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Pricing default risk: The good, the bad, and the anomaly☆

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ABSTRACT

While empirical literature has documented a negative relation between default risk and stock returns, theory suggests that default risk should be positively priced. In this paper, we calculate monthly probabilities of default (PDs) for a large sample of European firms and break them down into systematic and idiosyncratic components. The approach that we follow does not require data on credit spreads, thus it can also be applied to small firms that do not have such data available. In accordance with theory, we find that the systematic part, measured as the PD sensitivity to aggregate default risk, is positively related to stock returns. We show that stocks with higher PDs underperform because they have, on average, higher idiosyncratic risk. Finally, small and value stocks are quite heterogeneous with respect to their exposure to aggregate default risk.

1. Introduction

Finance theory suggests that if default risk is systematic (and thus non-diversifiable) it should be positively correlated with stock returns in the cross-section of firms. However, in the empirical literature there are two main strands that deliver contradictory findings regarding the sign and significance of this relationship. On the one hand, Vassalou and Xing (2004) and Chava and Purnanandam (2010) document a positive relationship between default risk and stock returns in the US and Aretz et al. (2014), in a recent working paper, report similar findings using an international sample. On the other hand, several studies find a negative relationship between default risk and returns, the so-called "default anomaly". Examples are Dichev (1998), Griffin and Lemmon (2002), Campbell et al., (2008), Garlappi et al., (2008), Avramov et al. (2009), Da and Gao (2010), Garlappi and Yan (2011), and Conrad et al., (2012) in the US, Bauer and Agarwal (2014) in the UK and Gao et al., (2015) internationally.[1]

These literature strands focus on the firm's physical (i.e. real/observed) probability of default (PD) as a measure of default risk. In most cases, they use either market-based PDs (calculated under Merton's, 1974 framework) or accounting-based PDs (such as the popular measure used by Campbell et al., 2008). Hence, these studies implicitly assume that physical PDs are monotoni-

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[1] Some of the explanations offered for this puzzling evidence are: (i) violations of the absolute priority rule (Garlappi et al., 2008; Garlappi and Yan, 2011): higher shareholder bargaining power reduces the risk of the shareholders' residual claim, thus returns close to default; (ii) long-run risk (Avramov et al., 2011): firms close to default are less exposed to long-run risk because they are not expected to survive for long, and hence have lower returns; (iii) glory (Conrad et al., 2012): firms with high default risk are glory stocks that realize high returns in the future, so their current low returns are not a good estimate of their future returns. (iv) psychological reasons (Gao et al., 2015): investors are overconfident about high default risk stocks, keeping their prices high and subsequently leading to sudden corrections and low returns; (v) neglected profitability (Bauer and Agarwal, 2014): distress risk without profitability related information is not relevant in pricing.

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cally related to risk-neutral PDs and that, as physical PDs increase, so does the exposure to aggregate default risk.

However, George and Hwang (2010) argue that a firm's physical PD does not necessarily reflect its systematic risk. In a theoretical model, they show that firms with high distress costs choose low leverage levels, which in turn lowers their physical PDs, therefore creating a negative relationship between PDs and returns. While their argument is based on the differences in the Loss-Given-Default (LGD) across firms, Johnson et al. (2011) extend George and Hwang (2010) by adding heterogeneity in cash-flow (profitability) in addition to heterogeneity in distress costs. As LGD does not play a major role for equity returns, Johnson et al. (2011) show that the results in George and Hwang (2010) are relevant for unlevered firm returns but do not necessarily hold for equity returns. They further show that simultaneous heterogeneity in both dimensions above, risk and profitability, captures effectively the negative relationship of expected return with leverage and distress risk. In the same spirit, Kapadia (2011) finds that firms with high physical PDs do not co-vary with aggregate distress, suggesting that the low returns of high PD stocks are not due to exposure to aggregate distress. Similarly, Avramov et al., (2011) show that firms with high idiosyncratic volatility (often identified as firms with high PDs) have low systematic risk exposure and low returns, thus suggesting a link between idiosyncratic volatility and default anomalies.[2] Finally, Ozdagli (2013) builds a model that separates physical and risk-neutral PDs and reconciles the above phenomena, by predicting that firms with a higher risk-neutral PD should have higher returns. In addition to reconciling the positive value premium with the negative distress premium, the dynamic framework in Ozdagli (2013) is also able to explain the empirical relationships between stock returns, book-to-market values, and financial leverage.

Following George and Hwang's (2010), Johnson's et al. (2011) and Ozdagli's (2013) influential work, many recent studies use proxies of risk-neutral PDs to measure default risk, and most document a positive relationship between default risk and returns. Examples are Chan-Lau (2006), Nielsen (2013) and Friedwald et al. (2014), who use credit default swap (CDS) spreads, and Anginer and Yıldızhan (2014), who calculate credit risk premia from corporate bond spreads to proxy for risk-neutral PDs. The disadvantage of these studies is that they include in their samples only firms that have CDS or bond information available. These firms constitute a small fraction of total firms and are usually the largest ones. For example, Ozdagli (2013) argues that CDS data are available for only about 20% of US public firms (and are reliable only after 2004).

Of the above studies that focus either on CDS or bond data, only Anginer and Yıldızhan (2014) extend their analysis to a larger sample of firms for robustness purposes. To do this, they use physical PDs of US firms with CRSP-COMPUSTAT data available and calculate sensitivities of these PDs to the median PD in their sample, which they use as a proxy for aggregate default risk. Interestingly, they document a positive relationship between these sensitivities and stock returns. Our study is close to their analysis. Specifically, we build on this methodology, which was introduced by Hilscher and Wilson (2015), and extend Anginer and Yıldızhan (2014) in three ways that we describe below.

First, we use as our main measure for aggregate default risk the CBOE Volatility Index (VIX). VIX is positively correlated with credit spreads, as documented in the literature on CDS (Pan and Singleton, 2008) and corporate bonds (Collin-Dufresne et al., 2001; Schaefer and Strebulaev, 2008). Moreover, VIX is strongly correlated with European volatility indices (correlations higher than 0.90), which are generally available only from 2000 onwards. In the academic literature VIX has been linked with economic uncertainty. Ang et al. (2006) show that changes in VIX are a very good proxy for changes in aggregate volatility, or in other words, aggregate uncertainty.[3] Whereas VIX primarily captures aggregate uncertainty risk, many studies suggest that aggregate default risk and aggregate uncertainty risk are related. Hamilton and Lin (1996) show that economic recessions are the single most important factor that explain around 60 percent of the change in market volatility (uncertainty). Similarly, Campbell et al. (2001) and Barinov (2013) show that aggregate uncertainty increases during recessions, when the expected risk premium is high. In another study, Barinov (2012) shows that both firms with very negative and very positive return sensitivities to VIX changes are smaller and have higher BM ratios, which are stock characteristics traditionally linked to default risk. In Section 4, we further motivate the use of VIX and, in Section 6, we perform three robustness tests related to its use. Initially, we follow Anginer and Yıldızhan (2014) and report results using the median PD as an alternative proxy for aggregate default risk. Although our results remain robust, we provide evidence that the median PD is a less appropriate proxy than VIX. Then, we use the average asset volatility σ_A instead of VIX and our findings improve compared to the ones using the median PD, indicating that the average asset volatility σ_A does a better job as a proxy and is closely related to VIX.[4] Finally, we examine, in addition to VIX, five other aggregate variables used by Collin-Dufresne et al., (2001) and Schaefer and Strebulaev (2008) and we find evidence that VIX alone performs better than in combination with these aggregate variables.

Second, instead of focusing on the US market, which has already been largely explored, we study a comprehensive sample of European firms from 22 countries, which notably also includes smaller firms. These firms are often neglected, but constitute the vast majority of firms listed on European exchanges. This heterogeneity is important as previous work has often associated default risk to other firm characteristics (such as size and book-to-market ratios). Thus, the inclusion of small stocks allows us to reconcile our findings with these earlier results.

Finally, we break down the calculated total PDs into systematic and idiosyncratic components and study the relationship between returns and the two components of PD separately. This enables us to detect the origin of the default anomaly. We refer to the systematic component as systematic default risk (SDR) beta and to the idiosyncratic component as idiosyncratic default risk (IDR). Specifically, we sort the stocks in our sample on both SDR betas and IDR instead of only SDR betas (as Anginer and Yıldızhan do) and perform several double-sorts in order to better identify the source of the anomaly and enforce our statements.

At this point it is useful to define the term SDR and explain what we are focusing on: In this study firm A has higher SDR beta than firm B if firm A has higher PD (i.e. is more likely to default) than firm B when aggregate default risk is high (i.e. other firms are defaulting). It should be noted that we do not examine the case where firm A has higher SDR beta than firm B because, conditional on being equally likely to default, firm A has higher LGD (i.e. causes greater losses). Therefore our study focuses on equity returns (stockholders' perspective) and not on overall returns (stockholders' and bondholders' perspectives combined). In George and Hwang's (2010) framework, LGD does not matter for stockhold-

[2] Other studies that document a negative relationship between idiosyncratic volatility and stock returns (the IV anomaly) include Ang et al. (2006) and Barinov (2012).

[3] In this study, Ang et al. (2006) calculate the sensitivity of individual returns to changes in VIX, and show that firms that perform well when VIX increases experience low average returns because they are a hedge against market downside risk.

[4] It is worth noting that we still consider both the median PD and the average asset volatility as worse proxies than VIX because they are sample-specific (therefore they suffer from in-sample bias).