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The international zero-leverage phenomenon ☆

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ABSTRACT

We analyze the zero-leverage phenomenon around the world. Countries with a common law system, high creditor protection, and a dividend imputation or dividend relief tax system exhibit the highest percentage of zero-leverage firms. The increasing prevalence of zero-leverage firms in all sample countries is related to market-wide forces during our sample period, such as IPO waves, shifts in industry composition, increasing asset volatility, and decreasing corporate tax rates. Firm-level comparisons reveal that only a small number of firms deliberately maintain zero-leverage. Most zero-leverage firms are constrained by their debt capacity. Analyzing the time-series dynamics of leverage and investment behavior, we further show that firms which pursue a zero-leverage policy only for a short period of time seek financial flexibility.

1. Introduction

Major listed firms in the S&P 500 index, such as Apple, Yahoo, Texas Instruments, Bed Bath & Beyond or Urban Outfitters, are examples for the stylized fact in corporate finance that the proportion of zero-leverage firms has sharply increased over time. The increasing prevalence of zero-leverage firms is not only a phenomenon in the United States, but it is also observable in other major financial markets. As shown in Fig. 1, only 8.47% of all firms in our sample of developed markets renounced the use of debt in 1988, but the percentage of zero-leverage firms rose to 25.70% by the end of our sample period in 2011. In other words, roughly one out of every four listed firms in the developed markets abstain from using debt. In the presence of market frictions, there are two main theories of capital structure: the trade-off theory (Kraus and Litzenberger, 1973) and the pecking order theory (Myers and Majluf, 1984). Both theories advocate the use of debt because of either tax benefits or lower costs of asymmetric information. The empirical literature is still undecided which theory better describes firms' financing decisions.[1] Perhaps most troubling, neither the trade-off theory nor the pecking order theory is able to explain why so many firms across countries follow a zero-leverage policy.

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[1] Most prior empirical studies either focus on identifying factors that affect firms' capital structures (Rajan and Zingales, 1995; Frank and Goyal, 2009; Fan et al., 2012) or directly test theories of capital structure (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003).

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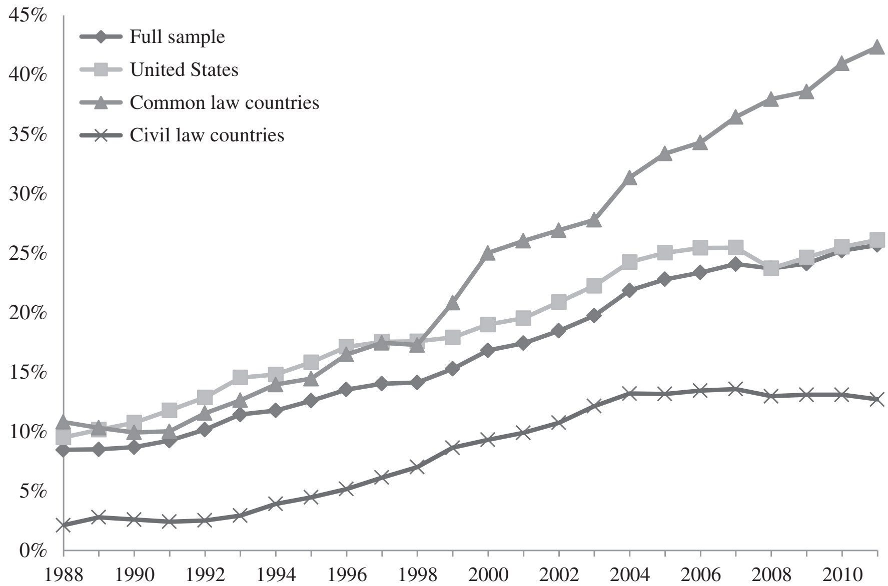

Fig. 1. Distribution of zero-leverage firms over time. This figure plots the percentages of firms that follow a zero-leverage policy for each country group in each year. The sample period is from 1988 to 2011. A firm is classified as zero-leverage if it has no long-term and short-term debt in a given year. The 20 developed countries in our sample either belong to the common law group or to the civil law group. US data is excluded from the common law group and reported separately. Table A3 contains a list of the different countries and their institutional characteristics.

This study contributes to our understanding of zero-leverage in three ways. First, we offer explanations for the upward trend in the percentage of zero-leverage firms. On the one hand, the increasing prevalence of zero-leverage is associated to the IPO waves during our sample period. A related explanation is that there are industry effects due to changes in industry composition towards sectors where extreme debt conservatism is more commonly adopted. On the other hand, listing effects are at work, with newly listed firms in the later years of our sample period being more likely to be debt-free. We attribute this increasing propensity to maintain zero-leverage across the different listing groups to rising asset volatility (or business risk) and decreasing corporate tax rates during our sample period. Second, unlike earlier studies, our results suggest that the zero-leverage puzzle extends to major financial markets outside the United States, although there are differences across countries. Country-level analyses reveal that countries with a common law origin and higher creditor protection exhibit the highest percentage of zero-leverage firms.

Our third contribution is that we analyze both demand- and supply-side explanations for zero-leverage. Firms are classified as financially constrained and unconstrained using the estimated debt capacity (Faulkender and Petersen, 2006; Lemmon and Zender, 2010) and the size-age index (Hadlock and Pierce, 2010). Most zero-leverage firms are financially constrained and do not have the choice to obtain debt financing (supply-side effect). These firms tend to be smaller, younger, riskier, and less profitable; they are also the most active equity issuers and hoard the largest cash holdings of all sample firms. Constrained firms do not possess sufficient debt capacity and thus (have to) maintain a zero-leverage policy for longer periods of time. In contrast, there is a small subsample of firms that deliberately choose to adopt a zero-leverage policy. These financially unconstrained firms are more profitable, distribute higher dividends, and are older as well as larger than their constrained zero-leverage peers.

When we restrict our international sample to established firms with a minimum of 15 years of historical data in order to analyze the time-series variation in leverage, we find evidence for the importance of financial flexibility in firms' capital structure decisions (Graham and Harvey, 2001). Adopting the long-run event approach in DeAngelo and Roll (2012), we document that firms which maintain a zero-leverage policy only for a short period of time preserve their debt capacity for use in the near future (demand-side effect). After abandoning zero-leverage, these unconstrained firms choose higher leverage ratios, make higher investments, and reduce cash holdings by a larger amount compared to their constrained zero-leverage peers. Unconstrained zero-leverage firms have the flexibility to issue larger amounts of debt and use it together with their cash holdings to invest in future periods when profitable investment opportunities arise. In contrast, constrained firms lack sufficient debt capacity and are unable to issue as much debt; they follow a zero-leverage policy for longer periods of time, depend more on internal funds, and are thus less flexible in their investment decisions.

These results for financial flexibility are further substantiated by estimating a Q-model of investment using a dynamic panel regression approach. The dependent variable in our model is capital expenditures. Lagged capital expenditures, Tobin's Q, lagged cash flow, as well as a zero-leverage duration dummy variable and its interaction term with lagged cash flow are the explanatory variables. As shown in Wintoki et al. (2012), Generalized Method of Moments (GMM) estimators for this type of dynamic model can mitigate endogeneity problems inherent in empirical corporate finance by using own lags of the model variables as valid instruments. Supporting our main findings, the zero-leverage duration dummy variables exert a positive impact on capital expenditures, indicating that zero-leverage firms invest more after switching to a debt policy. Both the magnitudes of the estimated coefficients and their significance levels decline for those dummy variables which indicate longer zero-leverage durations. Firms that (have to) maintain a zero-leverage policy for longer periods of time tend to be constrained and are unable to invest as much as firms with shorter durations of zero-leverage. Most importantly, the interaction term between the zero-leverage duration dummy and cash flow is significantly negative for firms that deliberately choose a zero-leverage policy over a shorter period of time. These firms have built up debt capacity, exhibit lower investment-cash flow sensitivities, and are thus financially flexible and less dependent on internal funds.

The remainder of our study is structured as follows: Section 2 contains an overview of the literature. Section 3 provides descriptive statistics and presents stylized facts about the zero-leverage phenomenon. Section 4 examines firm- and country-level determinants for the decision to maintain zero-leverage. Sections 5 and 6 provide an analysis of the capital supply-side and demand-side explanations for zero-leverage, respectively. Finally, Section 7 concludes.

2. Related literature

The zero-leverage puzzle is incompatible with standard capital structure theories. For example, based on the static trade-off theory, Leland (1994) forecasts an average debt ratio of approximately 60%. More recent simulation studies based on dynamic trade-off theories use contingent claims analysis and derive minimum leverage ratios as low as 10% (Ju et al., 2005; Morellec, 2004). The dynamic models of Goldstein et al. (2001) and Hennessy and Whited (2005) imply that firms, in the presence of adjustment costs or adverse selection costs, become debt-free in order to avoid either forgoing future investments or financing them with new risky securities. The model in DeAngelo et al. (2011) predicts that ex ante optimal financial policies preserve the ability to access capital markets ex post in the event of shocks to investment opportunities or after unexpected earnings shortfalls. The option to issue debt later at comparable terms is valuable, and the opportunity cost of raising debt implies that target capital structures tend to be more conservative than those produced by standard trade-off models. DeAngelo and Roll (2012) analyze leverage stability and document that it arises only infrequently and then largely when firms have low leverage; nevertheless, very low leverage is almost always temporary. In particular, managers chose to pay down debt when attaining a leverage trough and then issue debt to fund expansion.

Our study follows along a growing literature on debt conservatism and zero-leverage. Graham (2000) develops interest-benefit deduction functions by estimating marginal tax rates. He reports that large and profitable firms with high cash holdings and low expected distress costs could significantly increase their value if they used the optimal amount of debt. More recently, Korteweg (2010) shows that debt-free firms could increase their value by 5.50%, on average, if they levered up to their optimal debt ratios. Minton and Wruck (2001) analyze the low leverage phenomenon and show that financial conservatism is not an industry-specific phenomenon, even though conservative firms are widespread in industries prone to high financial distress. DeAngelo and Roll (2012) report that the incidence of low leverage firms in recent years is attributable to a surge in listings by young growth firms.

Recent studies explicitly analyze zero-leverage firms. One strand of this literature investigates firm-level fundamentals. For example, Devos et al. (2012), Dang (2012), Strebulaev and Yang (2013), and Byoun and Xu (2013) report that zero-leverage firms tend to be smaller, accumulate higher cash reserves, and exhibit higher market-to-book ratios as well as higher payout ratios. However, it is difficult to reconcile all observed characteristics of zero-leverage firms with standard capital structure theories. Another strand of the literature explores the quality of firm-level corporate governance mechanisms and managerial entrenchment as a potential explanation for zero-leverage. Strebulaev and Yang (2013) suggest that managerial and governance characteristics are determinants for the decision to follow a zero-leverage policy. In contrast, Devos et al. (2012) and Byoun and Xu (2013) report that zero-leverage firms do not suffer from weak internal or external corporate governance mechanisms. For example, Devos et al. (2012) document that the debt initiation decisions of zero-leverage firms are not triggered by shocks to managerial entrenchment, such as takeover threats or activist block holders. In another approach, Lambrecht and Pawlina (2013) attribute the zero-leverage phenomenon to human capital intensive industries. In their model, the asymmetry between physical capital and transferable human capital induces negative net debt. Finally, Lee and Moon (2011) test the long-run stock performance of zero-leverage firms and report that they outperform. Based on their risk-adjusted outperformance, they conclude that zero-leverage firms are more conservative, self-disciplined, and prudent in making decisions.

Only a few studies analyze low-leverage policies as a part of firms' intertemporal investment and financing decisions. Minton and Wruck (2001) show that firms with conservative debt policies increase leverage when they face lower internal funds and higher investments. More recently, Marchica and Mura (2010) analyze the dynamics of low-leverage policies and document that UK firms incur higher capital expenditures and higher abnormal investments following a period of low leverage, and that these investments are likely to be financed through the issuance of debt. Most importantly, there is a measurable effect from financial flexibility in the form of untapped borrowing reserves. Similarly, De Jong et al. (2012) document that US firms with high unused debt capacities and more financial flexibility make higher future investments than firms with less financial flexibility. Furthermore, flexible firms are in a position to reduce investment distortions because they have better access to debt markets during difficult times. De Jong et al. (2012) conclude that firms save debt capacity for more constrained periods in the future.

While many of the related studies focus on debt conservatism in general, we explicitly analyze its most extreme type and provide several explanations for the increasing prevalence of zero-leverage, such as IPO and industry effects, increasing asset risk, and decreasing corporate tax rates. Moreover, we are the first to show that zero-leverage is an international phenomenon, although country-specific factors exert strong influences. Our study further contributes to the literature by analyzing both supply- and demand-side explanations for the zero-leverage phenomenon. The approach is novel in that it entails a detailed comparison between constrained and unconstrained debt-free firms based on different measures of financial constraints. Finally, we analyze the dynamics of the investment and cash holding decisions of previously unlevered firms. The financing decisions of firms that maintain zero-leverage only for a short period of time are attributable to their preference for financial flexibility; these firms strategically use their debt capacity and start to issue debt when profitable investment opportunities arise.

3. Data description and initial empirical evidence

3.1. Definition of variables and descriptive statistics

We collect annual balance sheet and market data of exchange-listed firms from the Compustat North America and Compustat Global databases over the period from 1988 to 2011. All variables are denominated in US dollars. Based on the country classification of the Fiscal Monitor (International Monetary Fund, 2012), our sample comprises all active and inactive traded industrial firms from 20 developed countries. Fan et al. (2012) show that a country's legal system explains a large proportion of the variation in leverage, with common law systems being associated with lower debt ratios. We thus follow Djankov et al. (2007) and group countries according to their legal origin. In order to mitigate the predominance of the United States in our common law sample, we split the full sample into three groups: US firms, firms from other common law countries, and firms from civil law countries. Given the specific nature of their businesses, financial and utility firms (with SIC 6000–6999 and 4900–4949) are omitted from the sample. Firms that do not have an industrial sector or country code in the database as well as firms with non-consolidated balance sheet data are excluded. Moreover, we omit firm-year observations with missing information on total assets, total debt, or market value.

Tables A1 and A2 in Appendix A provide an overview of all the variables used in our empirical analyses together with a detailed description of their construction principles. Table A3 lists the countries in our sample together with their institutional characteristics. Following Frank and Goyal (2003), we recode deferred taxes, purchase of treasury shares, and preferred stock to zero if firm-year observations are missing. All constructed variables are winsorized at the 1% and the 99% tails. After all data cleaning steps, our final panel data set includes 31,820 industrial firms with a total of 315,464 firm-year observations.

Following Devos et al. (2012) and Strebulaev and Yang (2013), we define book leverage as the ratio of the sum of short- and long-term liabilities to total assets. Zero-leverage observations are firm-year observations without leverage. Table 1 provides descriptive statistics for all variables. Most importantly, the median book leverage ratio is 19.39% for the full sample. Firms in civil law countries exhibit the highest median book leverage ratio (22.27%), followed by the United States (20.78%). The country group with all other common law countries has the lowest median book leverage ratio (12.39%).

As shown in Fig. 1 and Table 2, the large number and the increase in the percentage of zero-leverage firms are an international phenomenon. For example, in our full sample 17.58% of all firm-year observations are classified as zero-leverage. A cross-country analysis reveals notable heterogeneity. While 18.34% of all firm-year observations in the US sample are zero-leverage, this percentage is even higher in other common law countries with 27.73%. In contrast, the corresponding fraction in the group of civil law countries is only 9.75%. These country effects are analyzed in more detail in Section 4.3.

3.2. Listing group and IPO effects

A main reason for the increase in the number of listed firms and coverage in our sample may be the strong IPO activity during the sample period. We conjecture that the sharp increase in the percentage of zero-leverage firms over time is attributable to the different IPO waves. In a first step, we examine DeAngelo and Roll's (2012) observation that an increase in the percentage of low leverage firms in recent years is due to a surge in listings by young growth firms that have little or no debt. We define four listing groups according to a firm's IPO date. The first group comprises all firms listed before 1988; the second group includes all firms listed between 1988 and 1993; the third group between 1994 and 2003; and the fourth group between 2004 and 2011. These four groups roughly represent the aggregate IPO waves during our sample period. Fig. 2 depicts the evolution of the percentage of zero-leverage firms in the four different listing groups for the full sample in Panel A, the US sample in Panel B, the common law subsample (excluding US firms) in Panel C, and the civil law subsample in Panel D. Even the pre-1988 listing group exhibits a small increase in the percentage of zero-leverage firms over time. As expected, however, the zero-leverage phenomenon is most pronounced in the more recent listing periods, and each listing group starts with a higher fraction of zero-leverage firms.[2] The upward trend in the percentage of zero-leverage firms is partly driven by firms in the more recent listing groups, thus by new IPO firms entering the sample.

Based on the result for different listing groups, we investigate in a second step the association with firm age. Firm age is measured as the difference between the actual calendar year and a firm's IPO date. The IPO date is obtained from merging the available IPO dates in the Compustat and the Thomson One databases. We classify a firm as an IPO firm if it was listed over the preceding three years (and established otherwise) and hypothesize that the zero-leverage phenomenon is more pronounced in the sample of younger firms.[3] Panel A of Fig. 3 shows the evolution of the fraction of zero-leverage firms in three different age groups for the full sample: (i) the oldest firms listed before 1988; (ii) IPO firms (not older than three years and listed 1988 or later); and (iii) non-IPO firms (older than three years and listed 1988 or later). As expected, young IPO firms exhibit the highest fraction of zero-leverage firms, and it is increasing sharply over time from around 10% in 1988 to almost 30% in 2011. However, the percentage of zero-leverage firms is also increasing in the subsample of non-IPO firms.

[2] The drop in the fraction of debt-free firms in the US in the most recent listing group may be explained by the decline in IPO activity in the US following the burst of the internet bubble in 2000 (Ritter et al., 2012).

[3] As a robustness check, we use a five-year period in the secondary market to classify IPO firms. The results remain qualitatively unchanged.

Table 1

Descriptive statistics. This table shows the mean, the standard deviation (S.D.), the median, the number of firm-year observations (N), as well as the minimum (Min.) and maximum (Max.) value of each variable. The final sample consists of 31,820 industrial firms from 20 developed countries. The 20 developed countries in the sample either belong to the common law group or the civil law group. US data is excluded from the common law group and reported separately. Table A3 contains a list of the different countries and their institutional characteristics. The sample period is from 1988 to 2011. Annualized data is from the Compustat North America and Compustat Global databases. All variables are defined in Table A1. Apart from debt capacity and age, all variables are winsorized at the upper and lower one percentile.

Variable	Full sample						United States			Common law countries			Civil law countries		
	Mean	S.D.	Median	Min.	Max.	N	Mean	Median	N	Mean	Median	N	Mean	Median	N
Book leverage	0.244	0.254	0.194	0.000	2.439	315,464	0.277	0.208	136,421	0.182	0.124	72,255	0.243	0.223	106,788
Age	9.630	11.556	6.000	0.000	62.000	315,464	7.687	6.000	136,421	5.263	4.000	72,255	15.066	8.000	106,788
Size	4.901	2.175	4.894	0.135	10.975	315,464	4.612	4.518	136,421	4.189	4.025	72,255	5.750	5.640	106,788
Market-to-book	1.843	1.662	1.281	−0.525	10.000	270,434	2.172	1.485	114,966	1.959	1.365	60,064	1.373	1.101	95,404
Tangibility	0.295	0.239	0.239	0.000	0.979	315,175	0.278	0.202	136,225	0.351	0.293	72,162	0.278	0.256	106,788
Profitability	−0.023	0.291	0.045	−3.074	0.469	314,132	−0.058	0.052	135,677	−0.049	0.035	71,802	0.040	0.045	106,653
Abnormal earnings	−0.002	0.331	0.010	−5.920	7.517	258,919	−0.005	0.011	111,475	−0.003	0.009	55,595	0.003	0.009	91,849
Retained earnings	−0.550	2.560	0.045	−41.131	1.012	311,814	−0.961	0.000	133,329	−0.738	−0.004	71,819	0.090	0.098	106,666
Asset growth	0.222	0.856	0.060	−0.800	20.108	287,962	0.264	0.055	125,342	0.313	0.087	63,798	0.109	0.055	98,822
Tobin's Q	1.913	2.081	1.289	0.282	35.170	270,544	2.310	1.500	114,906	2.030	1.372	60,135	1.361	1.102	95,503
Capital expenditures	0.063	0.080	0.037	0.000	0.734	278,952	0.062	0.039	134,443	0.084	0.043	67,406	0.045	0.031	77,103
Δ Property, plant, and equipment	0.047	0.200	0.007	−0.572	3.290	287,691	0.043	0.006	125,155	0.096	0.012	63,714	0.021	0.007	98,822
R&D	0.037	0.106	0.000	0.000	1.480	315,464	0.064	0.000	136,421	0.022	0.000	72,255	0.014	0.000	106,788
Payout ratio	0.020	0.046	0.003	0.000	0.555	220,424	0.021	0.000	123,779	0.023	0.001	45,018	0.015	0.008	51,627
Equity issuances	0.111	0.252	0.003	−0.001	1.630	228,331	0.103	0.003	133,485	0.159	0.008	60,395	0.054	0.000	34,451
Taxes	0.016	0.030	0.009	−0.159	0.156	314,589	0.016	0.006	135,889	0.012	0.003	71,935	0.018	0.014	106,765
Non-debt tax shield	0.046	0.041	0.037	0.000	0.593	296,643	0.051	0.041	135,495	0.042	0.033	69,142	0.040	0.034	92,006
Cash holdings	0.178	0.207	0.102	0.000	0.988	315,464	0.189	0.084	136,421	0.184	0.090	72,255	0.162	0.122	106,788
Asset risk	0.238	0.164	0.200	0.002	1.160	266,467	0.265	0.240	112,927	0.285	0.239	59,414	0.177	0.143	94,126
Debt capacity	0.121	0.236	0.011	0.000	0.998	216,910	0.188	0.032	101,062	0.070	0.003	35,926	0.058	0.005	79,922

Table 2
Distribution of zero-leverage firms over time. This table summarizes the distribution of zero-leverage firms over time by showing the absolute numbers and the percentages (%) of firms that maintain a zero-leverage (ZL) policy. The sample period is from 1988 to 2011, and a firm is classified as zero-leverage if it has no long-term and short-term debt in a given year. The 20 developed countries in the sample either belong to the common law group or the civil law group. US data is excluded from the common law group and reported separately. Table A3 contains a list of the different countries and their characteristics.

Year	Full sample			United States			Common law countries			Civil law countries		
	All	ZL	%	All	ZL	%	All	ZL	%	All	ZL	%
1988	7,600	644	8.47	5,520	525	9.51	860	93	10.81	1,220	26	2.13
1989	8,786	748	8.51	5,422	551	10.16	1,365	141	10.33	1,999	56	2.80
1990	8,902	774	8.69	5,432	584	10.75	1,359	135	9.93	2,111	55	2.61
1991	9,125	844	9.25	5,537	653	11.79	1,366	137	10.03	2,222	54	2.43
1992	9,569	973	10.17	5,855	754	12.88	1,385	160	11.55	2,329	59	2.53
1993	10,202	1,167	11.44	6,178	899	14.55	1,543	195	12.64	2,481	73	2.94
1994	11,200	1,319	11.78	6,465	957	14.80	1,755	245	13.96	2,980	117	3.93
1995	12,440	1,567	12.60	7,139	1,130	15.83	1,999	289	14.46	3,302	148	4.48
1996	13,960	1,891	13.55	7,316	1,253	17.13	2,594	428	16.50	4,050	210	5.19
1997	14,480	2,033	14.04	7,135	1,253	17.56	2,903	507	17.46	4,442	273	6.15
1998	15,238	2,152	14.12	7,213	1,269	17.59	3,112	538	17.29	4,913	345	7.02
1999	15,938	2,436	15.28	7,091	1,271	17.92	3,275	683	20.85	5,572	482	8.65
2000	15,826	2,664	16.83	6,651	1,264	19.00	3,467	868	25.04	5,708	532	9.32
2001	15,202	2,651	17.44	5,997	1,172	19.54	3,513	915	26.05	5,692	564	9.91
2002	14,849	2,745	18.49	5,633	1,177	20.89	3,563	960	26.94	5,653	608	10.76
2003	14,808	2,925	19.75	5,375	1,197	22.27	3,714	1,033	27.81	5,719	695	12.15
2004	15,180	3,320	21.87	5,211	1,264	24.26	4,071	1,277	31.37	5,898	779	13.21
2005	15,482	3,531	22.81	5,096	1,276	25.04	4,388	1,465	33.39	5,998	790	13.17
2006	15,555	3,637	23.38	4,888	1,244	25.45	4,593	1,576	34.31	6,074	817	13.45
2007	15,370	3,703	24.09	4,695	1,196	25.47	4,622	1,685	36.46	6,053	822	13.58
2008	14,868	3,528	23.73	4,441	1,054	23.73	4,485	1,703	37.97	5,942	771	12.98
2009	14,291	3,448	24.13	4,298	1,059	24.64	4,237	1,635	38.59	5,756	754	13.10
2010	13,873	3,498	25.21	4,093	1,045	25.53	4,203	1,722	40.97	5,577	731	13.11
2011	12,720	3,269	25.70	3,740	977	26.12	3,883	1,644	42.34	5,097	648	12.71
Observations/percentage	315,464	55,467	17.58	136,421	25,024	18.34	72,255	20,034	27.73	106,788	10,409	9.75

Given the standard capital structure theories that incorporate motives related to agency costs or asymmetric information, we expect that the zero-leverage phenomenon shows up strongest in subsamples with smaller firms. We repeat our analysis by sorting all firm-year observations into size quartiles. As shown in Panel B of Fig. 3, at the end of the sample period as many as 43% of all firms in the smallest size quartile, which Fama and French (2008) refer to as micro-caps, maintain a zero-leverage policy. Overall, our results on age and firm size indicate that zero-leverage firms are younger and smaller. According to Hadlock and Pierce (2010), age and size serve as useful predictors for a firm's financial constraints. We therefore use their size-age index as a constraint measure in Section 5 to analyze capital supply-side effects and to differentiate between financially constrained and unconstrained zero-leverage firms.

3.3. Industry effects

As we do not observe that newly listed firms in each listing group start debt-free and then initiate using debt as they mature, the observed increase in the percentage of zero-leverage firms cannot be fully captured by listing group and age effects. However, if riskier industries have become relatively more important because of newly-listed IPO firms, we hypothesize that an increase in newly-listed growth firms in the more recent years may further contribute to explain the listing group effect. In order to analyze the impact of changes in the overall industry composition, we assign all firms to industries according to the Fama and French (1997) 12-industry classification scheme based on their four-digit SIC codes. Panel C in Fig. 3 depicts the evolution of the percentage of zero-leverage firms in main industrial sectors (excluding financial and utility firms). Although zero-leverage firms are not limited to certain industries, they are concentrated in the healthcare, information technology, and energy sectors. The fraction of zero-leverage firms in these sectors increases to around 30% by the end of the sample period. For the healthcare and information technology sectors, this observation is consistent with Titman and Wessel's (1988) notion that firms with unique or specialized products (having high research and development expenditures and high selling expenses) will impose higher costs on their customers, workers, and suppliers in the event of liquidation, and thus choose extremely conservative debt ratios. The patterns also follow along Shleifer and Vishny's (1992) prediction that non-redeployability of assets creates ex ante incentives to reduce leverage in order to mitigate the possibility of forced sales at prices below "value in best use".[4]

[4] There are several country-specific industry effects. For example, in both the United Kingdom and Canada, the zero-leverage phenomenon is pronounced in the energy and materials sectors. This increase in the percentage of zero-leverage firms is accompanied by significant IPO activity in these two sectors in both countries. The percentage of zero-leverage firms in the telecommunication sector is high in Germany, which is attributable to privatization efforts in this sector and firms going public during the late 1990s. All in all, the country-specific industry effects seem to be driven to a large extent by the specific IPO waves in the different countries.

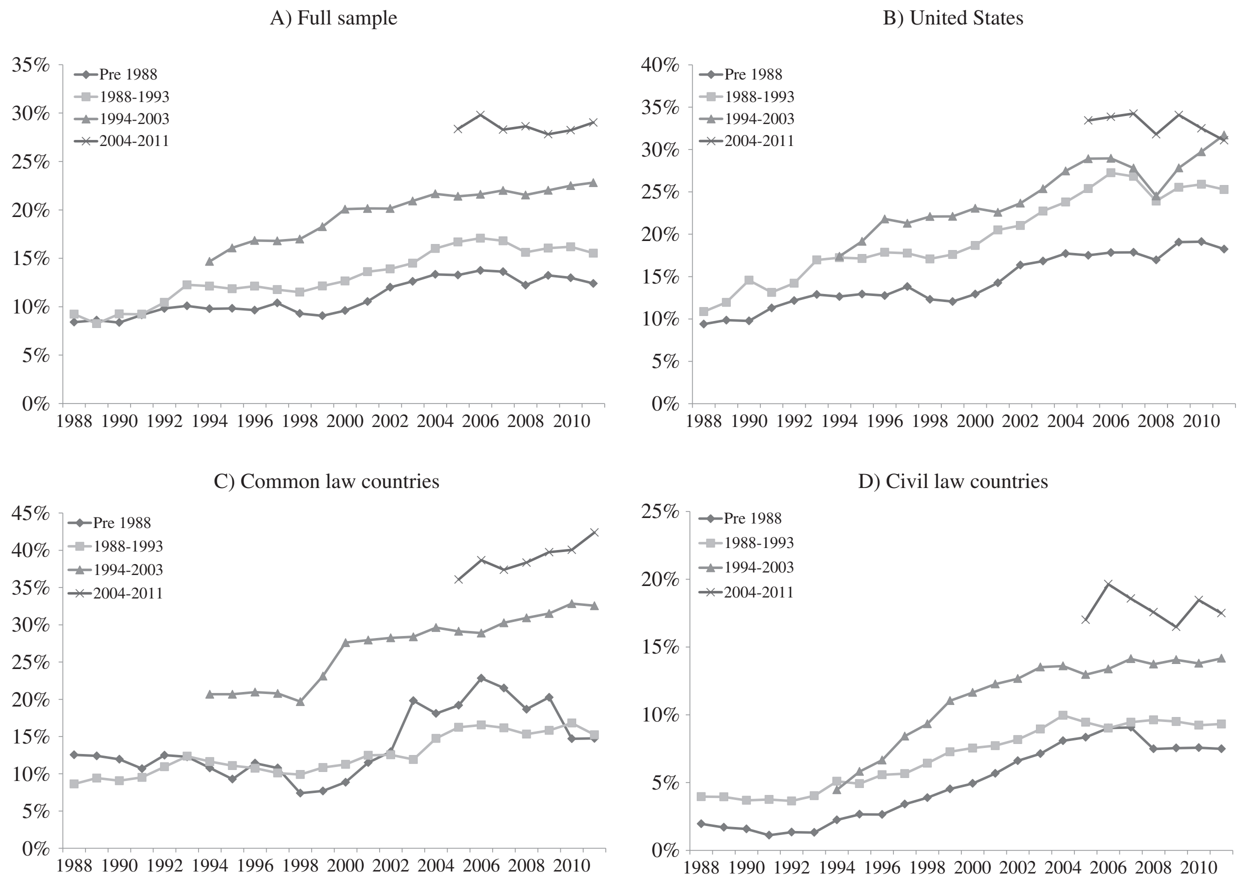

Fig. 2. Percentage of zero-leverage firms by listing group. This figure plots the percentage of zero-leverage firms by listing group. The four listing groups are defined according to a firm's IPO date and roughly represent the aggregate IPO cycles during the sample period. The sample period is from 1988 to 2011. The first group comprises all firms listed before 1988; the second group all firms listed between 1988 and 1993; the third group between 1994 and 2003; and the fourth group between 2004 and 2011. A firm is classified as zero-leverage if it has no long-term and short-term debt in a given year. The 20 developed countries in our sample either belong to the common law group or to the civil law group. US data is excluded from the common law group and reported separately. Table A3 contains a list of the different countries and their institutional characteristics.

In another related analysis, we compare the actual percentage of zero-leverage firms with the percentage of zero-leverage firms when holding all industry weights constant over time. Based on the full sample, Panel D of Fig. 3 plots the evolution of the actual percentage of zero-leverage firms and the value-weighted average across industries keeping the industry weights constant at their 1988 level. This methodology is taken from Custódio et al. (2013), who use it to examine the impact of changing industry structure on firms' decreasing debt maturity. The two lines for the full sample diverge already in the early 1990s, when the actual percentage of zero-leverage firms increases substantially more than the percentage based on the constant 1988 industry weights. The difference increases to around 8 percentage points in 2011. If industry composition effects were able to fully capture the zero-leverage phenomenon, however, the lower line incorporating the 1988 market capitalization weights should not exhibit any upward trend. We conclude that the zero-leverage phenomenon cannot be purely driven by a shift to industries where extreme debt conservatism is more commonly adopted. Instead, our results rather point towards an increasing propensity over time to adopt a zero-leverage policy.

4. Regression analysis

In this section, we first use the traditional capital structure variables in a regression framework to analyze whether there is indeed an increasing propensity to maintain zero-leverage during our sample period. We then proceed by examining the impact of a more comprehensive set of firm- and country-level variables on the observed increase in zero-leverage firm.

4.1. Propensity model and increasing asset risk

The increase in the percentage of debt-free firms could be driven either by an increasing propensity to follow a zero-leverage policy over the sample period or by changing firm characteristics. To sort out these explanations, we use the approach applied in

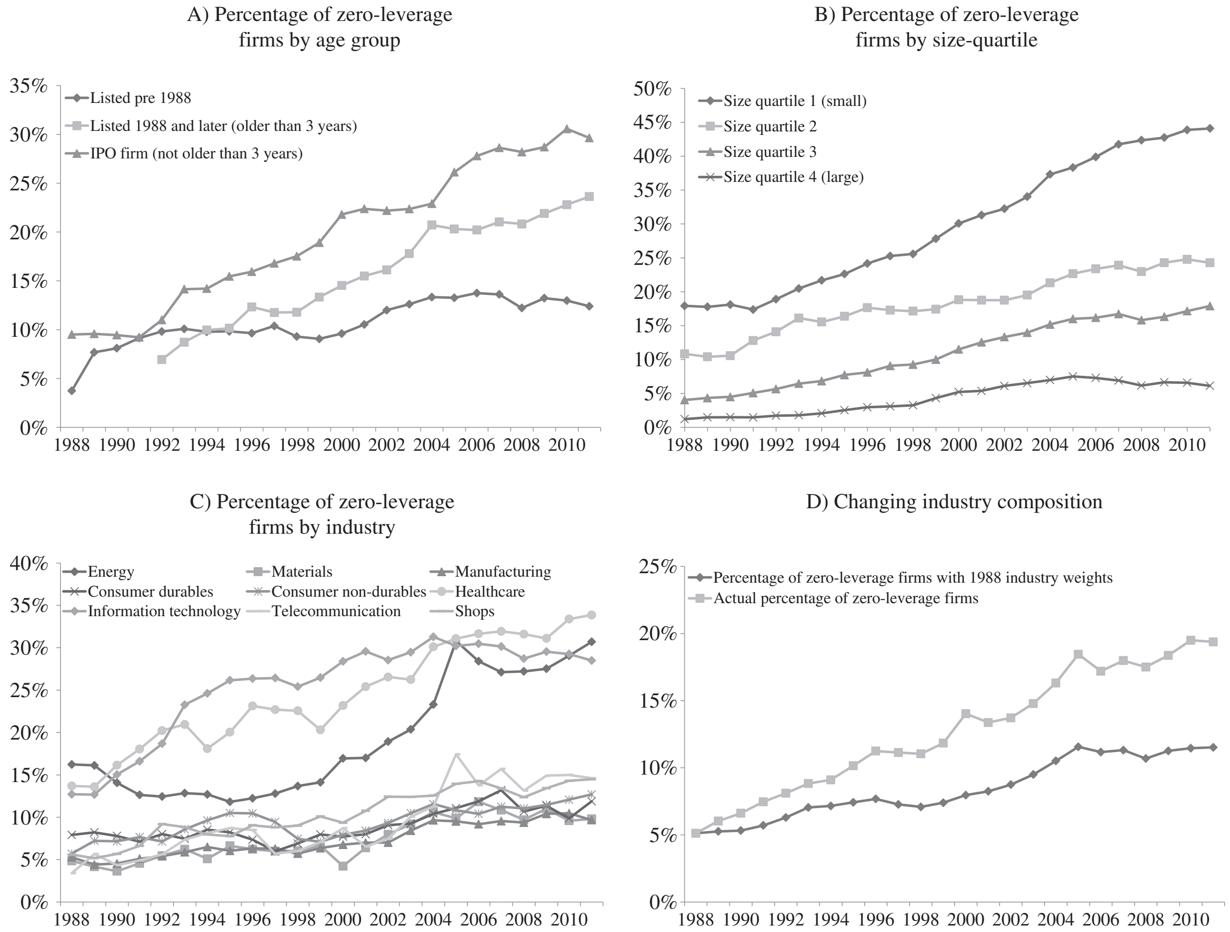

Fig. 3. IPO and industry effects. This figure relates the increasing percentage of zero-leverage firms to the different IPO waves and to the accompanying changes in industry composition. Panels A and B show the percentage of zero-leverage firms by age groups and size-quartiles over time. Panel C plots the evolution of the percentage of zero-leverage firms by industry sector, assigning firms to the 12 Fama and French (1997) industries based on their four-digit SIC codes (excluding financial and utility firms). Panel D depicts the evolution over time of the actual percentage of zero-leverage firms and the value-weighted average across industries keeping the industry weights constant at their 1988 level. All analyses are based on the full sample of firms from 20 developed countries. A firm is classified as zero-leverage if it has no long-term and short-term debt in a given year. The sample period is from 1988 to 2011.

Fama and French (2001) and Denis and Osobov (2008). In a first step, we run annual logistic regressions using the full sample to estimate the propensity to have zero-leverage during the 1988–1992 base period. The dependent binary variable is set equal to 1 for a firm adopting a zero-leverage policy in year *t* (and 0 otherwise). Our explanatory variables are the traditional capital structure variables (Rajan and Zingales, 1995): profitability, market-to-book ratio, size, and tangibility (see Table A1). The annual logistic regressions during the base period include fixed effects for both countries and industries to avoid an omitted variables problem. Standard errors are clustered by firms. In a second step, we compute the probability for each firm to maintain a zero-leverage policy based on these characteristics in each year (starting in 1993) using the average annual coefficient estimates from the base period. The expected percentage of zero-leverage firms is obtained by averaging the individual probabilities across firms in each year (and multiplying by 100). Therefore, the probabilities associated with firm characteristics are fixed at their base period values, and variation in the expected fraction of debt-free firms after 1992 is attributable to changing firm characteristics. The difference between the expected and the actual percentage of zero-leverage firms captures our sample firms' changes in their propensity to maintain zero-leverage.

Panel A of Table 3 shows the results of our out-of-sample logistic regressions for the full sample and the three subsamples. Controlling for changes in firm characteristics, changes in the unexpected proportion of zero-leverage firms reflect changes in the propensity to follow extreme debt conservatism. At the beginning of the forecasting period, the difference between the actual and the expected percentage is small, i.e., the coefficients obtained from the base period are good predictors for the expected fraction of zero-leverage firms. However, the actual percentage of zero-leverage firms is higher than the expected percentage, and this difference increases over time. For the full sample, the difference reaches 12 percentage points by the end of the sample period. The expected values barely change over time in all country groups, indicating that the standard capital structure variables cannot explain the upward trend in zero-leverage. Using the estimated coefficients from the base period regression on firm characteristics in any given

Table 3
Propensity model and increasing asset risk.

Panel A: Propensity model

This table reports the out-of sample estimates from logistic regressions for the expected percentage, the actual percentage, and the difference between the expected and the actual percentage of zero-leverage firms in the full sample. In a first step, yearly logistic models are used to estimate the probabilities that firms with given characteristics (profitability, market-to-book, size, and tangibility) maintain a zero-leverage policy during the 1988–1992 base period. In a second step, the probability for each firm to follow a zero-leverage policy is calculated based on the characteristics in each year (starting 1993), using the average annual coefficients from the base period. The expected percentage of zero-leverage firms is obtained by averaging the individual probabilities across firms in each year and multiplying the result by 100. The 20 developed countries in the sample either belong to the common law group or to the civil law group. US data is excluded from the common law group and reported separately. Table A3 contains a list of the different countries and their institutional characteristics.

Year	Full sample			United States			Common law countries			Civil law countries		
	Actual %	Expected %	Expected − actual %	Actual %	Expected %	Expected − actual %	Actual %	Expected %	Expected − actual %	Actual %	Expected %	Expected − actual %
1993	11.211	11.593	0.382	14.552	15.563	1.011	12.352	10.635	−1.717	2.797	2.055	−0.742
1994	11.530	10.972	−0.557	14.803	14.918	0.115	13.320	10.642	−2.678	3.795	2.034	−1.761
1995	12.318	11.736	−0.582	15.829	16.226	0.398	13.990	10.822	−3.168	4.276	2.825	−1.451
1996	13.220	11.768	−1.452	17.127	16.107	−1.020	15.841	11.419	−4.422	5.095	3.948	−1.146
1997	13.685	11.521	−2.164	17.561	15.513	−2.048	16.418	11.560	−4.858	6.349	4.904	−1.445
1998	13.811	10.989	−2.822	17.593	14.694	−2.899	16.244	11.743	−4.501	7.336	5.059	−2.277
1999	14.895	12.346	−2.549	17.924	16.499	−1.425	19.407	12.593	−6.814	8.773	7.582	−1.191
2000	16.404	11.661	−4.743	19.005	14.393	−4.612	23.430	12.299	−11.131	9.379	6.988	−2.391
2001	17.003	11.206	−5.797	19.543	13.925	−5.618	24.459	12.372	−12.087	10.072	5.162	−4.910
2002	17.610	10.908	−6.702	20.895	13.670	−7.225	25.065	13.051	−12.015	10.896	3.914	−6.982
2003	18.509	12.150	−6.358	22.270	16.019	−6.251	25.568	14.167	−11.400	11.804	5.195	−6.609
2004	20.203	12.646	−7.557	24.256	16.328	−7.929	28.453	14.660	−13.793	12.529	6.625	−5.904
2005	21.127	13.072	−8.055	25.039	15.985	−9.054	30.193	14.544	−15.649	12.846	8.841	−4.004
2006	21.684	13.049	−8.635	25.450	15.479	−9.971	30.736	13.930	−16.806	13.481	8.408	−5.072
2007	22.325	12.731	−9.595	25.474	15.039	−10.435	32.387	13.096	−19.292	13.847	7.504	−6.343
2008	21.828	11.261	−10.568	23.733	12.892	−10.841	33.527	11.655	−21.871	13.281	5.868	−7.413
2009	22.498	11.614	−10.884	24.639	13.657	−10.982	34.118	12.112	−22.006	14.148	5.606	−8.542
2010	23.097	11.816	−11.281	25.531	14.509	−11.022	36.093	12.040	−24.053	13.721	6.298	−7.424
2011	23.100	11.118	−11.982	26.123	13.574	−12.549	37.096	10.715	−26.382	13.443	5.852	−7.590

Panel B: Evolution of mean and median asset risk over listing groups

This table reports the results of tests for differences in mean and median asset risk between zero-leverage and debt-financed firms (Panel B.I) as well as between the successive listing groups (Panel B.II) for the full sample. Asset risk is defined as the annual stock return volatility for zero-leverage firms. For debt-financed firms, we follow Frank and Goyal (2009) and compute asset risk by unlevering the annual volatility of stock returns (see Table A1). The four listing groups are defined according to a firm's IPO date and roughly represent the aggregate IPO cycles during the sample period. The first group comprises all firms listed before 1988; the second group all firms listed between 1988 and 1993; the third group between 1994 and 2003; and the fourth group between 2004 and 2011. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

	Panel B.I			Panel B.II			
	Difference in annual asset risk between zero-leverage and debt-financed firms			Difference in annual asset risk between listings groups			
				Zero-leverage firms		Debt-financed firms	
	Median	Mean		Median	Mean	Median	Mean
[1] pre–1988	0.125	0.120					
[2] 1988–1993	0.138***	0.124***	[2] − [1]	0.025***	0.024***	0.012***	0.020***
[3] 1994–2003	0.154***	0.141***	[3] − [2]	0.029***	0.031***	0.012***	0.014***
[4] 2004–2011	0.161***	0.161***	[4] − [3]	0.026***	0.026***	0.015***	0.005***

sample year after the base period systematically underestimates the actual fraction of debt-free firms. These results suggest that there is indeed an increasing propensity to maintain zero-leverage.

Consistent with our findings for listing groups, the increase in the propensity to follow zero-leverage is most pronounced during the later sample years. In particular, in results not shown, we find that the average difference between the expected and actual percentages for zero-leverage firms is highest during the most recent 2004–2011 listing group (based on the average estimated coefficients from the base period). While the annual average expected percentages of zero-leverage firms are 14.20% and 15.03% in the 1994–2003 and 2004–2011 listing group, the actual percentages are 21.94% and 33.11%, respectively. We hypothesize that this increasing propensity is related to the finding in Wei and Zhang (2006) and Campbell et al. (2010) that individual stock returns have become more volatile over time. If firms' business risk is increasing over time, we expect that it contributes to explain the higher propensity to become debt-free. Given that distress costs are a positive function of asset volatility, the prevalence of zero-leverage is likely to increase with higher business risk. This association particularly holds for firms with illiquid tangible assets which are non-redeployable in bad macroeconomic environments (Shleifer and Vishny, 1992; Campello and Giambona, 2013). Similarly, the trade-off theory predicts an inverse relationship between asset volatility and leverage due to a lower collateralizable value and higher bankruptcy costs for firms with riskier asset values, e.g., from the information technology and healthcare sectors (see Section 3.3).

Table 4
Firm-level logistic regressions. This table reports coefficients, *t*-statistics (in parentheses), and economic significances from firm-level logistic regressions for the full sample over the sample period from 1988 to 2011. Economic significance is the average change in probability for a one standard deviation change for a continuous independent variable or for the change from zero to one for a dummy variable. The dependent variable takes the value of 1 if a firm has zero debt in a given year (and 0 otherwise). A firm is classified as zero-leverage if it has no long-term and short-term debt. All explanatory variables are lagged by one period and described in Table A1. The listing dummy variables denote the four listing groups, which are defined according to a firm's IPO date (the pre-1988 dummy variable is omitted). Fixed effects are indicated at the bottom of each column. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Independent variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Time trend						0.071***	0.066***	0.065***	0.050***
						(19.34)	(18.85)	(16.34)	(17.61)
						0.69%	0.59%	0.54%	0.52%
1989–1993 listing dummy									0.031
									(0.54)
									0.25%
1994–2003 listing dummy									0.046*
									(1.71)
									0.36%
2004–2010 listing dummy									0.190**
									(1.98)
									1.50%
Size	−0.218***	−0.259***	−0.254***	−0.324***	−0.328***		−0.326***	−0.211***	−0.211***
	(−22.12)	(−23.65)	(−23.13)	(−27.20)	(−27.37)		(−27.31)	(−13.01)	(−12.92)
	−4.62%	−5.36%	−4.90%	−6.01%	−5.88%		−5.89%	−3.62%	−3.61%
Market-to-book	0.139***	0.046***	0.052***	0.058***	0.057***		0.055***	0.001*	0.001*
	(15.51)	(4.56)	(5.25)	(5.68)	(5.61)		(5.48)	(1.68)	(1.71)
	2.06%	0.66%	0.71%	0.75%	0.72%		0.69%	0.01%	0.01%
Tangibility	−4.160***	−1.627***	−2.020***	−1.772***	−1.998***		−1.978***	−1.858***	−1.860***
	(−30.31)	(−10.84)	(−12.69)	(−11.34)	(−12.38)		(−12.30)	(−11.67)	(−11.67)
	−9.34%	−3.57%	−4.14%	−3.49%	−3.80%		−3.79%	−3.38%	−3.38%
Profitability	0.692***	0.753***	0.712***	0.723***	0.706***		0.718***	0.651***	0.642***
	(12.21)	(9.09)	(8.73)	(8.86)	(8.68)		(8.83)	(7.97)	(7.84)
	1.77%	1.88%	1.67%	1.62%	1.53%		1.57%	1.35%	1.33%
Abnormal earnings		−0.106***	−0.106***	−0.113***	−0.100***		−0.094***	−0.115***	−0.114***
		(−3.50)	(−3.43)	(−3.54)	(−3.15)		(−2.94)	(−3.11)	(−3.08)
		−0.36%	−0.34%	−0.35%	−0.30%		−0.28%	−0.33%	−0.32%
Retained earnings		0.047***	0.052***	0.086***	0.094***		0.094***	0.085***	0.086***
		(5.41)	(6.05)	(9.18)	(9.71)		(9.67)	(8.88)	(8.94)
		1.19%	1.23%	1.97%	2.08%		2.09%	1.78%	1.80%
Asset growth		−0.185***	−0.201***	−0.185***	−0.194***		−0.201***	−0.275***	−0.274***
		(−6.51)	(−7.00)	(−6.32)	(−6.61)		(−6.88)	(−8.91)	(−8.92)
		−0.94%	−0.95%	−0.84%	−0.85%		−0.89%	−1.15%	−1.15%
Capital expenditures		−1.280***	−0.355**	−0.795***	−1.041***		−0.874***	−0.354**	−0.375*
		(−4.55)	(−1.99)	(−2.94)	(−3.79)		(−3.20)	(−2.28)	(−1.65)
		−0.80%	−0.21%	−0.45%	−0.56%		−0.48%	−2.32%	−0.19%
R&D		0.208	0.714***	0.886***	0.731***		0.711***	0.597***	0.597***
		(1.10)	(3.80)	(4.66)	(3.84)		(3.73)	(3.15)	(3.15)
		0.20%	0.65%	0.78%	0.62%		0.61%	0.48%	0.48%
Payout dummy		−0.299***	−0.226***	−0.178***	−0.008*		−0.010*	−0.047	−0.046*
		(−6.75)	(−5.11)	(−4.01)	(−1.67)		(−1.72)	(−0.98)	(−1.66)
		−2.85%	−2.01%	−1.52%	−0.06%		−0.09%	−0.37%	−0.36%
Payout ratio		3.649***	3.539***	3.026***	2.541***		2.356***	2.754***	2.739***
		(13.09)	(12.50)	(10.25)	(8.67)		(8.16)	(9.46)	(9.40)
		1.62%	1.47%	1.21%	0.98%		0.92%	1.02%	1.01%
Equity issuances		0.734***	0.655***	0.598***	0.624***		0.605***	0.652***	0.650***
		(7.81)	(7.07)	(6.38)	(6.62)		(6.44)	(6.91)	(6.90)
		1.02%	0.85%	0.74%	0.75%		0.73%	0.75%	0.75%
Taxes		5.116***	5.334***	6.349***	6.229***		6.137***	5.587***	5.606***
		(11.10)	(11.59)	(13.75)	(13.76)		(13.59)	(12.50)	(12.54)
		1.59%	1.55%	1.77%	1.68%		1.67%	1.44%	1.45%
Non-debt tax shield		1.276***	0.371	0.469	0.617		0.858*	0.622	0.591
		(2.93)	(0.83)	(1.04)	(1.37)		(1.93)	(1.39)	(1.31)
		0.50%	0.14%	0.17%	0.21%		0.30%	0.20%	0.19%
Cash holdings		4.826***	4.708***	4.646***	4.632***		4.645***	4.329***	4.333***
		(48.81)	(46.86)	(45.90)	(45.18)		(45.44)	(42.23)	(41.86)
		8.79%	8.02%	7.60%	7.33%		7.39%	6.54%	6.54%
Asset risk								2.141***	2.142***
								(21.91)	(21.88)
								2.73%	2.73%
Debt capacity								−1.392***	−1.410***
								(−8.47)	(−8.42)
								−3.05%	−3.09%

(continued on next page)

Table 4 (*continued*)

Independent variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Intercept	−0.695**	−1.306***	−1.413***	−2.109***	−2.082***	−103.9***	−133.2***	−138.4***	−142.6***
	(−1.38)	(−20.10)	(−2.65)	(−4.11)	(−3.93)	(−19.64)	(−20.96)	(−21.55)	(−19.83)
Number of observations	112,029	112,029	112,029	112,029	112,029	112,029	112,029	112,029	112,029
Pseudo R^2	0.169	0.252	0.267	0.285	0.294	0.013	0.292	0.304	0.314
Country fixed effects	Yes	No	No	No	Yes	No	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes	Yes	No	No	No	No

A zero-leverage firm's stock return volatility reflects its business risk, and return volatility is equal to asset volatility. For debt-financed firms, we follow Frank and Goyal (2009) and compute their asset volatility by unlevering the annual volatility of stock returns (see Table A1). Annual standard deviations are derived from monthly stock returns. As expected, business risk is increasing, with the mean (median) annual asset volatility of zero-leverage firms rising from 31.24% (28.72%) in the earliest (pre-1988) to 39.39% (36.07%) in the most recent (2004–2011) listing group. Asset risk also increases for debt-financed firms, confirming the more general trend described in Wei and Zhang (2006) and Campbell et al. (2010). However, using tests for differences in means and medians, annual asset risk is significantly higher in the group of zero-leverage firms compared to the group of debt firms (Panel B.I of Table 3). The differences in asset risk between zero-leverage firms and debt firms are even increasing over time; the median (mean) difference increases from 12.45% (12.01%) to 16.12% (16.14%). Moreover, comparing asset volatilities between the successive listing groups, all pairwise differences in means and medians are statistically significant (Panel B.II of Table 3). These results suggest that in addition to IPO and industry effects, increasing asset risk constitutes another driver of the increasing propensity to maintain a zero-leverage policy.

Firms with higher business risk are more likely to engage in risk management. In addition to the risk management choices on the asset side of the balance sheet, their capital structure constitutes another layer of risk management (Stulz, 1996). By reducing the amount of debt in its capital structure (or completely delevering), a firm reduces shareholders' total risk exposure as equity represents a residual claim and offers an all-purpose cushion against risks that are difficult to anticipate or measure (Meulbroek, 2002). In this sense, our findings with regard to asset risk are consistent with our earlier result that zero-leverage firms tend to be concentrated in the information technology and healthcare sectors, which are characterized by sources of uncertainty that are particularly difficult to anticipate or measure.

4.2. Firm-level effects

Given that the traditional capital structure factors are unable to explain the increase in the percentage of zero-leverage firms over time, we examine if the increasing propensity is attributable to changes in other firm-specific variables. First, tax provisions are assumed to be a primary factor for capital structure choices (De Jong et al., 2008; Fan et al., 2012). As tax deductions are to a large extent generated by interest payments, we expect that firms with high tax payments are more likely to be zero-leverage firms. A related prediction is that firms may become debt-free because they achieve their tax deductions from non-debt sources (DeAngelo and Masulis, 1980). Second, based on adverse selection costs, we conjecture that the (static) pecking order theory implies that more profitable firms are more likely to become debt-free as they rely on internal funds. In contrast, the trade-off theory assumes increasing expected costs of financial distress with more pronounced information asymmetry. We thus hypothesize that proxy variables for asymmetric information are positively related to the propensity to maintain a zero-leverage policy.

Third, low levels of leverage limit the agency costs of debt, such as underinvestment (Myers, 1977). Hackbarth and Mauer's (2012) model predicts that leverage will be very low in cases where firms face an agency conflict over the timing of future investments and over how much additional debt the firm issues to finance future investments. If firms attempt to mitigate underinvestment problems by becoming debt-free, we expect them to have high growth options, high cash holdings, and to rely on new equity financing to retain their growth options. Further related to the agency costs of debt, Barclay et al. (1995) report that firms with higher abnormal earnings carry more secured debt and send a credible signal to mitigate overinvestment problems. Based on this notion, we expect that zero-leverage firms exhibit low abnormal earnings.

Without interest and amortization payments, dividends are a possibility to smooth the earnings of zero-leverage firms. Debt conservative firms that do not pay dividends might be prone to free cash-flow problems (Jensen, 1986; Fama and French, 2001). Alternatively, when coupled with high equity issuances, higher dividends may work as a means of establishing a reputation for moderation in expropriating wealth from minority shareholders (Gomes, 2000). Following Strebulaev and Yang (2013), we thus expect zero-leverage firms to make higher payouts.

Table 4 presents the results of our logit regression models. The dependent variable takes the value of 1 if a firm has zero debt in a given year (and 0 otherwise). All explanatory variables are lagged by one year. While Column (1) reports the results using only the four standard capital structure variables for the purpose of comparison, Column (2) shows the estimates of the expanded logistic model. Columns (3)–(5) add industry fixed effects (based on the 2-digit SIC code), year fixed effects, and country fixed effects. These results are qualitatively similar to those in Column (2). The table also reports the economic significance by providing the change in probability that a firm follows a zero-leverage policy for a one standard deviation change in an independent variable or the change from zero to one for a dummy variable.

The negative intercepts imply that zero-leverage firms are less common than debt firms. The positive coefficient on the ratio of income taxes paid to total book assets in Column (2) confirms that firms with higher tax payments are more likely to be debt-free.

Moreover, the positive coefficient on non-debt tax shields (ratio of depreciation to total assets) suggests that some firms become zero-leverage as they generate their tax deductions from non-debt sources (albeit statistical significance disappears when fixed effects are included in Columns (3)–(5)).

The positive coefficients on profitability and retained earnings confirm our hypothesis based on the pecking order theory that more profitable firms are more likely to become debt-free as they rely solely on internal funds. The results further corroborate our predictions based on the trade-off theory. Specifically, firms pursuing zero-leverage are smaller and have higher growth opportunities (i.e., higher market-to-book ratios, and higher research and development expenditures) as well as lower tangibility. All these firm characteristics are associated with more pronounced asymmetric information (Leary and Michaely, 2011) and a higher likelihood to be debt-free. However, these higher investment opportunities do not (yet) materialize in higher levels of capital expenditures; the corresponding coefficient is significantly negative. We interpret this result as indicating a demand for financial flexibility in the sense that firms with large expected investments become debt-free in order to avoid financing them with new risky securities or even being forced to forgo them (see Section 6). At the same time, the positive coefficients on market-to-book, research and development expenditures, cash holdings, and equity issuances as well as the negative coefficient on tangibility all support our agency costs of debt argument. The accumulation of precautionary cash holdings to avoid underinvestment problems (or opportunity costs of foregone investments; Opler et al., 1999) shows the largest economic significance; a one standard deviation change in cash holdings is associated with an increase in the propensity to become debt-free by roughly 8%. In addition, the negative coefficient on the proxy variable for abnormal earnings supports our overinvestment argument.

A payout dummy variable that takes the value of 1 if a firm pays dividends or repurchases its own shares in a given year (and 0 otherwise) exhibits a negative coefficient. Together with a positive coefficient on the payout ratio, this finding indicates that there are two different kinds of zero-leverage firms: non-payout and high payout zero-leverage firms. Conditional on being a payer firm, zero-leverage firms behave according to our prediction and choose a higher payout ratio either to build up a good reputation for future equity issuances or to mitigate agency problems of free cash flow (see Section 5). Together with the high asset risk of zero-leverage firms, all our results so far are consistent with the conjecture in Bolton and Freixas (2000) that the riskiest firms are constrained to use equity.

The year dummy coefficients in Columns (4) and (5) also provide an indication of whether there is a positive and significant trend in zero-leverage after controlling for changes in firm-specific demand-side factors. We observe that in both models the year dummy coefficients (not shown) are positive and significant in all sample years. A Wald-test rejects the null hypothesis that all year dummy coefficients are jointly equal to zero.

The model in Column (6) estimates a logit regression using a linear time trend as the only explanatory variable. The marginal coefficient indicates a significant increase in the fraction of zero-leverage firms of 0.69% per year. Column (7) shows results that replicate the full model with firm-specific factors together with a linear time trend (omitting year fixed effects), which allows to test whether there remains a significant trend after controlling for changes in firm characteristics (Custódio et al., 2013). The marginal effect related to the time trend is still significant but lower at 0.59% (compared to 0.69% without controlling for demand-side factors).

Column (8) shows the estimates of a logit regression that includes asset risk and adds our estimated debt capacity variable (Faulkender and Petersen, 2006). As described in more detail in Section 5, we use the probability to have a public bond rating in a given year as an indication for the extent of a firm's debt capacity. As expected, asset risk and debt capacity have a positive and a negative impact on the likelihood to become debt-free, respectively. While the estimated trend coefficient is still positive and significant, the marginal effects continue to decrease (from 0.59% in Column (7) to 0.54% in Column (8) with both asset risk and debt capacity). These additional variables thus capture at least part of the increasing trend left unexplained so far.

Our results indicate that changes in firm characteristics are not the only reason for the increase in the percentage of zero-leverage firms. As shown in Section 4.1, the difference between the predicted and actual fraction captures the increase in zero-leverage firms that is unrelated to changes in firm characteristics, and the widening difference indicates a higher propensity to renounce debt. Column (10) includes dummy variables that allow the intercept to shift over the different listing groups. As described in Table A1, listing group dummy variables take the value of 1 if a firm was listed in the respective years (and 0 otherwise). Year fixed effects are omitted. All listing dummy variables are positive, which is again consistent with the changes in firm characteristics in the logit model not being able to fully explain the increase in zero-leverage. Most importantly, the listing dummy variables exhibit increasing significance levels and marginal effects, indicating that the increase in zero-leverage is least explained during the more recent listing periods. As the marginal effect of the included time trend further decreases to 0.52% but remains significant, the new listing effect is necessary although not sufficient to explain the upward zero-leverage trend. Pseudo R-squares increase to approximately 30%, which is slightly higher than in Strebulaev and Yang (2013).

4.3. Country-level effects

The use of (time-invariant) country fixed effects in our logit model in Table 4 cannot explain the increasing percentage of zero-leverage firms. Given the substantial cross-sectional differences over the country groups (see Fig. 1), it is nevertheless insightful to examine country-specific factors in more detail. For example, La Porta et al. (1998, 2002) argue that the common law system provides better external investor protection than the civil law system, resulting in better access to external financing and higher security values. Weak legal systems and public enforcement of laws are associated with less external equity, and, all else being equal, this implies that firms from common law countries will use more outside equity. Fan et al. (2012) show that a country's legal system explains a large proportion of the variation in leverage, with common law systems being associated with lower debt ratios. Petersen and Rajan (2002) and Djankov et al. (2007) note that the most important aspect of corporate lending is information. If lenders know more about borrowers, their credit history, or other lenders to the firm, they are less concerned about the lemons problem and extend more credit. Furthermore, civil law countries are usually characterized by relationship lending. Banks are natural monitors and have privileged access to information (Leland and Pyle, 1977), thus the asymmetric information problem should be less pronounced. Based on these arguments, we hypothesize that common law countries have a higher proportion of zero-leverage firms than civil law countries and create a dummy variable that takes the value of 1 for firms from a common law country (and 0 otherwise).

Harris and Raviv (1993) argue that the principles of a country's bankruptcy law play an important role in determining the leverage ratio that creditors are willing to accept. Djankov et al. (2007) report that there are large variations in the insolvency procedures across countries. In equity-friendly countries there is an explicit bankruptcy code that specifies and limits the rights and claims of creditors and facilitates the reorganization of an ongoing business. In contrast, in debt-friendly countries without bankruptcy codes or weakly enforced codes, creditors hastily claim the collateral by liquidating distressed firms without seeking reorganization (Davydenko and Franks, 2008). Fan et al. (2012) document that the existence of an explicit bankruptcy code (and thus lower creditor rights) is associated with higher debt ratios. Acharya et al. (2011) show that managers choose to reduce leverage in countries with strong creditor rights. All else being equal, we expect countries with higher creditor protection to have more zero-leverage firms than countries with lower creditor protection. The Creditor Protection Score (CPS) from La Porta et al. (1998) and the updated score by Djankov et al. (2007) are used to classify sample firms. For the regression analysis, we define a dummy variable, labeled bankruptcy code, which takes the value of 1 if the firm is listed in a country with high creditor protection, i.e., the country has a CPS of 2 or higher (and 0 otherwise).[5]

The tax system is another country-specific factor for capital structure choices (De Jong et al., 2008; Fan et al., 2012). Under the classical tax system dividend payments are taxed at both corporate and personal levels, whereas interest payments are tax-deductible corporate expenses. In contrast, the goal of the various forms of the dividend imputation tax system is to tax corporate profits only once. Firms deduct interest payments, but domestic shareholders of a corporation receive a tax credit for the taxes paid by the corporation. The proportion of corporate tax available as a tax credit under an imputation system varies from country to country. However, given the larger tax benefits from leverage, we expect a lower percentage of zero-leverage firms in countries with a classical tax system and double taxation of corporate profits. An alternative hypothesis could be that multinational firms are able to shift their leverage into countries with the most favorable tax regime, and thus the country of origin's tax code is not restrictive in their choice of leverage (Desai and Dharmapala, 2004; Huizinga et al., 2008). In order to test these competing hypotheses, we use a dummy variable that takes the value of 1 if the firm is listed in a country with a dividend imputation or a dividend relief tax system and 0 if the firm stems from a country with a classical tax system (see Table A3).

The sample period under investigation is characterized by decreasing tax rates on a broad scale in virtually all countries. One expects that decreasing corporate tax rates are accompanied by lower leverage due to reduced benefits of interest tax shields, and thus we hypothesize that this tax effect further contributes to explaining the increasing prevalence of zero-leverage. As an additional variable that exhibits annual time variation at the country-level (different from the time-constant country fixed effects), we include the combined federal and state corporate tax rate provided by the Organisation for Economic Cooperation and Development (OECD).[6]

The results of a logistic regression involving only the set of country-level variables are shown in Column (1) of Table 5. As indicated by the positive coefficients on the law origin, the bankruptcy code, and the tax system dummy variables, firms from countries with a common law origin, high creditor protection, and dividend imputation or dividend relief tax systems exhibit the highest likelihood to maintain zero-leverage. The marginal effect of the law system dummy is the largest of all country-level variables; on average, being based in a common law country rather than a civil law country is associated with an increase in the propensity to become debt-free by more than 8%.[7] Furthermore, the coefficient on the corporate tax rate is positive, which is consistent with our prediction that the global trend for decreasing tax rates during our sample period limits the relative advantage of debt over equity and thus contributes to explaining the upward trend in zero-leverage.

Following Fan et al. (2012), we use GDP per capita growth, deposits, and the inflation rate as additional explanatory variables in our logistic regression (see Table A1 for variable descriptions). The coefficients on the variables GDP per capita growth and inflation rate are negative, supporting the result of Djankov et al. (2007) that firms are more likely to carry higher leverage ratios in countries with more stable and healthier economic conditions. The variable deposit measures the degree of a country's financial intermediation or 'financial depth' (Beck et al., 2000). We find a negative relationship between the likelihood of a firm being classified as zero-leverage and the relative size of the deposits in a country, indicating that financial intermediation encourages the use of corporate debt (Booth et al., 2001).

In order to check the robustness of our country-level results, Columns (2)–(4) in Table 5 add a linear time trend and all firm-level variables used in Table 4. The results for the country-level variables remain stable. Although all estimated coefficients are in line with our hypotheses, the logit model's incremental explanatory power is small. While the model in Column (3) with all firm-level explanatory variables shows a pseudo R-square of 28.48%, it barely rises to 31.84% in the combined model in Column (4) with all firm- and country-level variables.

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[5] The four aspects of creditor protection in the CPS are: no automatic stay on assets, rights of secured creditors, restrictions for going into reorganization, and management control in reorganization. A value of 1 is added to the score when the country's laws and regulations provide each of these aspects to secured lenders. The CPS thus ranges from 0 to 4, where 0 indicates a very low and 4 a very high creditor protection (see Table A3).

[6] Available at: http://taxfoundation.org/article/oecd-corporate-income-tax-rates-1981-2012.

[7] As a robustness test, we analyze the country dummy variables in Column (5) of Table 4. For example, of the 15 civil law countries in our sample, nine exhibit a significantly negative coefficient on the country dummy variable (not tabulated). A Wald-test rejects the null hypothesis that all coefficients are jointly equal to zero.

Table 5
Country-level logistic regressions. This table reports coefficients, *t*-statistics (in parentheses), and economic significances from country-level logistic regressions for the full sample over the sample period from 1988 to 2011. Economic significance is the average change in probability for a one standard deviation change for a continuous independent variable or for the change from zero to one for a dummy variable. The dependent variable takes the value of 1 if a firm has zero debt in a given year (and 0 otherwise). A firm is classified as zero-leverage if it has no long-term and short-term debt. All country- and firm-specific variables are described in Table A1. All explanatory variables are lagged by one period and described in Table A1. The listing dummy variables denote the four listing groups, which are defined according to a firm's IPO date (the pre-1988 dummy variable is omitted). Fixed effects are shown at the bottom of each column and standard errors are adjusted for heteroskedasticity and clustering at firm level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Independent variables	[1]	[2]	[3]	[4]
Time trend		0.069***	0.066***	0.059***
		(16.41)	(17.76)	(16.25)
		0.80%	0.61%	0.57%
1989–1993 listing dummy			0.013	0.007
			(0.23)	(0.12)
			0.11%	0.06%
1994–2003 listing dummy			0.141*	0.077*
			(1.68)	(1.77)
			1.21%	0.62%
2004–2010 listing dummy			0.180***	0.272**
			(2.82)	(2.50)
			1.55%	2.17%
Deposits	−0.003***	−0.003***		−0.000
	(−3.44)	(−3.57)		(−0.50)
	−1.29%	−1.33%		−0.13%
GDP per capita growth	−1.930***	−0.605		−1.645***
	(−3.77)	(−1.18)		(−2.67)
	−0.42%	−0.13%		−0.24%
Inflation rate	−6.034***	2.624**		2.232*
	(−5.19)	(2.27)		(1.68)
	−0.88%	0.38%		0.22%
Corporate tax rate	0.276*	2.031***		3.818***
	(1.71)	(3.36)		(6.04)
	0.14%	1.03%		1.32%
Bankruptcy code	0.013*	0.266***		0.228***
	(1.69)	(3.65)		(3.04)
	0.15%	3.11%		1.82%
Law system	0.711***	0.769***		0.805***
	(10.37)	(11.36)		(11.54)
	8.43%	8.99%		6.42%
Tax system	0.376**	0.179*		0.088*
	(11.16)	(2.06)		(1.84)
	4.46%	2.09%		0.70%
Size			−0.326***	−0.215***
			(−27.33)	(−13.17)
			−6.07%	−3.72%
Market-to-book			0.056***	0.001*
			(5.57)	(2.10)
			8.47%	0.13%
Tangibility			−1.786***	−1.813***
			(−11.37)	(−11.27)
			−3.53%	−3.32%
Profitability			0.725***	0.627***
			(8.88)	(7.55)
			1.63%	1.31%
Abnormal earnings			−0.075***	−0.094**
			(−3.34)	(−2.47)
			−0.33%	−0.27%
Retained earnings			0.087***	0.090***
			(9.19)	(8.84)
			1.99%	1.90%
Asset growth			−0.187***	−0.270***
			(−6.47)	(−8.57)
			−0.85%	−1.14%
Capital expenditures			−0.754***	−0.313*
			(−2.78)	(−1.91)
			−0.42%	−0.16%
R&D			0.877***	0.624***
			(4.63)	(3.23)
			0.77%	0.51%
Payout dummy			−0.181***	−0.013
			(−4.11)	(−0.26)
			−1.56%	−1.25%

(continued on next page)

Table 5 (*continued*)

Independent variables	[1]	[2]	[3]	[4]
Payout ratio			2.833***	2.778***
			(9.73)	(9.34)
			1.13%	5.10%
Equity issuances			0.575***	0.652***
			(6.16)	(6.85)
			0.72%	0.76%
Taxes			6.291***	5.670***
			(13.68)	(12.47)
			1.76%	1.48%
Non-debt tax shield			0.605	0.634
			(1.35)	(1.40)
			0.21%	0.21%
Cash holdings			4.672***	4.356***
			(45.61)	(41.80)
			7.67%	6.64%
Asset risk				2.171***
				(21.61)
				2.79%
Debt capacity				−1.308***
				(−7.71)
				−2.89%
Intercept	−2.209***	−140.6***	−134.0***	−162.0***
	(−4.4)	(−16.68)	(−18.91)	(−16.53)
Number of observations	106,549	106,549	106,549	106,549
Pseudo R^2	0.076	0.088	0.284	0.318
Country fixed effects	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No

5. The impact of supply-side effects

Our results so far show that changes in observable firm- and country-level characteristics are not sufficient to explain the increase in the fraction of zero-leverage firms. Listing group effects, changing industry composition, increasing asset risk, and decreasing tax rates contribute to explaining this phenomenon, but they cannot provide a full explanation. Whether industry structure or asset risk, in particular, are just capturing unobserved firm-specific demand-side factors or rather supply-side factors remains an open question. In this section, we argue that supply-side effects have an impact on the zero-leverage phenomenon, and thus we provide a detailed comparison of financially constrained and unconstrained zero-leverage firms.

5.1. Financial constraints and zero-leverage

According to Stiglitz and Weiss (1981), asymmetric information about asset risk leads to increased debt issuance costs, and firms are eventually rationed by lenders. Faulkender and Petersen (2006) argue that a firm's ability to issue public (rated) debt is an indicator of a large debt capacity. Firms with a credit rating have easier access to debt markets than those without a rating, and thus rated firms hold higher leverage. This result can occur either directly through a quantity channel (lenders are willing to lend more) or a price channel (firms with access to a cheaper source of capital borrow more). Gatchev et al. (2009) suggest that the concept of financial constraints is more binding in long-term debt (bond) markets, and that the presence or absence of capital market constraints is more likely to be observed in these markets. While during crisis periods both long- and short-term issue costs increase, long-term debt issue costs increase more relative to short-term borrowings (and adverse selection costs of equity).

Based on supply-side arguments, we argue that a new approach to better understand the characteristics of zero-leverage firms is to distinguish between firms that deliberately choose to pursue a zero-leverage policy and firms that have no other choice than renouncing the use of debt. Zero-leverage firms that have no other option are constrained in their debt capacity and simply unable to tap debt markets. In this case, the choice of being debt-free is not a deliberate financial strategy. In contrast to other studies (Devos et al., 2012; Byoun and Xu, 2013), however, we suggest that not all zero-leverage firms suffer from supply-side constraints, and thus zero-leverage firms may be classified as either financially constrained or unconstrained. In particular, we hypothesize that most zero-leverage firms suffer from debt constraints, although there may be some firms that have access to debt markets but deliberately choose to maintain a zero-leverage policy.

The differences with respect to the underlying motives for being debt-free should also be reflected in all other firm characteristics. For example, while high liquidity is considered as one dimension of debt conservatism (Arslan et al., 2013), we nevertheless hypothesize that constrained zero-leverage firms hoard the highest cash holdings in order to avoid underinvestment situations (Almeida et al., 2011). Furthermore, if some firms are classified as unconstrained zero-leverage, we expect them to be highly profitable without having the immediate need to access external capital markets (and holding accumulated profits as liquidity). In contrast, constrained zero-leverage firms are smaller and younger, and these characteristics should be coupled with higher growth opportunities and the lowest profitability rate of all sample firms. Based on Fama and French (2005) and Gatchev et al. (2009), who show that the use of external equity is most pronounced among small firms, high growth firms, and low profit firms, we hypothesize that constrained zero-leverage firms are the most active equity issuers of all sample firms. Moreover, to the extent that zero-leverage firms make payouts to shareholders, we conjecture that the motives are different for constrained and unconstrained firms. While the former group may use dividends as a multi-period signal to establish a reputation that supports future external financing at favorable conditions (Gomes, 2000), the latter group may attempt to control free cash flow problems (Jensen, 1986; La Porta et al., 2000). Finally, financial constraints may be related to asset risk due to low collateralizable values and high expected bankruptcy costs. In addition to the demand-side analysis of the association between asset risk and zero-leverage in Section 4.1, we expect that constrained zero-leverage firms exhibit the highest level of asset volatility across all sample firms due to supply-side frictions.

In order to differentiate between the different types of zero-leverage firms and to contrast their characteristics, we construct two measures of financial constraints: (i) the estimated debt capacity and (ii) the size-age index (Hadlock and Pierce, 2010). Based on Bolton and Freixas' (2000) extended model of the pecking order theory, Denis and Sibilkov (2010) and Lemmon and Zender (2010) argue that a firm's ability to issue public (rated) debt indicates a large debt capacity. While the presence (or absence) of rated debt provides an indication of the extent to which a firm has access to relatively low-cost borrowing on public bond markets and suggests a large (or small) debt capacity, the use of the actual presence or absence of a bond rating as a measure of debt capacity may impose a problem. Firms without bond ratings might have chosen to rely on equity financing for reasons unrelated to the pecking order theory and despite having the capacity to issue rated debt. Identifying these firms as being constrained in their debt capacity leads to biased results, and thus we use a predictive model of whether a firm has a public bond rating in a given year as the primary indication for the extent of its debt capacity. We run a logistic regression using our full sample over the 1988–2011 time period to assess whether a firm is likely able to access debt markets. The dependent binary variable has a value of 1 if firm *i* in year *t* has a long-term credit rating (and 0 otherwise).[8] As in Faulkender and Petersen (2006) and Lemmon and Zender (2010), the predicting firm characteristics are: tangibility, size, market-to-book, EBIT to sales, research and development expenses, age, volatility, and industry dummy variables for all two-digit SIC codes in the sample.[9] In order to divide our sample into constrained and unconstrained firms, we insert the estimated coefficients into the logit regression model and compute the estimated probabilities that a given firm would be able to obtain a bond rating in each sample year. The levels of these probabilities are used as an indicator for the debt capacity of a given firm.

Our second financial constraint measure is the size-age index (SA-index). Hadlock and Pierce (2010) develop a financial constraint index that is based on firm size and age as follows:

$$\textit{SA-index} = -0.737 \times \textit{Size} + 0.043 \times \textit{Size}^2 - 0.040 \times \textit{Age}, \tag{1}$$

where *Size* is the natural logarithm of total assets, and *Age* denotes the number of years a firm appears with a non-missing stock price in Compustat (in contrast to our definition of age in all other analyses). A higher (lower) SA-index value is consistent with greater (smaller) financial constraints.[10]

In order to maintain the panel structure of our dataset, firms are grouped into quintiles according to their mean value of a constraint measure during the sample period. In a first step, we calculate quintiles of the cross-sectional distribution for each of the two constraint measures in each year and assign all firm-year observations to one of these quintiles. In a second step, we compute the (rounded) average quintile of a firm over time and assign all its observations to this average quintile. This procedure leaves us with five groups for each constraint measure into which all firms are sorted according to their average quintile. For the debt capacity measure, firms in quintiles 5 and 4 (Q5 and Q4; highest rating probability) are considered as unconstrained, and firms in quintiles 2 and 1 (Q2 and Q1; lowest rating probability) as constrained; the reverse order holds for the alternative SA-index. In order to avoid misclassifications in the middle quintile, we exclude all firms in Q3 from our analysis.

5.2. Comparing constrained and unconstrained zero-leverage firms

In order to analyze the impact of financial constraints, we compare the mean characteristics of constrained and unconstrained zero-leverage firms with each other as well as with all other debt-financed firms. The results are shown in Table 6, where Panels A and B use the estimated debt capacity and the SA-index, respectively. For each fundamental variable, we compute the mean for each of the three subsamples (debt-financed firms, constrained zero-leverage firms, and unconstrained zero-leverage firms) and test whether there are pairwise differences in means (based on a two-sample *t*-test). One finding based on the number of firm-year observations in the different groups is that there are many more constrained than unconstrained zero-leverage firms. This observation confirms our hypothesis that zero-leverage is not so much a deliberate strategy. Most zero-leverage firms are classified as financially constrained, indicating that they have no other choice than renouncing the use of debt. Although the construction principles of the SA-index are much simpler than those of our debt capacity measure, both approaches deliver very similar results.

To confirm that our constraint measures correctly distinguish between constrained and unconstrained zero-leverage firms, we compute Almeida's et al. (2004) cash flow sensitivity of cash. The effect of financial constraints is captured by a firm's propensity

[8] We use the RatingXpress historical rating files from S&P to determine whether a firm has a long-term credit rating. These files contain ratings for all rating levels and rating types.

[9] We follow Faulkender and Petersen (2006) and exclude leverage as an explanatory variable because we sort firms into zero-leverage and debt-financed firms. The regression model includes year, industry, and country fixed effects.

[10] As the SA-index is calculated for US data but we use an international sample, we conduct another robustness check. Following Bharath et al. (2009), we use principal component analysis (PCA) to derive the common informational component of firm size and age. Groups are constructed where firms in quintiles 1 and 2 are taken as constrained, and firms in quintiles 4 and 5 as unconstrained. We repeat our analysis in Table 6 using this alternative PCA-measure. Our results (not reported) remain qualitatively unchanged.

Table 6
Constrained and unconstrained zero-leverage firms. This table compares the mean characteristics of constrained and unconstrained zero-leverage (ZL) firms with debt-financed firms for the full sample using a two-sample *t*-test. A firm is classified as zero-leverage if it has no long-term and short-term debt. Following Lemmon and Zender (2010), the probability of a firm to have a public debt rating (debt capacity) is used to divide the sample into constrained and unconstrained firms in Panel A. Based on Hadlock and Pierce (2010), the size-age index is used to divide the sample into constrained and unconstrained firms in Panel B. The index is computed as $(-0.737 \times Size) + (0.043 \times Size^2) - (0.040 \times Age)$, where *Size* is the log of total assets, and *Age* is the number of years the firm is contained in Compustat with a non-missing stock price. Firms are sorted into quintiles based on the average yearly quintile of a given firm over time. For the debt capacity measure, firms in the upper two quintiles are considered as unconstrained, and firms in the lower two quintiles as constrained; the reverse holds for the size-age index. All variables are defined in Table A1. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Variable	ZL unconstrained − ZL constrained	Debt-financed − ZL constrained	Debt-financed − ZL unconstrained
Panel A: Debt capacity			
Age	2.8986***	3.6500***	0.7514***
Size	2.6042***	2.2533***	0.3488***
Market-to-book	−0.0737***	−0.8304***	−0.8567***
Payout ratio	0.0142***	−0.0055***	−0.0197***
Tangibility	0.0054***	−0.1304***	0.1249***
Profitability	0.1534***	−0.1180***	0.0353***
Abnormal earnings	−0.0019***	−0.0023*	−0.0004***
Retained earnings	0.9300***	−0.8453***	0.0847***
Asset growth	0.0812***	−0.1040***	−0.1852***
Capital expenditures	0.0016***	−0.0090***	0.0074***
R&D	−0.0022***	−0.0368***	−0.0406***
Equity issuances	−0.1286***	−0.1573***	−0.0287***
Cash holdings	−0.0369***	−0.2606***	−0.2237***
Asset risk	−0.0191***	−0.1447***	−0.1255***
Zero-leverage duration	−0.0878***	−0.3475***	−0.2867***
Number of observations	ZL unconstrained: 12,035	Debt-financed: 212,944	Debt-financed: 212,944
	ZL constrained: 30,107	ZL constrained: 30,107	ZL unconstrained: 12,035
Panel B: Size-age index			
Age	8.1662***	4.7738***	3.3924***
Size	3.2686***	2.3821***	0.8865***
Market-to-book	−0.5359***	−1.0104***	−0.4745***
Payout ratio	0.0209***	−0.0028***	−0.0237***
Tangibility	0.0147***	0.1120***	0.0973***
Profitability	0.2515***	0.1620***	0.0895***
Abnormal earnings	−0.0021***	−0.0001	−0.0022***
Retained earnings	1.6873***	1.0922***	−0.5951***
Asset growth	0.2365***	−0.2221***	0.0144***
Capital expenditures	−0.0173***	−0.0024***	0.0149***
R&D	−0.0413***	−0.0477***	−0.0064***
Equity issuances	−0.2142***	−0.1848***	0.0294***
Cash holdings	−0.1316***	−0.2793***	−0.1477***
Asset risk	−0.0944***	−0.1723***	−0.0780***
Zero-leverage duration	−0.1746***	−0.4135***	−0.2390***
Number of observations	ZL unconstrained: 10,252	Debt-financed: 233,755	Debt-financed: 233,755
	ZL constrained: 39,737	ZL constrained: 39,737	ZL constrained: 39,737

to save cash out of cash flows, and we apply their baseline empirical model (with changes in cash holdings as the dependent and cash flow, Tobin's Q, and size as the independent variables) to our sample of zero-leverage firms (not reported). Constrained zero-leverage firms exhibit a significantly positive cash flow sensitivity of cash, indicating their limited ability to access capital markets. In contrast, unconstrained zero-leverage firms have an insignificant cash flow coefficient, corroborating that our constraint measures adequately classify zero-leverage firms.

Almeida et al. (2011) show that concerns about future financing abilities and underinvestment situations are a main determinant of cash holdings for constrained firms. Denis and Sibilkov (2010) further report that the value of cash increases with the degree of financing constraints. Moreover, Opler et al. (1999) and Byoun (2011) document that cash holdings and leverage are negatively related. The results in Table 6 support our hypothesis that constrained zero-leverage firms even hoard significantly higher cash reserves than unconstrained zero-leverage firms and all other debt-financed firms in our sample. Constrained zero-leverage firms possess the lowest debt capacity, and they accumulate higher cash reserves to avoid being forced to reject positive net present value projects. As constrained firms may suffer from pronounced information asymmetries, this finding is also consistent with Opler et al. (1999) and Drobetz et al. (2010) that firms with higher adverse selection costs hold more cash due to a precautionary motive.

The results confirm our hypothesis that constrained zero-leverage firms are less profitable than all other debt-financed firms. In contrast, unconstrained zero-leverage firms are the most profitable ones in our sample, and they also exhibit the highest retained earnings. A small subsample of highly profitable zero-leverage firms exist which deliberately choose an extremely conservative debt strategy. These unconstrained zero-leverage firms are more profitable and make higher payouts than their constrained peers. As expected, unconstrained zero-leverage firms have lower growth opportunities compared to constrained zero-leverage firms, as indicated by their lower research and development expenditures and market-to-book ratios. Agency costs of free cash flow seem be the major motive for the high payout ratios of unconstrained zero-leverage firms (La Porta et al., 2000). This conjecture is supported by the observation that unconstrained zero-leverage firms issue the lowest amount of equity, thus they are less subject to investor monitoring. Given their higher profitability together with their higher cash holdings (compared to debt-financed firms), unconstrained zero-leverage firms rely on internal equity and have no immediate need to raise external capital.

In sharp contrast, constrained zero-leverage firms are the most active equity issuers of all sample firms, supporting our notion that concerns over debt capacity explain the use of external equity financing (Lemmon and Zender, 2010). The results for capital expenditures are mixed for the two alternative measures, implying that unconstrained zero-leverage firms are not (yet) investing more. These findings are in line with Gatchev et al. (2009), who find that firms tend to compensate profit shortfalls with equity and predominantly use equity in funding intangible projects (e.g., research and development). As expected, constrained zero-leverage firms exhibit the highest market-to-book ratios and the highest research and development expenses of all sample firms. Accompanying their higher equity issuance activities, constrained zero-leverage firms choose higher payouts compared to debt-financed firms as a means to establish a reputation for good treatment of minority shareholders, thereby signaling their high quality for future equity issuances at more favorable terms without excessive adverse selection costs (Gomes, 2000). Further corroborating our expectations, constrained zero-leverage firms exhibit higher asset volatility than both unconstrained zero-leverage and debt-financed firms.

Finally, constrained zero-leverage firms differ from their unconstrained peers with respect to the length of the debt-free period before initiating debt issuances. Table 6 contains the variable labeled 'zero-leverage duration'; it refers to the ratio of a firm's longest zero-leverage period divided by the number of years the firm is contained in our sample. Constrained firms have no debt capacity and are forced to maintain zero-leverage for significantly longer periods of time.

Overall, there seem to be two different types of firms that adopt a zero-leverage policy. First, most zero-leverage firms are financially constrained and do not have the choice to obtain debt financing. These firms tend to be smaller, younger, and riskier; they are also the most active equity issuers in our sample. Constrained zero-leverage firms are characterized by higher growth opportunities. Although they are the least profitable firms in our sample, constrained zero-leverage firms make higher payouts than debt-financed firms (but lower ones than their unconstrained zero-leverage peers) in order to build up reputation. The observation that they hoard more cash is in line with Simutin's (2010) result that high excess cash firms invest more in the future. He interprets this evidence as consistent with the notion that excess cash holdings proxy for risky growth options. Similarly, Palazzo (2012) documents that high cash firms are small, have high betas, higher growth opportunities, and a low current profitability rate. Second, there is a smaller subsample of firms that deliberately chooses to maintain a zero-leverage policy. These financially unconstrained firms are more profitable, make higher payouts, and are older as well as bigger than their constrained zero-leverage peers. While the first group of firms is debt constrained and simply unable to raise debt (and equity being their last resort to raise external capital), this second group is unconstrained and would, in principle, have access to debt markets. Apple and Google represent two prominent examples of firms that are assigned to this latter group over extended periods during our sample years.

6. The impact of demand-side effects

Compared to debt-financed firms, unconstrained zero-leverage firms exhibit significantly lower capital expenditures, which is in contrast to their higher market-to-book ratios as well as research and development expenses. The findings for constrained zero-leverage firms are mixed, and thus we hypothesize that financial flexibility is a missing link to capture the zero-leverage phenomenon. Our analysis in this section starts with a time-series analysis of leverage and investment behavior to highlight the role of financial flexibility for the zero-leverage phenomenon and proceeds with a more formal analysis within a dynamic panel framework.

6.1. Demand for financial flexibility

Financial flexibility refers to a firm's ability to respond in a timely and value-maximizing manner to unexpected changes in its cash flows or investment opportunity set. The model of DeAngelo et al. (2011) predicts that ex ante optimal financial policies preserve a firm's ability to access the capital markets ex post in the event of shocks to investment opportunities (or after unexpected earnings shortfalls). The option to issue debt is valuable, and the opportunity cost of borrowing implies that target capital structures are more conservative than those predicted by the trade-off model (which omits the value loss when a firm is unable to preserve the option to borrow later at comparable terms). They further argue that firms which build up or maintain financial flexibility also hoard large cash holdings.

Byoun (2011) hypothesizes that developing firms that are in the phase of building up financial flexibility choose low leverage ratios. In contrast, growth firms that are in the next phase of their lifecycle and utilize financial flexibility to fund growth opportunities have high leverage ratios, while mature firms that are in the phase of recharging financial flexibility carry moderate leverage. Developing firms are small, with large cash holdings, low capital expenditures, and a low rating probability. In addition, given their low debt capacity, they prefer using equity over debt. Simutin (2010) interprets the positive relationship between excess cash holdings and future stock returns as evidence that excess cash holdings proxy for risky growth options. The marginal value of cash is higher for smaller firms with uncertain future investment opportunities; these firms have lower internal funds and face higher financial constraints. Marchica and Mura (2010) show that low-leverage UK firms attempt to maintain financial flexibility by preserving debt capacity and starting to issue debt as soon as they are able to exploit their growth opportunities.[11]

Based on these arguments, we hypothesize that our findings so far indicate an association between the choice to initiate a zero-leverage policy and financial flexibility. We claim that some firms become debt-free in order to maintain flexibility and prepare for large capital expenditures in the near future in order to exploit future investment opportunities. Given an association between debt constraints and the duration of a zero-leverage policy before abandoning it, we further analyze changes in property, plant, and equipment, capital expenditures, and cash holdings; all these variables are indicators for financial flexibility (Arslan et al., 2013; Byoun, 2011). We expect that financially unconstrained firms, which maintain zero-leverage only for a short period of time, switch to higher leverage ratios and have higher changes in property, plant, and equipment and higher capital expenditures than constrained firms, which (have to) maintain zero-leverage for longer periods of time before they eventually raise debt. Rather than building up flexibility by preserving debt capacity, the firms in the latter group are unable to tap debt markets and attempt to smooth their high cash holding over time.

In order to better understand the demand for financial flexibility in the form of untapped reserves of borrowing, we analyze the time-series dynamics of leverage. Adopting the dynamic framework in DeAngelo and Roll (2012), we identify all changes from a zero-leverage policy to a book leverage ratio greater than zero. Following their approach, we exclude all firms with a history of less than 15 years in order to appropriately capture the time-series characteristics. This choice implies that we exclude a large part of the constrained zero-leverage firms (mostly IPO firms and firms from the later listing groups). Table 7 reports the mean and median values of book leverage, changes in property, plant, and equipment, capital expenditures, and cash holdings from four years before ($t = -4$) to three years after ($t = +3$) the switch to a debt policy. We specify $t = 0$ as the event year, i.e., it denotes the last year during which a firm maintains zero-leverage just before issuing debt. Statistical significance levels are reported for the differences between the variables' average values between $t = 0$ and $t = +1$. Firms in Panel A exhibit exactly one year of zero-leverage before they decide to issue debt. Similarly, firms have exactly two years of zero-leverage before the switch to a debt policy in Panel B, exactly three years in Panel C, exactly four years in Panel D, and at least five years of zero-leverage in Panel E. Book leverage ratios are zero in $t = 0$; they are also zero in $t = -1$ to $t = -4$ depending on the model specification.

Although the difference in leverage between $t = 0$ and $t = +1$ is always statistically significant at the 1% level in Table 7, there are notable differences in the levels of leverage. While firms that are debt-free for exactly one year switch to a median (mean) leverage ratio of 7.17% (13.24%) in Panel A, this ratio is decreasing with the length of the preceding zero-leverage period. Firms that maintain a zero-leverage policy for at least five years switch to median (mean) leverage ratio of only 4.53% (6.21%) in Panel E. This observation supports our hypothesis that constrained zero-leverage firms have a low debt capacity and have to maintain a zero-leverage policy for longer periods of time. Apparently, they even issue less debt once they are able to access debt markets.

Given the association between debt constraints and the duration of a zero-leverage policy before abandoning it, we examine additional indicators for financial flexibility: changes in property, plant, and equipment as well as the level of capital expenditures and cash holdings (relative to total assets). As expected, firms' investments in property, plant, and equipment significantly increase after the jump in Panels A–C (with firms in Panel A having the largest difference between $t = 0$ and $t = +1$). In contrast, investments in property, plant, and equipment are smaller in Panel D, and they are even slightly lower after the switch compared to the preceding zero-leverage periods in Panel E. The results are similar for capital expenditures, again suggesting that unconstrained zero-leverage firms (i.e., firms with the shortest duration of zero-leverage) build up financial flexibility and use this flexibility after switching to a debt policy when investment opportunities arise. In contrast, constrained zero-leverage firms (i.e., firms with the longest duration of zero-leverage) tend to make even lower investments after the switch than before. Finally, unconstrained firms with only one year of zero-leverage tend to be the most profitable ones (see Section 5.2), thus increasing their cash holdings before issuing debt and reducing them when they invest (Panel A of Table 7). In contrast, constrained firms in Panels D and E tend to be the least profitable ones in our sample. However, for precautionary motives they hoard the largest amount of cash in the years prior to the switch (albeit slightly declining).

As a robustness check, we consider negative net debt ratios instead of zero book leverage. Net debt is calculated as the ratio of the difference between the book value of total debt and cash holdings to total assets. Acharya et al. (2007) and Berk et al. (2010) argue that cash holdings should be interpreted as negative debt and are thus part of capital structure decisions rather than an explanatory variable.[12] Using negative net debt ratios instead of zero book leverage allows us to examine cash holding and leverage decisions simultaneously. In results not reported, we replicate the analysis in Table 7 based on negative net debt ratios. Our findings remain qualitatively unchanged, indicating that even firms that do not follow a zero-leverage policy but instead maintain a negative net debt ratio build up financial flexibility. Moreover, we also use a more moderate threshold of at most 2% leverage and replicate the analysis in Table 7 for this larger number of extremely debt conservative (instead of zero-leverage) firms. Supporting DeAngelo and Roll (2012), our results (not shown) remain similar, albeit they are less pronounced. While Byoun and Xu (2013) report that low-leverage

[11] On the other hand, Denis and McKeon (2012) report that firms increase their total debt even at a time when their debt ratios are at least 10% above the target leverage. Their finding is consistent with DeAngelo et al. (2011), who argue that a firm's leverage ratio consists of both a permanent and a transitory component; the former reflects a firm's long-run target and the latter the evolution of its cash flows and operating needs.

[12] Lambrecht and Pawlina (2013) argue that net debt contains more information than the traditional left censored book leverage ratio. Hennessy and Whited (2005) and Acharya et al. (2007) simultaneously analyze financing and cash holding decisions.

Table 7

Long-run event study. This table reports the means and medians of variables that are related to financial flexibility surrounding the abandonment of a zero-leverage policy for firms from the full sample with at least 15 years of data history in the Compustat databases. $t = 0$ and $t = 1$ denote the years of and immediately after the switch from zero-leverage to a debt policy, respectively. All other event years from $t = -4$ to $t = +3$ are defined accordingly. Each panel refers to a different duration of the zero-leverage policy prior to the switch, e.g., the firms in Panel A maintained a zero-leverage policy for exactly one year, and those in Panel E for at least five years before they switch to a debt policy. A firm is classified as zero-leverage if it has no long-term and short-term debt. All variables are defined in Table A1. ***, **, and * indicate a significant difference between the mean value of a variable in the year after a jump ($t = 1$) and the year of the jump ($t = 0$) at the 1, 5, and 10 percent levels, respectively.

		Year t before and after the last year of zero leverage ($t = 0$):							
		−4	−3	−2	−1	0	+1	+2	+3
Panel A: One year of zero-leverage before the jump									
Book leverage	Mean	0.137	0.124	0.119	0.100	0.000	0.132***	0.141	0.156
	Median	0.075	0.061	0.048	0.039	0.000	0.072	0.079	0.085
	N	850	931	998	1093	1247	1247	1135	1084
Δ Property, plant, and equipment	Mean	0.029	0.033	0.026	0.032	0.031	0.106***	0.050	0.036
	Median	0.004	0.004	0.004	0.004	0.005	0.028	0.010	0.006
	N	799	875	945	1014	1128	1237	1130	1079
Capital expenditures	Mean	0.057	0.057	0.058	0.060	0.061	0.076***	0.061	0.056
	Median	0.037	0.037	0.035	0.035	0.035	0.041	0.035	0.032
	N	762	841	910	995	1125	1145	1059	1019
Cash holdings	Mean	0.188	0.194	0.196	0.195	0.255	0.191***	0.191	0.196
	Median	0.129	0.141	0.138	0.144	0.197	0.134	0.132	0.138
	N	850	931	998	1093	1147	1247	1135	1084
Panel B: Two years of zero-leverage before the jump									
Book leverage	Mean	0.154	0.136	0.110	0.000	0.000	0.124***	0.135	0.151
	Median	0.070	0.055	0.042	0.000	0.000	0.063	0.072	0.083
	N	472	505	554	657	657	657	618	586
Δ Property, plant, and equipment	Mean	0.024	0.028	0.032	0.016	0.041	0.101***	0.051	0.037
	Median	0.004	0.001	0.003	0.003	0.007	0.027	0.011	0.004
	N	443	472	509	570	655	649	615	583
Capital expenditures	Mean	0.062	0.059	0.058	0.053	0.059	0.074***	0.060	0.056
	Median	0.040	0.036	0.037	0.032	0.038	0.039	0.034	0.031
	N	425	462	507	596	607	610	582	555
Cash holdings	Mean	0.196	0.202	0.215	0.283	0.276	0.198***	0.192	0.202
	Median	0.141	0.141	0.167	0.220	0.220	0.144	0.132	0.137
	N	472	505	554	697	657	657	618	586
Panel C: Three years of zero-leverage before the jump									
Book leverage	Mean	0.120	0.099	0.000	0.000	0.000	0.115***	0.114	0.126
	Median	0.053	0.041	0.000	0.000	0.000	0.062	0.064	0.065
	N	323	349	407	407	407	407	388	367
Δ Property, plant, and equipment	Mean	0.016	0.026	0.015	0.036	0.034	0.093***	0.029	0.041
	Median	0.004	0.003	0.003	0.008	0.009	0.021	0.008	0.007
	N	311	329	370	404	404	400	387	367
Capital expenditures	Mean	0.058	0.059	0.053	0.057	0.059	0.066**	0.056	0.055
	Median	0.035	0.038	0.034	0.036	0.039	0.039	0.035	0.035
	N	303	330	379	383	387	392	373	357
Cash holdings	Mean	0.198	0.205	0.288	0.295	0.271	0.202***	0.209	0.209
	Median	0.152	0.158	0.227	0.242	0.223	0.141	0.154	0.145
	N	323	349	407	407	407	407	388	367
Panel D: Four years of zero-leverage before the jump									
Book leverage	Mean	0.099	0.000	0.000	0.000	0.000	0.103***	0.114	0.118
	Median	0.049	0.000	0.000	0.000	0.000	0.056	0.058	0.060
	N	221	256	256	256	256	256	245	233
Δ Property, plant, and equipment	Mean	0.025	0.026	0.035	0.028	0.042	0.084**	0.032	0.047
	Median	0.004	0.005	0.007	0.005	0.011	0.017	0.005	0.001
	N	205	229	253	255	255	253	245	233
Capital expenditures	Mean	0.057	0.057	0.056	0.051	0.052	0.058	0.056	0.046
	Median	0.037	0.038	0.037	0.033	0.039	0.036	0.032	0.030
	N	209	241	247	247	247	245	236	223
Cash holdings	Mean	0.270	0.332	0.339	0.337	0.307	0.235***	0.236	0.239
	Median	0.213	0.284	0.283	0.284	0.243	0.178	0.171	0.171
	N	221	256	256	256	256	256	245	233
Panel E: At least five years of zero-leverage before the jump									
Book leverage	Mean	0.000	0.000	0.000	0.000	0.000	0.062***	0.096	0.098
	Median	0.000	0.000	0.000	0.000	0.000	0.045	0.052	0.049
	N	718	718	718	718	718	718	659	611
Δ Property, plant, and equipment	Mean	0.021	0.025	0.024	0.026	0.043	0.040**	0.040	0.023
	Median	0.002	0.004	0.002	0.004	0.005	0.005	0.004	0.001
	N	684	715	710	712	712	705	651	609

(continued on next page)

Table 7 (*continued*)

		Year t before and after the last year of zero leverage ($t = 0$):							
		−4	−3	−2	−1	0	+1	+2	+3
Panel E: At least five years of zero-leverage before the jump									
Capital expenditures	Mean	0.049	0.048	0.050	0.051	0.055	0.053	0.051	0.047
	Median	0.030	0.030	0.030	0.032	0.031	0.033	0.029	0.027
	N	670	682	685	689	690	701	646	602
Cash holdings	Mean	0.353	0.353	0.351	0.338	0.305	0.237***	0.246	0.249
	Median	0.316	0.317	0.304	0.292	0.255	0.183	0.183	0.189
	N	718	718	718	718	718	718	659	611

firms (with leverage between 0% and 5% of total assets) are different from debt-free firms, our results indicate that financial flexibility is an important driver of all these firms' capital structure decisions.

6.2. Financial flexibility in a dynamic panel framework

Unconstrained zero-leverage firms have the flexibility to issue larger amounts of debt and use it together with their cash holdings to invest as profitable investment projects arise. In contrast, constrained zero-leverage firms lack sufficient debt capacity and they are not able to issue as much debt. Therefore, this latter group of firms is not as flexible to invest. In addition, they hoard the largest amount of cash as they fear that they may not be able to issue debt in the near future. In order to corroborate our previous findings for financial flexibility, we use a dynamic panel regression approach. Adapting the empirical framework in Marchica and Mura (2010), we estimate a Q-model of investment[13]:

$$Capex_{it} = \alpha \times Capex_{it-1} + \beta_1 \times CF_{it-1} + \beta_2 \times Q_{it} + \beta_3 \times ZL\text{-}duration_{it} + \beta_4 \times (CF_{it-1} \times ZL\text{-}duration_{it}) + \eta_i + \eta_t + \upsilon_{it}, \tag{2}$$

where $Capex_{it}$ denotes capital expenditures; Q_{it} is Tobin's Q (computed as the ratio of market value to book value of assets); CF_{it-1} the one period lagged cash flow; and $ZL\text{-}duration_{it}$ a zero-leverage duration dummy variable. As an example, in the one-year specification of this dynamic model, the latter dummy variable is set equal to 1 in $t = 1$ if a firm maintains zero-leverage for exactly one year prior to the switch (and 0 otherwise); the other specifications are defined accordingly. Most importantly, ($CF_{it-1} \times ZL\text{-}duration_{it}$) denotes an interaction term with cash flow that tests whether firms with a shorter zero-leverage duration are more flexible, benefitting from a lower investment-cash flow sensitivity and thus an enhanced investment ability. Finally, η_i denotes an entity fixed effect; η_t a time-specific effect; and υ_{it} a disturbance term (serially uncorrelated with mean zero).

Dynamic panel models with lagged dependent variables (here $Capex_{it-1}$) have received considerable attention in the recent literature. For example, Wintoki et al. (2012) propose dynamic panel Generalized Method of Moment (GMM) estimators to alleviate endogeneity concerns in empirical corporate finance research. Flannery and Hankins (2013) provide an evaluation of different dynamic panel methods to estimate the speed of adjustment back to a target capital structure. Given the biases in simple pooled and standard fixed effect regressions, the dynamic panel model in Eq. (2) is estimated based on three different GMM-techniques to control for endogeneity and fixed effects. In particular, we use the Arellano and Bond (1991) difference GMM-estimator in Panel A, the Blundell and Bond (1998) system GMM-estimator in Panel B, and the DPF-estimator with a fractional dependent variable (Elsas and Florysiak, 2011) in Panel C. The results are shown in Table 8, and they are similar for all three GMM estimators.

In line with Marchica and Mura (2010), we observe a significantly positive relationship between capital expenditures and Tobin's Q. This result is consistent with the prediction that growth opportunities play an important role in investment decisions. The estimated coefficient on cash flow is always positive and significant, indicating that the presence of capital market imperfections results in firms relying on internal funds to invest (Fazzari et al., 1988; Gatchev et al., 2010). Supporting our analysis in Table 7, the zero-leverage duration dummy variables exerts a positive impact on firms' capital expenditures, indicating that zero-leverage firms invest more after switching to a debt policy. Both the magnitude of the estimated coefficients and their significance level tend to decline for dummy variables that indicate longer preceding zero-leverage durations. Firms that maintain zero-leverage for longer periods of time tend to be constrained and are unable to invest as much as firms with a shorter duration of zero-leverage. Furthermore, the interaction term between the duration dummy and cash flow is negative for firms that deliberately choose a zero-leverage policy over a shorter period of time, thus revealing their reduced investment-cash flow sensitivity. These firms possess a higher debt capacity, are financially flexible and able to raise external funds for investments. In contrast, firms that maintain a zero-leverage policy for longer periods of time are most constrained in their debt capacity and exhibit insignificant coefficients on the interaction term.

[13] See Cleary (1999) for details on the Q-model.

Table 8
Dynamic panel analysis. This table shows the coefficients and *t*-statistics (in parentheses) of GMM regressions for the Q-model of investment as specified in Eq. (2). The dependent variable is capital expenditures in year *t*. The model includes zero-leverage (ZL) duration dummy variables that refer to the duration of a zero-leverage period before a firm switches to a debt policy. A firm is classified as zero-leverage if it has no long- and short-term debt in a given year. For example, in the one-year specification the ZL-duration dummy variable is set equal to 1 in $t = 0$ if a firm maintains zero-leverage for exactly one year prior to the switch (and 0 otherwise); the other specifications are defined accordingly. (*ZL-duration dummy* × *Cash flow*$_{t-1}$) denotes an interaction term with cash flow that tests whether firms with a shorter zero-leverage duration are more flexible and benefit from their lower (investment) cash flow-investment sensitivity. All variables are defined in Table A1. Panel A reports the results from estimating the model using the Arellano and Bond (1991) difference GMM-estimator, Panel B the Blundell and Bond (1998) system GMM-estimator (using the two-step estimator), and Panel C a model with a fractional dependent variable (DPF-estimator; Elsas and Florysiak, 2011). All regressions include year, industry, and country fixed effects and use heteroskedasticity robust standard errors. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

	One year ZL	Two years ZL	Three years ZL	Four years ZL	At least five years ZL
Panel A: Difference GMM-estimator					
Capital expenditures ($t-1$)	0.419***	0.419***	0.420***	0.420***	0.420***
	(29.37)	(29.29)	(29.35)	(29.34)	(29.35)
Cash flow ($t-1$)	0.014***	0.014***	0.014***	0.014***	0.014***
	(4.29)	(4.25)	(4.19)	(4.25)	(4.20)
Tobin's Q	0.001***	0.001***	0.001***	0.001***	0.001***
	(4.70)	(4.69)	(4.62)	(4.63)	(4.64)
ZL-duration dummy	0.017***	0.014***	0.009**	0.004	0.002
	(5.73)	(3.27)	(2.47)	(0.48)	(1.17)
ZL-duration dummy × Cash flow($t-1$)	−0.023**	−0.010*	−0.012	−0.006	−0.001
	(−1.97)	(−1.85)	(−0.85)	(−0.48)	(−0.24)
Constant	0.027***	0.027***	0.027***	0.027***	0.027***
	(28.08)	(28.23)	(28.16)	(28.17)	(28.14)
Number of observations	70,524	70,524	70,524	70,524	70,524
Panel B: System GMM-estimator					
Capital expenditures ($t-1$)	0.388***	0.388***	0.388***	0.388***	0.388***
	(27.13)	(26.99)	(27.05)	(27.03)	(27.01)
Cash flow ($t-1$)	0.006**	0.006**	0.006**	0.006**	0.006**
	(2.22)	(2.28)	(2.30)	(2.31)	(2.29)
Tobin's Q	0.001***	0.001***	0.001***	0.001***	0.001***
	(4.03)	(3.94)	(3.98)	(3.96)	(4.00)
ZL-duration dummy	0.013***	0.008**	0.005*	0.002	0.002
	(4.28)	(1.99)	(1.65)	(0.43)	(0.99)
ZL-duration dummy × Cash flow($t-1$)	−0.030**	−0.016*	−0.009*	−0.002	−0.002
	(−2.10)	(−1.94)	(−1.66)	(−0.35)	(−0.42)
Constant	0.024***	0.024***	0.024***	0.024***	0.024***
	(27.12)	(27.19)	(27.14)	(27.19)	(27.18)
Number of observations	78,658	78,658	78,658	78,658	78,658
Panel C: DPF-estimator					
Capital expenditures ($t-1$)	0.462***	0.462***	0.462***	0.462***	0.462***
	(17.77)	(17.69)	(17.67)	(17.65)	(17.67)
Cash flow ($t-1$)	0.024***	0.023***	0.023***	0.023***	0.024***
	(23.79)	(23.64)	(23.53)	(23.67)	(23.84)
Tobin's Q	0.002***	0.002***	0.002***	0.002***	0.002***
	(18.60)	(18.61)	(18.64)	(18.62)	(18.61)
ZL-duration dummy	0.017***	0.016***	0.012***	0.011***	0.010***
	(11.35)	(8.20)	(4.96)	(3.57)	(5.62)
ZL-duration dummy × Cash flow($t-1$)	−0.024***	−0.015*	−0.012*	−0.011*	−0.010
	(−4.24)	(−1.78)	(−1.87)	(−1.66)	(−1.12)
Constant	0.050***	0.050***	0.050***	0.050***	0.050***
	(24.18)	(24.32)	(24.32)	(24.34)	(24.34)
Number of observations	78,658	78,658	78,658	78,658	78,658

7. Conclusion

This study investigates why a surprisingly large number of firms maintain a zero-leverage policy, a behavior that cannot be explained by the standard theories of capital structure. The increasing percentage of zero-leverage firms is an international phenomenon. While only 8.47% of all firms in our sample of developed markets renounce the use of debt in 1988, the percentage of zero-leverage firms has risen to 25.70% by the end of our sample period in 2011. Our analysis offers several explanations for the zero-leverage phenomenon. First, exploiting the cross-sectional information from our sample, we find that countries with a common law origin, high creditor protection, and a dividend imputation or dividend relief tax system exhibit the highest percentage of zero-leverage firms. Second, there is an IPO effect, and thus a large proportion of the upward trend in the percentage of zero-leverage firms is generated by firms that went public in more recent sample years. Third, there is an industry effect attributable to changes in the industry composition toward sectors where extreme debt conservatism is more commonly adopted. Fourth, the zero-leverage phenomenon is driven by a more general listing period effect, where newly listed firms in the later years of the sample period exhibit a higher propensity to maintain a zero-leverage policy (demand side-explanation). Increasing asset volatility and decreasing corporate tax rates during the sample period offer an explanation for this increase in the percentage of zero-leverage firms over the listing groups.

Another contribution of our study is that we focus on the supply-side of financing choices by dividing the full sample of zero-leverage firms into financially constrained and unconstrained ones. Only a small number of very profitable firms with high payout ratios deliberately pursue a zero-leverage policy. In contrast, most zero-leverage firms are constrained by their debt capacity. They tend to be smaller, riskier, and less profitable, and they are the most active equity issuers. Zero-leverage firms accumulate higher cash holdings than all other sample firms, presumably in an attempt to build up financial flexibility. In particular, firms that maintain zero-leverage for only a short period of time are seeking financial flexibility. After abandoning their zero-leverage policy, they switch to higher book leverage ratios, make higher investments, and reduce their cash holdings by a larger amount compared to constrained firms that (have to) maintain zero-leverage for longer periods of time.

Appendix A

Table A1
Definition of variables.

Variable	Definition	Construction
Panel A: Firm-level variables		
Book leverage	Ratio of long- and short-term debt to total book assets	$(dltt + dlc) / at$
Age	Difference between the actual year and a firm's IPO date	
Size	Natural logarithm of total book assets	$\log(at)$
Market-to-book	Market-to-book ratio	$(at - seq + mkval) / at$
Tangibility	Ratio of fixed assets to book assets	$ppent / at$
Profitability	Ratio of operating income before depreciation to book assets	$ebit / at$
Abnormal earnings	Ratio of difference between the income before extraordinary items for time t and $t - 1$ to the market value of equity	$\Delta oibdp / mkval$
Retained earnings	Ratio of retained earnings to book assets	re / at
Asset growth	Ratio of assets in event year t minus assets in year $t - 1$ divided by assets in $t - 1$	$(at_t - at_{t-1}) / at_{t-1}$
Tobin's Q	Ratio of market to book value of assets	$(at + mkval - seq - txdc) / at$
Capital expenditures	Ratio of capital expenditures to book assets	$capx / at$
Δ Property, plant, and equipment	Ratio of difference between the net property plant & equipment for time t and $t - 1$ to book assets	$\Delta ppent / at$
R&D	Ratio of research and development expenses to book assets	xrd / at
Payout ratio	Ratio of the sum of cash dividends and share repurchases to book assets	$(rp + div) / at$
Equity issuances	Ratio of total equity issuances to book assets	$sstk / at$
Taxes	Ratio of income taxes paid to total book assets	txt / at
Non-debt tax shield	Ratio of depreciation to book assets	dp / at
Cash holdings	Ratio of cash holdings to book assets	che / at
Asset risk	Unlevered annualized volatility of logarithmic monthly stock returns (r_t)	$\text{S.D.}(r_t) \times (mkval / (at - seq + mkval))$
Debt capacity	Dummy variable for estimated debt capacity of a firm in a given year (based on the rating probability; see Section 5.1)	
Payout dummy	Dummy variable that takes the value of 1 if a firm has a payout ratio greater than zero in a given year (and 0 otherwise).	
Listing group dummy variables	Listing group dummy variables take the value of 1 if a firm was listed in the respective years (and 0 otherwise). The four listing group dummy variables represent the following listing periods: pre-1988, 1988–1993, 1994–2003, and 2004–2010.	
Zero-leverage duration	Ratio of a firm's longest zero-leverage period to the number of years the firm is contained in the sample	
Panel B: Country-level variables		
Deposits	Ratio of a country's deposits (liquid liability) to GDP. See Table A3 for the mean value in all countries. (Source: World Bank)	
GDP per capita growth	Annual real GDP growth rate. See Table A3 for the mean value in all countries. (Source: World Bank)	
Inflation rate	Annual change of the Consumer Price Index. See Table A3 for the mean value in all countries. (Source: World Bank)	
Corporate tax rate	Combined federal and state corporate tax rate provided by the Organisation for Economic Cooperation and Development (OECD). See Table A3 for the mean value of the corporate tax rate in all countries. (Source: http://taxfoundation.org/article/oecd-corporate-income-tax-rates-1981-2012)	
Bankruptcy code	Dummy variable that equals 1 if the country has a high creditor protection score (CPS of 2 and higher), and 0 if the country has a low creditor protection score (CPS below 2). See Table A3 for an overview of the bankruptcy code in all countries. (Source: Djankov et al., 2007)	
Legal system	Dummy variable that equals 1 for countries with a common law system, and 0 for countries with a civil law system. See Table A3 for an overview of the legal system in all countries. (Source: Fan et al., 2012 and International Monetary Fund, 2012)	
Tax system	Dummy variable that equals 1 if the country has a dividend imputation or a dividend relief tax system, and 0 if the country has a classical tax system. See Table A3 for an overview of the tax system in all countries. (Source: Fan et al., 2012)	

Table A2
Description of Compustat abbreviations.

Variable	Description	Format code[a] 1, 3, 5, 7	Format code[a] 12	Format code[a] 10, 11
at	Assets — total	*at*	*at*	*at*
capx	Net capital expenditures	*capx*	*capxfi*	*capx*
che	Cash and equivalents	*che*	*che*	*che*
div	Cash dividend	*dv*	*eqdivp*	*dv*
dlc	Short-term debt	*dlc*	*dlc*	*dlc*
dltt	Long-term debt	*dltt*	*dltt*	*dltt*
dp	Depreciation expenses	*dp*	*dp*	*dp*
ebit	Earnings before interest and taxes	*ebit*	*ebit*	*ebit*
mkval	Market value	*mkval*	*mkval*	*mkval*
oibdp	Op. income bf. depreciation & amortization	*oibdp*	*oibdp*	*oibdp*
ppent	Property, plant, and equipment (net) — total	*ppent*	*ppent*	*ppent*
pstk	Preferred stock — total	*pstk*[b]	*pstk*[b]	*pstk*[b]
re	Retained earnings	*re*	*re*	*re*
rp	Purchase of common and preferred stocks	*prstkc*	*prstkc*	*prstkc* (f.c.11); *prstkc* + *purtshr*[b] (f.c. 10)
seq	Shareholders' equity — total	*seq*	*seq*	*seq*
sstk	Sale of common and preferred stock	*sstk*	*sstk*	*sstk*
txdc	Deferred taxes	*txdc*[b]	*txdc*[b]	*txdc*[b]
txt	Total taxes	*txt*	*txt*	*txt*
xrd	Research and development expense	*xrd*[b]	*xrd*[b]	*xrd*[b]

[a] Refers to the format code (f. c.) and identifies the format of a firm's Flow of Funds Statement in Compustat Global. Format codes 1, 3, 5, and 7 generally apply to firms from the United States and Canada, format code 12 to firms from the United Kingdom, and format code 10 to countries from the rest of the world. The Compustat variable *scf* provides information about the format of a firms' Flow of Funds Statement for every firm-year. All variables in Table A1 are constructed according to this variable.
[b] Missing observations are replaced by zero.

Table A3
Country-level variables. This table summarizes the country-level variables. CPS denotes the Creditor Protection Score from La Porta et al. (1998); the classification shown here incorporates the updates in Djankov et al. (2007). Mean values are reported for the variables corporate tax rate, deposits, GDP per capita growth, inflation rate, number of firms, and the percentage of zero-leverage firms during the sample period.

Country	Compustat ID	Law system	Bankruptcy code	Tax system	Corporate tax rate	Deposits	GDP per capita growth	Inflation rate	Number of firms	% of zero-leverage firms
Australia	AUS	Common	High CPS	Dividend imputation	0.314	101.457	0.032	0.035	2058	38.13%
Austria	AUT	Civil	High CPS	Dividend relief	0.307	125.216	0.023	0.015	129	9.04%
Belgium	BEL	Civil	High CPS	Dividend relief	0.370	115.437	0.019	0.019	159	6.65%
Canada	CAN	Common	High CPS	Dividend imputation	0.370	109.788	0.025	0.023	3172	27.86%
Denmark	DNK	Civil	High CPS	Dividend relief	0.309	121.608	0.015	0.022	198	8.13%
Finland	FIN	Civil	High CPS	Dividend relief post 2005/dividend imputation pre 2006	0.286	73.859	0.025	0.018	156	16.94%
France	FRA	Civil	Low CPS	Dividend relief post 2004/dividend imputation pre 2005	0.365	108.968	0.017	0.017	1011	8.08%
Germany	DEU	Civil	High CPS	Dividend relief post 2001/dividend imputation pre 2002	0.434	135.550	0.016	0.011	1000	5.27%
Greece	GRC	Civil	Low CPS	Dividend relief	0.305	94.491	0.016	0.032	233	6.25%
Ireland	IRL	Common	High CPS	Classical post 1999/dividend imputation pre 2000	0.237	122.173	0.024	0.027	128	5.51%
Israel	ISR	Civil	High CPS	Classical	0.306	93.948	0.040	0.043	368	21.14%
Italy	ITA	Civil	High CPS	Dividend relief post 2004/dividend imputation pre 2005	0.358	101.447	0.009	0.025	325	7.37%
Japan	JPN	Civil	High CPS	Classical	0.428	195.907	0.011	−0.007	3858	19.33%
Netherlands	NLD	Civil	High CPS	Classical	0.326	147.352	0.025	0.022	265	25.62%
Norway	NOR	Civil	High CPS	Dividend imputation	0.291	73.228	0.021	0.046	340	3.70%
Portugal	PRT	Civil	Low CPS	Dividend relief	0.324	131.789	0.018	0.031	80	9.14%
Spain	ESP	Civil	High CPS	Dividend imputation	0.339	137.064	0.026	0.034	175	11.16%
Switzerland	CHE	Civil	Low CPS	Classical	0.246	173.203	0.017	0.012	271	13.57%
United Kingdom	GBR	Common	High CPS	Dividend relief post 2001/dividend imputation pre 2002	0.305	138.754	0.024	0.028	2814	2.58%
United States	USA	Common	Low CPS	Dividend relief post 2002/classical pre 2003	0.393	59.088	0.028	0.023	15,080	18.34%

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