility and contradictory signals for the existence of financial constraints. We also find conflicting corroboration for both the trade-off and pecking order theories.

ZLDP vs. nZLDP

Panel B of Table 4 reports a range of descriptive statistics for ZLDP, nZLDP, ZLnDP, and nZLnDP firms, alongside the associated like-for-like t tests. Focusing on the dividend-paying cohorts, we find that ZLDP firms are smaller than nZLDP firms – but kindred spirits in age – as reflected by a similar S-A index for these groups. As is the case for the broader ZL cohort, ZLDP firms have fewer tangible assets. These data, taken together, cast doubt on the purported deterministic role of financial constraints in ZLDP firms' zero-leverage decision.

Though the difference is not as marked as it is for ZL firms, ZLDP firms have greater cash holdings than nZLDP firms, as well as pay more taxes and have less interest expenses. They also sport lower non-debt tax shields, much to the chagrin of trade-off theory proponents.

Moving to the dividend-payout ratio, ZLDP firms pay more than twice as much in dividends as their nZLDP counterparts – further marginalizing the ostensible role of information asymmetry in firms' zero-leverage decision. ZLDP firms are also more profitable and capital efficient than nZLDP firms. Both signals are consistent with what was established for the broader ZL group.

To sum up, our representative ZLDP firm is smaller, has fewer tangible assets, has more cash on hand, pays more taxes and has lower interest tax shields, pays more dividends, and outperforms in both profitability and capital allocation relative to nZLDP firms. For ZLDP firms, financial flexibility once again emerges as the most plausible explanatory hypothesis, with scant evidence of increased financial constraints vis-à-vis nZLDP firms. Matching the ZL results, we note that the predictions of the pecking order and trade-off theories do not entirely pan out.

ZLnDP vs. nZLnDP

Still on Panel B of Table 4, we shift gears and narrow down on non-payers. ZLnDP firms, straying from the precedent set by ZL and ZLDP firms, are both younger and smaller than nZLnDP firms (though not as measured by employee base), with a correspondingly higher level of perceived financial constraints (per S-A index). They also have fewer tangible assets, painting a picture wholly consistent with that envisioned by the financial constraint hypothesis.

ZLnDP firms – as is the case across the ZL firm spectrum - have higher cash balances, pay more taxes, and have less interest expenses than their nZLnDP peers. Non-debt tax shields are also lower for ZLnDP firms. Swerving to performance markers, ZLnDP firms are no lame duck, presenting as more profitable and more efficient capital allocators than nZLnDP firms – again, in-line with what was observed across all ZL cohorts.

To sum up, our representative ZLnDP firm is smaller, younger, has fewer tangible assets, is ostensibly more financially constrained, has more cash on hand, pays more taxes, has lower interest tax shields and non-debt tax shields, and outperforms in both profitability and capital allocation vis-à-vis nZLnDP firms. From these results, we glean robust evidence for financial flexibility and contradictory signals – though stronger than for the residual ZL groups – for the existence of financial constraints. We also find conflicting corroboration for both the trade-off and pecking order theories.

Takeaways

In aggregate, these results prompt several suggestions. Firstly, the financial flexibility hypothesis emerges as the most congruous of all relevant theoretical frameworks. All ZL cohorts, regardless of conditioning on dividend policy, reported a larger amount cash on hand and capital allocation efficiency than their respective nZL comparators – the implication being that ZL firms do in fact choose to preserve debt capacity and hoard cash, and are subsequently able to capitalize on NPV-positive investment opportunities which enhance the efficiency of their asset base.

Secondly, the financial constraint hypothesis is greeted with desultory evidence. Relative to age, size, and S-A index, only the ZLnDP cohort matches expectations across the board, comprised of firms that are relatively younger and smaller than their nZLnDP peers, with an associated higher level of perceived financial constraints. The ZL and ZLDP groups replicate the aforementioned size effect but appear to be on equal footing with their respective comparators in age and S-A index. Some consistency is found in the level of tangible assets of all ZL groups – which is lower than in their respective controls. Looking at dividend payout, however, the outlook is grim: all eligible ZL groups (i.e., excluding ZLnDP firms) pay more dividends than their respective peers, positing that information asymmetry plays a limited role in shaping the zero-leverage puzzle. For profitability, the tale is much the same, with all ZL cohorts outperforming their respective counterparts – an unlikely feat in the face of financial constraints. As a whole, this tabulation is inconclusive. Crucially, the degree of perceived financial constraints appears to ebb and flow with dividend-paying status, with the ZLDP group yielding fewer signs of supply side credit restrictions than the ZLnDP group, as suggested by Dang (2013). This is consistent with unreported results where we find that ZLDP firms are larger, older, and more profitable and efficient than ZLnDP firms. The degree to which these perceived financial constraints are binding on firms' zero-leverage decision, however, is questionable in view of the plurality of evidence in favor of the financial flexibility hypothesis across all ZL groups.

Thirdly, the predictions of the trade-off and pecking order theories do not always correspond with the reality of our sample. As to the former, it correctly plots the effect of the well-established tax benefit of debt on all ZL groups' characteristics, as reflected by higher tax expenses and lower interest tax shields vis-à-vis their respective nZL comparators. It also rings true for expected levels of collateral, which are lower across all ZL cohorts as measured by tangible assets relative to their respective peers. For levels of non-debt tax shields, however,

trade-off theory is unable to explain any of the results obtained, with ZL groups inexorably coming under their respective counterparts. As to the latter, it correctly pinpoints the greater level of cash holdings for ZL groups. It also predicts the heightened profitability across ZL cohorts, in direct detriment of the financial constraint hypothesis. On dividend payout it falls short, with ZL and ZLDP firms paying more dividends than their comparators. Of note, models using either of these classical capital structure theories are unable to explain the zero-leverage puzzle (Ju et al., 2005; Leland, 1994). As such, regardless of the accuracy of their prognoses for some of the variables we have considered here, their relevance is subdued.

Lastly, our results are largely consistent with the empirical findings of other studies. Bessler et al. (2013), Dang (2013), Devos et al. (2012), Lee and Moon (2011), and Strebulaev and Yang (2013)[5][6] all report that ZL firms have fewer tangible assets and hold more cash than nZL firms, with the former four also showing that ZL firms are on average younger and smaller. Further, there is evidence that ZL firms pay more taxes[7] (Bessler et al., 2013; Lee & Moon, 2011; Strebulaev & Yang, 2013), have lower or similar non-debt tax shields (Dang, 2013; Bessler et al., 2013), and pay more dividends[8] (Bessler et al., 2013; Devos et al., 2012; Lee & Moon, 2011; Strebulaev & Yang, 2013) than nZL firms. On performance, a tug-of-war is at play, with signals in favor (Strebulaev & Yang, 2013) and against (Bessler et al., 2013; Dang, 2013; Lee & Moon, 2011) increased profitability for ZL firms abounding. Dang (2013) and Strebulaev and Yang (2013) also condition their analysis on dividend-paying status, with most findings remaining unchanged. Notably, the former show that ZLDP firms, contrary to what is established for the broader ZL group, are more profitable than their nZLDP counterparts; and that ZLDP firms are larger, older, and more profitable than ZLnDP firms.

[5] Devos et al. (2012) and Lee and Moon (2011) employ a multi-year definition for ZL firms.
[6] Strebulaev and Yang (2013) do not condition on leverage policy in building their set of proxy firms.
[7] Dang (2013) and Devos et al. (2012) measure the effective tax rate rather than tax expense.
[8] Where applicable, the dividend payout ratio is proxied by the total payout rate.

IV. Recovery performance and credit dynamics

Recovery performance

Sales

Panel A of Table 5 presents the results from logistic regressions modelling the recovery of our sample firms in the wake of the Sovereign Debt Crisis, stratified into 6 distinct groups by zero-leverage and dividend-paying status. This model envisages three like-for-like (i.e., equivalent) comparisons over three different recovery periods (ranging from 3-5 years): in columns 1, ZL vs. nZL; in columns 2, ZLDP vs. nZLDP; and in columns 3, ZLnDP vs. nZLnDP. Notably, all the dependent variables use sales as the underlying building block. The corresponding rates of recovery can be found in Appendix 3.

Table 5

Recovery performance. This table reports the results of logistic regressions on the performance of sample firms in the years following the Sovereign Debt Crisis. Three distinct models are shown: (relevant comparison in brackets)

(1) $Recovery_{n,i} = \alpha + \beta_1 \cdot ZL_i$ + Firm characteristics + Industry dummies + ε_i; *[ZL vs. nZL]*

(2) $Recovery_{n,i} = \alpha + \beta_1 \cdot ZLDP_i + \beta_2 \cdot ZLnDP_i + \beta_3 \cdot nZLnDP_i$ + Firm characteristics + Industry dummies + ε_i; *[ZLDP vs. nZLDP]*

(3) $Recovery_{n,i} = \alpha + \beta_1 \cdot ZLDP_i + \beta_2 \cdot ZLnDP_i + \beta_3 \cdot nZLDP_i$ + Firm characteristics + Industry dummies + ε_i. *[ZLnDP vs. nZLnDP]*

For Panel A, $Recovery_n = 1$ if $\Delta Sales_{t+1,t+n} > 0$, 0 otherwise; for Panel B, $Recovery_n = 1$ if $\Delta EBITDA_{t+1,t+n} > 0$, 0 otherwise; where $Recovery_n$ is the recovery flag for each firm during the period comprising n years, and $n \in \{3,4,5\}$. ZL, ZLDP, ZLnDP, nZLDP and nZLnDP are dummy variables based on firms' leverage and dividend-paying status in 2010. The coefficients are the natural logarithm of the corresponding odds of recovery. Z-statistics are in parentheses. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Sales

		(1) Recovery_3	*(1)* Recovery_4	*(1)* Recovery_5	*(2)* Recovery_3	*(2)* Recovery_4	*(2)* Recovery_5	*(3)* Recovery_3	*(3)* Recovery_4	*(3)* Recovery_5
ZL		0.179**	0.150*	0.131						
		(2.11)	(1.68)	(1.45)						
ZLDP					0.476***	0.337*	0.235	0.414***	0.247	0.232
					(2.83)	(1.95)	(1.35)	(2.60)	(1.50)	(1.40)
ZLnDP					0.158	0.181	0.110	0.097	0.091	0.107
					(1.33)	(1.45)	(0.87)	(1.02)	(0.90)	(1.05)
nZLDP								-0.062	-0.090	-0.003
								(-0.68)	(-0.96)	(-0.03)
nZLnDP					0.062	0.090	0.003			
					(0.68)	(0.96)	(0.03)			
Intercept		1.430***	1.419***	1.553***	1.330***	1.313***	1.520***	1.392***	1.403***	1.523***
		(4.05)	(3.80)	(4.19)	(3.57)	(3.32)	(3.87)	(3.95)	(3.76)	(4.12)
Firm characteristics	Yes									
Industry dummies	Yes									
Number of observations	4 959									
Pseudo R-squared		0.022	0.017	0.017	0.023	0.018	0.017	0.023	0.018	0.017

(continues)

Table 5 (continued)
Recovery performance.

Panel B: EBITDA										
		(1) Recovery_3	*(1)* Recovery_4	*(1)* Recovery_5	*(2)* Recovery_3	*(2)* Recovery_4	*(2)* Recovery_5	*(3)* Recovery_3	*(3)* Recovery_4	*(3)* Recovery_5
ZL		0.039	0.079	0.120						
		(0.48)	(0.95)	(1.44)						
ZLDP					-0.068	0.139	0.155	-0.224	0.090	0.102
					(-0.44)	(0.88)	(0.98)	(-1.56)	(0.60)	(0.69)
ZLnDP					0.230**	0.119	0.171	0.074	0.070	0.118
					(1.98)	(1.01)	(1.46)	(0.79)	(0.74)	(1.25)
nZLDP								-0.156*	-0.049	-0.053
								(-1.77)	(-0.55)	(-0.59)
nZLnDP					0.156*	0.049	0.053			
					(1.77)	(0.55)	(0.59)			
Intercept		-0.259	1.277***	0.168	-0.478	1.173***	0.061	-0.322	1.223***	0.114
		(-0.74)	(3.46)	(0.48)	(-1.30)	(3.02)	(0.16)	(-0.93)	(3.33)	(0.33)
Firm characteristics	Yes									
Industry dummies	Yes									
Number of observations	4 959									
Pseudo R-squared		0.013	0.010	0.010	0.014	0.010	0.010	0.014	0.010	0.010

Broaching on the 3-year recovery period, as measured by the dependent variable $Recovery_3$, ZL firms clearly outperform vis-à-vis nZL firms, with a relative probability of recovery 6% greater[9]. This effect is replicated for the ZLDP cohort with newfangled vigor, showcasing an 17% increase in the likelihood of recovery relative to nZLDP firms. ZLnDP firms' recovery performance, however, is undistinguished from that of nZLnDP firms. Though not on an equivalent basis, we note that ZLDP firms also show an increased probability of recovery as compared to nZLnDP firms.

In the 4-year recovery period, as measured by the dependent variable $Recovery_4$, ZL firms maintain their edge – though at a lower level of significance – and tally a probability of recovery 4% greater than that of their nZL peers. The differential is likewise smoothed out for ZLDP firms, which maintain a 10% increment in the probability of recovery relative to nZLDP firms. The recovery rate in the ZLnDP group remains undistinguished from that of nZLnDP firms.

Onward to the 5-year recovery period, as measured by the dependent variable $Recovery_5$, the results for ZL firms fall on the outskirts of significance – though the numerical trend is consistent with that yielded in the 3-to-4-year periods. Similarly, the ZLDP and ZLnDP cohorts do not distinguish themselves from their respective counterparts.

This tabulation depicts a clear trend of outperformance across most ZL groups, which fades as the recovery period is extended. ZLDP firms, in particular, put on a strong showing, with meaningfully greater chances of recovery in almost all like-to-like comparisons (i.e., excepting the 5-year recovery period) and intermittent primacy over nZLnDP firms. Conversely, ZLnDP firms present as the weakest link in the ZL chain, unable to establish an increased probability of recovery relative to nZLnDP firms in any of the windows considered. Regardless, in spite of these intra-group idiosyncrasies, the ZL cohorts emerge as the clear pole-sitters, with a matching or improved record vis-à-vis the nZL firm spectrum.

EBITDA

Panel B of Table 5 presents the results from logistic regressions modelling the recovery of our sample firms in the wake of the Sovereign Debt Crisis – now with all the dependent variables using EBITDA as the underlying building block. The corresponding rates of recovery can be found in Appendix 3.

[9] We refer to logistic regression coefficients as relative risk ratios rather than odds ratios to facilitate interpretation. The conversion procedure followed is that suggested by Zhang and Yu (1998). The unaffected sample probabilities employed are reported in Appendix 3.

For the 3-year recovery period, as measured by the dependent variable $Recovery_3$, we observe a striking lack of performance differentiation between the various cohorts stacked up to each other. The ZL and ZLnDP groups show favorable numerical trends relative to their respective comparators, but neither reach statistical significance. Curiously (given the sales precedent), the ZLDP group brandishes a negative coefficient across all possible comparisons with nZL firms, drifting dangerously close to significance on a non-equivalent basis vis-à-vis nZLnDP firms. In another tantalizing twist, ZLnDP firms outperform on a non-equivalent basis relative to nZLDP firms – injecting doubt into the former's status as the proverbial sick man of the ZL field.

Jumping over to the 4-year recovery period, as measured by the dependent variable $Recovery_4$, the horizon is exceptionally uniform. None of the ZL cohorts distinguish themselves from the corresponding nZL cohorts, and ZLnDP firms no longer appear to hold a tacit edge. Of note, ZLDP firms no longer allude to inferiority in any of the regressions considered. Recovery performance is by and large undifferentiated.

In the 5-year recovery period, as measured by the dependent variable $Recovery_5$, the window is different, but the view is largely the same. All ZL cohorts run afoul of statistical significance relative to their respective comparators – though they all display favorable numerical trends and their lowest yet p-values.

As a whole, the evidence of ZL groups' relative recovery advantage vis-à-vis their nZL counterparts in the Sovereign Debt crisis aftermath is not as clear-cut using EBITDA as it was with sales as the dependent variable building block. Further, intra-ZL firm differentiation based on dividend-paying status is not forthcoming. Interestingly, contrary to the trend observed with sales, the ZL cohorts' relative probabilities of success seem to gap away from those of their comparators as the recovery period is extended – never reaching statistical significance, but seemingly walking toward it. Looking at EBITDA as a proxy for operating cash flows, we conjecture that this might reflect a longer cash conversion cycle for ZL firms. Firm size is negatively correlated with the length of firms' cash conversion cycle (Moss & Stine, 1993), which is consistent with our finding that ZL firms are on average smaller than their nZL counterparts. As such, a longer recovery period might be required to capture a signal of relative outperformance. Nonetheless, in spite of the shallower differential between ZL groups and their respective nZL comparators, the overarching conclusion is that ZL firms perform at least as

well as nZL firms in the turbulent years which follow a crisis – namely when conditioning for dividend-paying status.

Takeaways

It appears that reports of ZL firms' underperformance have been greatly exaggerated, as measured by either change in sales or EBITDA throughout the several recovery periods. These results are particularly poignant if the predictions of the financial constraint and financial flexibility hypotheses pertaining to sales growth are considered (Musso & Schiavo, 2008) – with the former positing that ZL firms are financially constrained, and thus, will have their sales growth stunted; and the latter suggesting that ZL firms have relatively unbridled access to external financial resources, and as such, will see their sales growth augmented. Proponents of the financial constraint hypothesis will find little in the way of solace, as the gleam in the framework's determination of binding credit supply restrictions is buffed out by the on-par or above performance of all ZL cohorts, namely when conditioning for dividend-paying status. For advocates of the financial flexibility hypothesis, however, the outlook is not so dour. In fact, the framework's directional prognosis on the sales growth of ZL firms is well-received empirically, lending support to the view of strategic considerations as an important determinant of the zero-leverage decision.

Our findings on zero-leverage performance are novel in the extent to which they include private and public Portuguese firms, cover a period of creditless recovery following an economic crisis, condition on dividend-paying status, and employ a different criterion for recovery performance. The direction of the effect itself, however, is in-line with what is reported for US public firms (Lee & Moon, 2011; Moon et al., 2014; Zaher, 2010) – though positive abnormal returns are captured here as an increased relative likelihood of recovery. Interestingly, the expected relative superiority of ZLDP firms, as the sole group motivated by strategic considerations as postulated by Dang (2013), is not clearly stated and only hints at existence using one of the dependent variable's building blocks (sales).

Overall, we find limited evidence for financial constraints as a generalized phenomenon driving zero-leverage decisions in our analysis of recovery performance, contrary to what is suggested by Bessler et al. (2013), Dang (2013), and Devos et al. (2012). Conversely, the financial flexibility hypothesis, interpreted as a much broader basis for zero-leverage status, finds purchase in our data. This seemingly important role of financial flexibility is recognized by

several papers (Bessler et al., 2013; Dang, 2013; Strebulaev & Yang, 2013), though usually with a narrower scope (e.g., relevant only for ZLDP firms).

Credit dynamics

Sales

Panel A of Table 6 presents the results from logistic regressions modelling creditless recovery for sample firms classified as having recovered within each period. Notably, the variables used to determine which firms recovered ($Recovery_n = 1$) use sales as the underlying building block. This model envisages four like-for-like (i.e., equivalent) comparisons over three different recovery periods (ranging from 3-5 years): in columns 1, ZL vs. nZL; in columns 2, ZLDP vs. nZLDP; in columns 3, ZLnDP vs. nZLnDP; and in columns 4, ZLDP vs. ZLnDP. The corresponding rates of (within recovery) creditless recovery can be found in Appendix 4.

Table 6

Credit dynamics. This table reports the results of logistic regressions on the propensity to use debt of sample firms that recovered in the years following the Sovereign Debt Crisis. Four distinct models are shown: (relevant comparison in brackets)

(1) $\text{Creditless\_Recovery}_{n,i} = \alpha + \beta_1 \cdot \text{ZL}_i$ + Firm characteristics + Industry dummies + ε_i; *[ZL vs. nZL]*

(2) $\text{Creditless\_Recovery}_{n,i} = \alpha + \beta_1 \cdot \text{ZLDP}_i + \beta_2 \cdot \text{ZLnDP}_i + \beta_3 \cdot \text{nZLnDP}_i$ + Firm characteristics + Industry dummies + ε_i; *[ZLDP vs. nZLDP]*

(3) $\text{Creditless\_Recovery}_{n,i} = \alpha + \beta_1 \cdot \text{ZLDP}_i + \beta_2 \cdot \text{ZLnDP}_i + \beta_3 \cdot \text{nZLDP}_i$ + Firm characteristics + Industry dummies + ε_i; *[ZLnDP vs. nZLnDP]*

(4) $\text{Creditless\_Recovery}_{n,i} = \alpha + \beta_1 \cdot \text{ZLDP}_i + \beta_2 \cdot \text{nZLDP}_i + \beta_3 \cdot \text{nZLnDP}_i$ + Firm characteristics + Industry dummies + ε_i. *[ZLDP vs. ZLnDP]*

With $\text{Creditless\_Recovery}_n = 1$ if $\Delta\text{Debt}_{t+1,t+n} > 0$, 0 otherwise; where $\text{Creditless\_Recovery}_n$ is the creditless recovery flag for each firm that recovered during the period comprising n years, and $n \in \{3,4,5\}$. ZL, ZLDP, ZLnDP, nZLDP and nZLnDP are dummy variables based on firms' leverage and dividend-paying status in 2010. In Panel A, recovery is defined by the change in sales. In Panel B, recovery is defined by the change in EBITDA. The coefficients are the natural logarithm of the corresponding odds of creditless recovery (assuming recovery). Z-statistics are in parentheses. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Sales

		(1) Creditless _Recovery_ 3	*(1)* Creditless _Recovery_ 4	*(1)* Creditless _Recovery_ 5	*(2)* Creditless _Recovery_ 3	*(2)* Creditless _Recovery_ 4	*(2)* Creditless _Recovery_ 5	*(3)* Creditless _Recovery_ 3	*(3)* Creditless _Recovery_ 4	*(3)* Creditless _Recovery_ 5	*(4)* Creditless _Recovery_ 3	*(4)* Creditless _Recovery_ 4	*(4)* Creditless _Recovery_ 5
ZL		0.646***	0.512***	0.476***									
		(6.30)	(5.29)	(5.06)									
ZLDP					1.112***	0.818***	0.813***	1.286***	1.043***	0.880***	0.740***	0.577***	0.473**
					(5.17)	(4.09)	(4.25)	(6.35)	(5.53)	(4.86)	(3.37)	(2.82)	(2.41)
ZLnDP					0.373**	0.241*	0.339**	0.546***	0.466***	0.407***			
					(2.56)	(1.75)	(2.53)	(4.80)	(4.32)	(3.86)			
nZLDP								0.174	0.225**	0.068	-0.373**	-0.241*	-0.339**
								(1.55)	(2.12)	(0.65)	(-2.56)	(-1.75)	(-2.53)
nZLnDP					-0.174	-0.225**	-0.068				-0.546***	-0.466***	-0.407***
					(-1.55)	(-2.12)	(-0.65)				(-4.80)	(-4.32)	(-3.86)
Intercept		-1.098**	-0.337	-0.830**	-0.975**	-0.184	-0.866**	-1.149***	-0.409	-0.934**	-0.602	0.057	-0.527
		(-2.54)	(-0.82)	(-2.05)	(-2.14)	(-0.42)	(-2.02)	(-2.67)	(-1.00)	(-2.31)	(-1.37)	(0.14)	(-1.27)
Firm characteristics	Yes												
Industry dummies	Yes												
Number of observations		3 234	3 533	3 585	3 234	3 533	3 585	3 234	3 533	3 585	3 234	3 533	3 585
Pseudo R-squared		0.027	0.020	0.021	0.027	0.019	0.020	0.027	0.019	0.020	0.027	0.019	0.020

(continues)

Table 6 (continued)
Credit dynamics.

Panel B: EBITDA

		(1) Creditless_Recovery_3	*(1)* Creditless_Recovery_4	*(1)* Creditless_Recovery_5	*(2)* Creditless_Recovery_3	*(2)* Creditless_Recovery_4	*(2)* Creditless_Recovery_5	*(3)* Creditless_Recovery_3	*(3)* Creditless_Recovery_4	*(3)* Creditless_Recovery_5	*(4)* Creditless_Recovery_3	*(4)* Creditless_Recovery_4	*(4)* Creditless_Recovery_5
ZL		0.541***	0.457***	0.414***									
		(5.13)	(4.52)	(4.12)									
ZLDP					1.087***	0.622***	0.639***	1.281***	0.803***	0.745***	0.837***	0.362*	0.366*
					(4.48)	(3.00)	(3.12)	(5.58)	(4.12)	(3.85)	(3.41)	(1.71)	(1.75)
ZLnDP					0.249*	0.259*	0.273*	0.443***	0.440***	0.378***			
					(1.68)	(1.80)	(1.90)	(3.82)	(3.90)	(3.37)			
nZLDP								0.194*	0.181	0.105	-0.249*	-0.259*	-0.273*
								(1.69)	(1.63)	(0.94)	(-1.68)	(-1.80)	(-1.90)
nZLnDP					-0.194*	-0.181	-0.105				-0.443***	-0.440***	-0.378***
					(-1.69)	(-1.63)	(-0.94)				(-3.82)	(-3.90)	(-3.37)
Intercept		-0.800*	-0.281	-1.024**	-0.625	-0.160	-1.012**	-0.819*	-0.342	-1.117***	-0.376	0.099	-0.739*
		(-1.78)	(-0.66)	(-2.38)	(-1.31)	(-0.35)	(-2.22)	(-1.82)	(-0.80)	(-2.61)	(-0.83)	(0.23)	(-1.70)
Firm characteristics	Yes												
Industry dummies	Yes												
Number of observations		3 112	3 275	3 187	3 112	3 275	3 187	3 112	3 275	3 187	3 112	3 275	3 187
Pseudo R-squared		0.021	0.015	0.018	0.021	0.015	0.017	0.021	0.015	0.017	0.021	0.015	0.017

Before delving into the results, we first note that the macroeconomic data characterizing the recovery from the Sovereign Debt Crisis as creditless clearly reflect the firm-level reality, with creditless recovery rates ranging from 50% to 80% – meaning that regardless of the group and period combination considered, a minimum of half of the firms in the chosen group will have staged a recovery without resorting to additional debt.

Onward to the 3-year recovery period, as measured by the dependent variable $\text{Creditless\_Recovery}_3$, the results are remarkably one-sided. Assuming recovery, the probability of it being creditless is 29% greater for ZL firms relative to their nZL peers[10]. For ZLDP and ZLnDP firms, the equivalent nZL group differentials are 40% and 26%, respectively. Looking at the intra-ZL comparison between ZLDP and ZLnDP firms, we find that a recovery in the former group is 22% likelier to be creditless. We also note that on all non-equivalent comparisons with the nZL group spectrum, assuming recovery, all ZL cohorts boast a greater likelihood of it being creditless.

In the 4-year recovery period, as measured by the dependent variable $\text{Creditless\_Recovery}_4$, ZL groups' stated tendency to eschew additional debt is reiterated. Assuming recovery, the probability of it being creditless is 23% greater for ZL firms relative to their nZL peers. For ZLDP and ZLnDP firms, the equivalent nZL group differentials are 31% and 22%, respectively. As for the intra-ZL test, a recovery for ZLDP firms is 18% likelier to be creditless than a recovery for ZLnDP firms. All non-equivalent comparisons between ZL and nZL groups continue to attribute a greater likelihood of creditless recovery (within recovery) to the former.

Delving into the 5-year recovery period, as measured by the dependent variable $\text{Creditless\_Recovery}_5$, the creditless bias in ZL firms' recoveries is maintained. Assuming recovery, the probability of it being creditless is 23% greater for ZL firms relative to their nZL peers. For ZLDP and ZLnDP firms, the equivalent nZL group differentials are 36% and 20%, respectively. In the intra-ZL test, ZLDP firms edge out ZLnDP firms in their relative probability of creditless recovery by 17%. All non-equivalent comparisons between ZL and nZL groups continue to attribute a greater likelihood of creditless recovery (within recovery) to the former.

Taking stock, we extract a consistent and evocative signal on the apparently long lifespan of ZL firms' aversion to debt, lasting up to 8 years following their zero-leverage decision. The

[10] We refer to logistic regression coefficients as relative risk ratios rather than odds ratios to facilitate interpretation. The conversion procedure followed is that suggested by Zhang and Yu (1998). The unaffected sample probabilities employed are reported in Appendix 4.

persistence of this behavioral trait appears to be robust to different recovery windows and conditioning on dividend-paying status. It is noticeably expressive for ZLDP firms – which standout in their zeal against debt even in comparison with ZLnDP firms.

EBITDA

Panel B of Table 6 presents the results from logistic regressions modelling creditless recovery for sample firms classified as having recovered within each period – now with the variables used to determine which firms recovered ($Recovery_n = 1$) using EBITDA as the underlying building block. The corresponding rates of (within recovery) creditless recovery can be found in Appendix 4.

Akin to what is found when the recovery variable is defined by sales, the macroeconomic basis for classifying the recovery from the Sovereign Debt Crisis as creditless is indeed backed by firm-level evidence, with creditless recovery rates ranging from 52% to 81%.

Moving into the 3-year recovery period, as measured by the dependent variable $Creditless\_Recovery_3$, ZL groups foreswear debt in their recoveries at a higher rate than nZL groups. For ZL firms, ZLDP firms, and ZLnDP firms, the equivalent differentials are 23%, 36%, and 20%, respectively. As for the intra ZL test, a recovery for ZLDP firms is 24% likelier to be creditless than a recovery for ZLnDP firms. All non-equivalent comparisons between ZL and nZL groups attribute a greater likelihood of creditless recovery (within recovery) to the former.

In the 4-year recovery period, as measured by the dependent variable $Creditless\_Recovery_4$, we the credit dynamics identified in the previous recovery window are preserved. For ZL firms, ZLDP firms, and ZLnDP firms, the equivalent differentials are 20%, 23%, and 20%, respectively. In the intra-ZL test, ZLDP firms show an increased probability of creditless recovery of 12% relative to ZLnDP firms. All non-equivalent comparisons between ZL and nZL groups continue to attribute a greater likelihood of creditless recovery (within recovery) to the former.

Tapping out with the 5-year recovery period, as measured by the dependent variable $Creditless\_Recovery_5$, the coda sticks to the melody played throughout. For ZL firms, ZLDP firms, and ZLnDP firms, the equivalent differentials are 19%, 26%, and 18%, respectively. As for the intra ZL test, a recovery for ZLDP firms is 13% likelier to be creditless than a recovery

for ZLnDP firms. All non-equivalent comparisons between ZL and nZL groups continue to attribute a greater likelihood of creditless recovery (within recovery) to the former.

Putting it all together, we are once again left with a clear outlook on the long-run credit apprehension of ZL firms. The persistence of this conservative bias is robust to several time windows (i.e., up to 8 years after 2010) and conditioning on dividend-paying status. To the latter point, ZLDP firms remain particularly keen on keeping their balance sheets devoid of additional debt, namely when compared to ZLnDP firms.

Takeaways

In aggregate, our results pertaining to ZL firms' propensity to use debt in the years following an economic crisis are rather homogeneous – assuming recovery, ZL firms are less prone to rely on debt than their nZL peers, regardless of how recovery is defined, time window, and conditioning on dividend-paying status.

On the one hand, these findings are not unexpected. The tenacious nature of the zero-leverage phenomenon is alluded to by several authors. Dang (2013) shows that ZL firms maintain systematically lower levels of debt up to 5 years around the year of the zero-leverage decision. Strebulaev and Yang (2013) likewise characterize zero-leverage behavior as extremely persistent, with 15% of ZL firms not raising any debt over the 10-year increment following the zero-leverage event, conditioning on firm survival. Our results are much in the same vein, though we circumscribe our analysis to a period of generalized credit supply constraints across the firm leverage spectrum (in a post-crisis context) – we reason that the number of creditless recoveries registered (as we have defined them) would be significantly lower if we performed the same analysis in a period of credit market stability. In this enriched backdrop, we observe remarkably high levels of creditless recovery for all firms, ranging from 50% to 81%. In spite of this, ZL firms still manage to loom above nZL firms in their hesitancy to dip their balance sheets in debt markets' waters.

On the other hand, the sustained increased likelihood of recovery for ZLDP firms relative to ZLnDP firms is not per our expectations, as it implies that the effect of a zero-leverage event does not dissipate faster for ZLDP firms than ZLnDP firms. This goes against the collated findings of Dang (2013) and Bessler et al. (2013), which suggest that ZLDP firms – zero-leverage by self-imposition, in a strategic effort to pounce on and retain NPV-positive opportunities as they arise – remain debtless and follow a conservative debt policy for a shorter period of time than ZLnDP firms – which are forced to trudge on creditless in Sisyphean fashion

by edict of their financial constraints. The two-nexus explanation for the origin of the zero-leverage phenomenon is thus weakened, as we find few reasons to believe that ZLDP firms are less financially constrained than ZLnDP firms in our persistence analysis. In fact, if anything, these data burnish the claim of the financial flexibility hypothesis, as it is exactly those ZL firms whose characteristics (at baseline) are less consistent with a constrained diagnosis that eschew debt for the longest period, suggesting that strategic considerations might be at play across the ZL spectrum, but particularly so for ZLDP firms – in the extent to which financial robustness grants firms the leeway to implement strategy.

Closing discussion

The body of evidence we have generated concerning both recovery performance and credit dynamics is extensive and insightful. All ZL groups showcase an increased or similar probability of recovery relative to their respective nZL counterparts. The ZL firms that recover are also likelier to do so without resorting to additional debt, a signal that is significant regardless of the specification considered and particularly strong for ZLDP firms. In the context of the financial constraint hypothesis, these two streams of data do not paint a wholly favorable outlook. Contrary to what would be expected from financially constrained firms – namely when the recovery variable is defined by sales (Musso & Schiavo, 2008) – ZL firms outperform or match their respective nZL controls. On the persistence side of the equation, one might argue that the increased rates of creditless recovery reflect the relative financial decrepitude of ZL firms. That argument, however, is undercut by the finding that ZLDP firms, those less likely to be financially constrained within the ZL playing field (as measured in relation to their respective nZL counterparts) by our sample characteristics and performance analysis, are actually likelier to eschew debt in their recoveries than ZLnDP firms. This is also in conflict with the combined findings of Bessler et al. (2013) and Dang (2013), which suggest that ZLDP firms, as the unconstrained minority within ZL firms, will embrace a conservative debt policy for a shorter period of time than ZLnDP firms. We therefore find it unlikely that a segmentation by dividend-paying status accurately cuts across the ZL spectrum by underlying driver, especially when the widespread on-par to superior performance of ZL groups is taken into account. Ultimately, from the totality of our data, we extract weak evidence for the financial constraint hypothesis for ZL firms in general, and ZLnDP firms in specific.

In the context of the financial flexibility hypothesis, our results are far more accommodating. Moving across sample characteristics, performance analysis, and credit dynamics during the recovery period, most of the datapoints considered are remarkably congruent. ZL firms'

performance track record is consistent with that expected from firms with privileged access to NPV-positive investment opportunities – with their long-winded hesitation to take on debt more aptly associated to a deliberately implemented modus operandi (predicated on the maintenance of future financial flexibility) than a transitory shift in strategy in response to external factors (whose effects would not be as persistent). We posit that ZLDP firms represent a particularly aggressive breed in the ZL gens, with heightened aversion to debt in view of increased return expectations (i.e., fewer amenable investment opportunities[11]) and an expectedly steadier performance vis-à-vis their nZL counterparts. As such, in the totality of our data, we find strong evidence for the financial flexibility hypothesis for ZL firms in general, and ZLDP firms in specific.

[11] The lower the equity-only project IRR, the lower the amount of debt required to reach the desired return. There is a binding restriction on the amount of debt compatible with future financial flexibility. As such, an investor with a steep risk profile seeking to preserve financial flexibility is subject to a rarefied set of investment opportunities.

V. Conclusion

Our paper describes the post-crisis performance and credit dynamics of public and private Portuguese firms, and in that prism, takes a fresh look at the proposed drivers of the zero-leverage puzzle. We show that ZL firms match or exceed the performance of nZL firms in the recovery from the Sovereign Debt Crisis, namely when conditioning for dividend-paying status. Furthermore, assuming recovery, we find that the ZL firms are significantly likelier to stage a creditless recovery than nZL firms, regardless of the window considered in the 8-year timeframe. Importantly, in an intra-ZL comparison, ZLDP firms are likelier to eschew debt in their recovery than ZLnDP firms. Taken in aggregate, our data are lopsided towards the financial flexibility hypothesis – with sparce evidence in favor of the financial constraint hypothesis.

Alas, our analysis is handicapped in several areas. Firstly, the recovery variables constructed are binary in nature (i.e., are dummy variables) – and though this has interpretation and methodological advantages – sensitivity on the magnitude of the effects weighed is lost. Secondly, our sample characteristics refer solely to the baseline year – as that is the onboarding year for all cohorts tracked – and as such, any inferences thereby made are naturally prone to temporal bias. Thirdly, we do not include alternative metrics which could provide insights into zero-leverage behavior, such as credit ratings, governance indicators, and market values – the bane of considering private firms in our sample. Incremental research to fill these gaps is thus warranted.

Taking stock of our contributions, it is clear that we have not yet arrived at our terminal destination. Much remains to be done until we can fully claim to understand the zero-leverage puzzle. Nonetheless, we firmly believe to have crossed the proverbial Rubicon – and like the Roman generals of times past, we have no intention of turning back.

VI. References

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VII. Appendices

Appendix 1
Variable definitions. All firm characteristics root data are denominated in thousands of euros, unless otherwise stated. The corresponding SABI label is between brackets, if applicable.

Panel A: Firm characteristics	
Variables	Definitions
Age	Number of months since inception [Date of Establishment]
Employees	Number of employees reported [Number of Employees]
Total assets	Natural logarithm of total assets [Total Assets]
Book debt	Ratio of total debt [Loans] to total assets [Total Assets]
Cash	Ratio of cash & cash equivalents [Cash and Cash Equivalents] to total assets [Total Assets]
Tangibility	Ratio of tangible assets [Tangible Fixed Assets] to total assets [Total Assets]
Tax	Ratio of tax expense [Taxation] to total assets [Total Assets]
Interest tax shields	Ratio of interest expense [Interest] to total assets [Total Assets]
Non-debt tax shields	Ratio of depreciation and amortization [EBITDA - EBIT] to total assets [Total Assets]
Asset turnover	Ratio of sales [Operating Revenue / Turnover] to total assets [Total Assets]
Profitability	Ratio of EBITDA [EBITDA] to total assets [Total Assets]
Dividend payout	Ratio of dividends paid [Dividends] to total assets [Total Assets]
S-A index	$-0.737 \cdot Size + 0.043 \cdot Size^2 - 0.040 \cdot Age$, per Hadlock and Pierce (2010) – total assets is used as a proxy for size

Panel B: Macroeconomic context	
Variables	Definitions
Real GDP	Nominal GDP divided by the GDP deflator, as sourced from the IMF IFS database
Real private credit	Claims on Private Sector (Other Depository Corporations) divided by the GDP deflator, as sourced from the IMF IFS database
Cyclical GDP	Difference between the natural logarithm of real GDP and de-trended real GDP. The trend is extracted with a Hodrick-Prescot filter with the smoothing parameter set to 6.25, per Ravn and Uhlig (2002) for annual data

Appendix 2

Distribution of ZL firms by year. ZL firms are defined as having no debt in their balance sheets.

Year	ZL	
	n	% of total sample
2010	911	18.4
2011	803	16.2
2012	843	17.0
2013	889	17.9
2014	932	18.8
2015	990	20.0
2016	1013	20.4
2017	1014	20.4
2018	1018	20.5

Appendix 3

Recovery rates by cohort. Panel A contains results for recovery as defined by the change in sales over the 3-year, 4-year, and 5-year intervals. Panel B contains results for recovery as defined by the change in EBITDA over the 3-year, 4-year, and 5-year intervals. Reported are the percentage of firms that recovered within each group.

Panel A: Sales						
Variables	ZL	nZL	ZLDP	nZLDP	ZLnDP	nZLnDP
$Recovery_3$	68.8	64.4	71.5	60.8	67.9	65.2
$Recovery_4$	73.7	70.7	74.8	67.7	73.2	71.4
$Recovery_5$	74.6	71.8	75.2	70.2	74.4	72.1
Panel B: EBITDA						
Variables	ZL	nZL	ZLDP	nZLDP	ZLnDP	nZLnDP
$Recovery_3$	63.2	62.6	56.6	58.3	65.6	63.6
$Recovery_4$	67.0	65.8	64.5	62.4	67.9	66.6
$Recovery_5$	65.6	64.0	63.6	61.2	66.4	64.6

Appendix 4

Creditless recovery rates by cohort. Panel A contains results for recovery as defined by the change in sales over the 3-year, 4-year, and 5-year intervals. Panel B contains results for recovery as defined by the change in EBITDA over the 3-year, 4-year, and 5-year intervals. Reported are the percentage of firms that that staged a creditless recovery within each group's set of recovering firms.

Panel A: Sales						
Variables	ZL	nZL	ZLDP	nZLDP	ZLnDP	nZLnDP
$Creditless\_Recovery_3$	69.9	52.6	79.8	57.3	66.1	51.7
$Creditless\_Recovery_4$	67.5	52.9	75.7	58.0	64.5	51.8
$Creditless\_Recovery_5$	64.1	50.5	71.4	52.8	61.4	50.0
Panel B: EBITDA						
Variables	ZL	nZL	ZLDP	nZLDP	ZLnDP	nZLnDP
$Creditless\_Recovery_3$	69.6	55.2	81.0	59.7	66.1	54.3
$Creditless\_Recovery_4$	67.7	55.0	73.1	59.3	65.9	54.2
$Creditless\_Recovery_5$	64.4	52.3	70.8	56.0	62.2	51.6

Appendix 5
Cyclical GDP over the period 2001-2020. Troughs are identified in 2013 and 2020. Refer to appendix 1 for variable definitions.