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DOES PASSIVE BOND INVESTING ENCOURAGE CORPORATE LEVERAGE IN EMERGING MARKET ECONOMIES?

Key points:

- *With the rising popularity of passively managed bond funds investing in emerging market economies (EMEs), this study assesses empirically whether a larger exposure of EMEs corporate bonds to passive bond investing will lead to a higher leverage of these corporate issuers and pose a risk to financial stability. As these passive bond funds mechanically replicate some benchmark bond indices in their investment portfolios, the emergence of passive bond investing could weaken the discipline of issuers of constituent bonds, especially the more leveraged ones, and result in higher aggregate leverage.*

- *Using EMEs non-financial corporates' weights in a major EME corporate bond index as a proxy for the exposure of their bonds to passive bond investing, our empirical analysis finds that an increase in the exposure could drive up the long-term leverage of these corporate issuers. However, the effect is significant only on solvent corporates, especially those with lower leverage.*

- *These results suggest the emergence of passive bond investing does not necessarily lead to a material increase in the solvency risk of corporates, while helping to promote the development of corporate bond markets in EMEs. Nevertheless, policy-makers in EMEs should still pay close attention to the capital flows of passive bond investing, particularly those corporates from emerging American economies, as massive investment outflows from corporate bonds and the resulting disruptions to financing or even economic conditions could lead to a substantial increase in the credit and refinancing risks of EMEs corporates.*

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1. INTRODUCTION

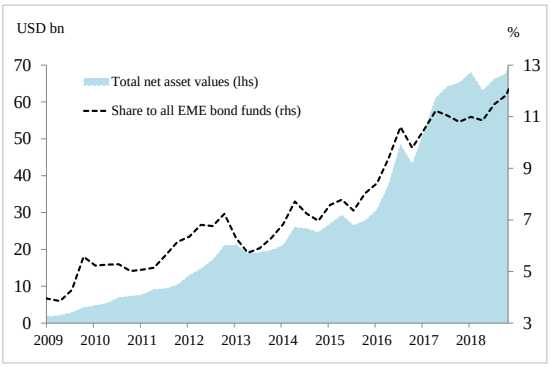
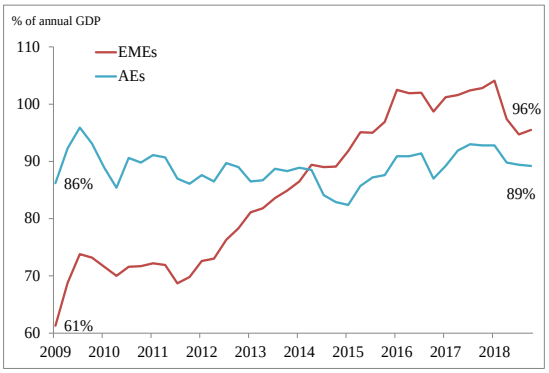
Passive bond investing, an investment strategy that aims at replicating the return of a benchmark bond index by holding a portfolio of bonds in proportion to their index weightings, has been playing an increasingly important role in bond fund investments in EMEs (Chart 1). On one hand, the growth of passively managed bond funds could provide increased market liquidity and broaden the investor base of developing bond markets in EMEs (Chan et al., 2012).[1] On the other hand, questions have been raised on whether their emergence will pose risks to financial stability. For instance, a recent BIS Quarterly Review raised the possibility that the emergence of passive bond investing could weaken the discipline of bond issuers and lead to a build-up of leverage (Sushko and Turner, 2018).[2,3] More specifically, passive bond investing generates demand for the constituent bonds of underlying benchmark indices. The increased access to bond markets could tempt these bond issuers to act against the interests of their bonds' investors and raise further debt that otherwise would not have been issued. This could lead to additional credit and solvency risks of EMEs, especially their corporate sector, where a surge in leverage since the global financial crisis has been observed (Chart 2).

Against this background, we assess empirically if a larger exposure of EME corporates' bonds to passive bond investing leads to a higher leverage of these corporate issuers, and if this poses a risk to financial stability. We proxy the exposures by their weights in a major bond index that tracks bonds issued by EMEs' corporates. In assessing the risk to financial stability, we investigate from two perspectives, 1) whether the effect is larger on corporates with larger debt burdens, and 2) whether this is likely to increase the risk of insolvency.

[1] For instance, Xinhua (2019) reported an estimate by Morgan Stanley that the inclusion of renminbi-denominated government and policy-banks' bonds into the Bloomberg Barclays Global Aggregate Index (via a 20-month phase-in period starting April 2019) could attract as much as US$80-100 billion of foreign investments into Chinese government bonds in 2019, compared to the annual average inflow of US$35 billion between 2015 – 2018.

[2] Sushko and Turner (2018) was a special feature in March 2018's BIS Quarterly Review which discussed the implications of passive investing for securities.

[3] The linkage between passive bond investing and the discipline of bond issuers is thus: unlike actively managed funds which can express their disagreement with the individual issuers by selling their holdings, passively managed funds mechanically replicate the benchmark index in their investment portfolios that cannot be adjusted unless there is a change in the benchmark index's composition. This could make the issuers of index constituent securities (e.g. bonds) less compelled to act in the interest of investors, and therefore weaken their discipline, when passive investing becomes more popular.

Chart 1: Growth of EMEs passive bond funds	Chart 2: Post-crisis development of corporate leverage
	
Source: EPFR	Note: Figures refer to the outstanding credits to non-financial corporates and expressed as % of annual GDP. Source: BIS

The study is organised as follows. Section 2 describes our data sample and the variables used in the analysis. Section 3 describes our empirical models, while section 4 summarises and discusses our findings. The final section concludes and discusses the implications for financial stability.

2. DATA SAMPLE AND VARIABLES

We primarily assess the effect of passive bond investing by investigating the relationship between corporates' weights in the bond index and its leverage ratio.[4] The Corporate Emerging Markets Bond Index (CEMBI) Broad Diversified, compiled by J.P. Morgan, is chosen for this analysis, given its comprehensive coverage of EMEs corporate bonds.[5] At the end of 2017, the CEMBI tracked US$314 billion worth of USD-denominated bonds issued by non-financial corporates of EMEs. This accounted for 59% (49%) of USD-denominated (all currencies) corporate debt securities in EMEs (Chart 3).

Covering the sample period from 2009 to 2017, our annual data sample contains 349 non-financial corporates whose bonds have been included in the CEMBI.[6] Each corporate's weight in the CEMBI is defined as the sum of

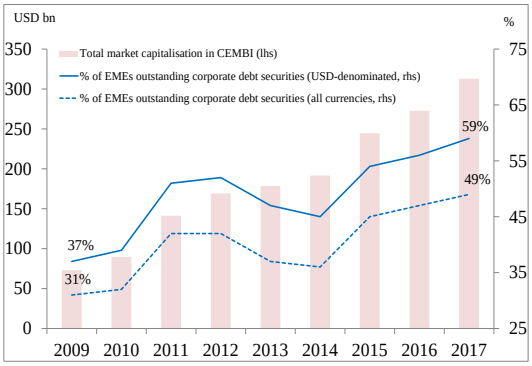
[4] A more direct measurement of the exposure would be the actual investment on a corporate's bonds under passive bond investing. However, this is difficult to measure given the lack of granular information on detailed investment on constituents by different passive bond funds. Instead, we proxy the exposure of the corporate's weight in the bond index as this will be strictly proportional to the investments on the corporate's debt under passive bond investing.

[5] Appendix A provides details of the selection criteria of the CEMBI.

[6] A total of 529 non-financial corporates appeared in the index during our sample period. The remaining corporates are not covered in this study as we cannot match them with corresponding financial data.

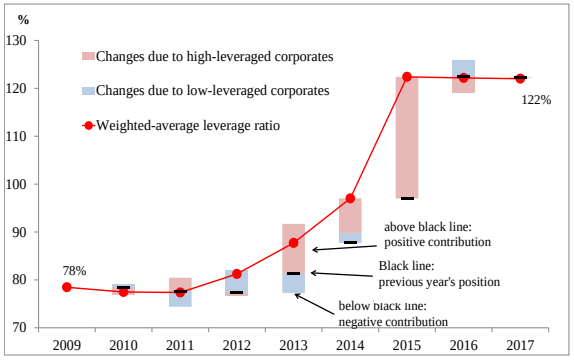
price-adjusted weights of all constituent bonds issued by that corporate.[7] The leverage ratio of a corporate is measured by the ratio of total debt to total equity. Chart 4 shows that the average leverage ratio of our corporates' sample increased by more than half during the sample period (78% in 2009 to 122% in 2017), similar to the growth rate of the overall EME corporate leverage in Chart 2. The increase in leverage was largely contributed by the highly-leveraged corporates (i.e. the pink shades in Chart 4).

Chart 3: EME corporate bonds covered by CEMBI



Note: (1) EMEs outstanding corporate debt securities are based on the quarterly debt securities published by BIS. (2) Corporate refers to non-financial corporations. (3) Year-end positions. Source: J.P. Morgan and BIS

Chart 4: Average leverage ratio of sample corporates



Notes: (1) Figures refer to the weighted average (by size) total debt to total equity ratio of sample corporates. (2) Shades in pink (blue) denote the contribution by highly (low) leveraged corporates to the change in average leverage ratio as compared to previous year. (3) Highly (low) leveraged corporates refer to those with leverage ratio higher (lower) than its industry median. (4) Shades above (below) the black line (indicating previous year's position) denote a positive (negative) contribution. Source: Bloomberg and HKMA staff estimates

In addition to a corporate's weight in the CEMBI, we also consider a host of corporate-specific and macro-economic variables to control for factors that are commonly considered as determinants of corporate leverage. These corporate-specific factors include i) lagged leverage, ii) size, iii) profitability, iv) tangibility, v) market-to-book value ratio, and vi) corporate's industry median leverage (Frank and Goyal, 2009). For macro-economic variables, changes in the Fed shadow interest rate and the growth rate of world real GDP are included to

[7] The CEMBI weight of each bond issuance, which is reviewed monthly, is primarily determined by its total outstanding market value (i.e. market price times outstanding quantity). We adjust these weights by the changes in bond prices during the year to remove the effect of price on the changes of a corporate's weight in the CEMBI. The results remain robust when we adopt the weights without such price adjustments (i.e. the actual weights).

control for the borrowing cost and the global economic condition respectively. Appendix B provides the definitions of these variables.

Table 1 gives some summary statistics of these variables. It can be seen that the leverage ratio and most of the corporate-specific variables are highly skewed or have heavy tails, suggesting that extreme outliers exist in these variables. As such, we have winsorised these variables at 90% to reduce the possibility of spurious estimates due to these outliers (Herwadkar, 2017). All variables are further standardised into zero mean and unity variance for better comparability.

Table 1: Descriptive statistics of data variables

	Mean	SD	Min	Median	Max	Skewness
Leverage ratio	134.7	354.9	0.1	79.5	13516.3	22.2
Long-term leverage ratio	99.1	273.5	0.0	58.7	10438.7	22.7
Short-term leverage ratio	34.5	124.6	0.0	14.6	3258.4	17.1
CEMBI weight	0.1	0.3	0.0	0.04	4.1	5.1
Corporate size	22.7	1.3	17.4	22.8	26.7	0.0
Profitability	4.7	9.8	-132.9	4.2	124.5	-0.9
Tangibility	34.4	24.3	0.0	34.5	89.5	0.1
Market-to-book value ratio	210.7	294.8	0.0	136.3	6909.5	9.3
Interest coverage ratio	11.9	77.0	-661.0	3.8	2872.7	24.3
Median industry leverage	80.1	15.9	41.9	80.0	139.0	0.9
Growth of world real GDP	3.4	1.3	-0.1	3.5	5.4	-1.6
Change in Fed shadow interest rate	0.0	1.1	-1.9	-0.3	1.7	0.2

3. EMPIRICAL MODELS

We first assess the average effect of the CEMBI weight on corporate leverage by considering the following dynamic panel regression model:[8]

$$Lev_{i,t} = \alpha + \gamma w_{i,t-1} + \beta Lev_{i,t-1} + X_{i,t-1}\delta + Z_{t-1}\rho + \theta_i + \varepsilon_{i,t} \qquad (1)$$

where Lev denotes corporate i's leverage ratio, w denotes its weight in CEMBI while X and Z denotes the vector of other corporate-specific and macro-economic variables (as described in section 2) respectively. Finally, θ denotes the fixed

[8] The dynamic panel model is estimated using the generalised method of moments (GMM) proposed by Arellano and Bond (1991), as the ordinary least square (OLS) will yield biased and inconsistent estimates. Our panel data sample satisfies the stationarity condition which ensures the validity of GMM estimations.

effect and ε denotes the error term. Under this set-up, the effect of corporate i's weight in the CEMBI on its leverage can be referred to the estimated coefficient γ.

To further assess if the effect differs between corporates with different levels of debt-burdens, we consider an extended form of equation (1) as follow;

$$\mathrm{Lev}_{i,t} = \alpha + \gamma w_{i,t-1} + \omega w_{i,t-1} * \mathrm{Dummy}_{\mathrm{insolvent}_{i,t-1}} + \varphi w_{i,t-1} * \mathrm{Dummy}_{\mathrm{leverage}_{i,t-1}} + \beta \mathrm{Lev}_{i,t-1} + X_{i,t-1}\delta + Z_{t-1}\rho + \theta_i + \varepsilon_{i,t} \quad (2)$$

where $\mathrm{Dummy}_{\mathrm{insolvent}_{i,t-1}} = \begin{cases} 0 \text{ if Interest coverage ratio}_{i,t-1} \geq 1 \\ 1 \text{ if Interest coverage ratio}_{i,t-1} < 1 \end{cases}$; and

$$\mathrm{Dummy}_{\mathrm{leverage}_{i,t-1}} = \begin{cases} 0 \text{ if } \mathrm{Lev}_{i,t-1} \leq \text{industry median } \mathrm{Lev}_{i,t-1} \\ 1 \text{ if } \mathrm{Lev}_{i,t-1} > \text{industry median } \mathrm{Lev}_{i,t-1} \end{cases}$$

We distinguish insolvent corporates from solvent corporates based on the interest coverage ratio (ICR). If the corporate's ICR is less than one, this implies that its earnings before interest and taxes are not sufficient to pay the interest (i.e. it is insolvent), and vice versa.[9] On the other hand, if the corporate's leverage exceeds its industry median, then it is viewed as highly-leveraged, and vice versa. Accordingly, equation (2) assumes that the effect of the CEMBI weight on corporate leverage differs between solvent and insolvent corporates, as well as between low and highly-leveraged corporates. Table 2 summarises the effects of the CEMBI weight on these four groups;

Table 2: Summary on the effects for different types of corporates

Leverage/Solvency	Solvent	Insolvent
Low-leveraged	γ	$\gamma + \omega$
Highly-leveraged	$\gamma + \varphi$	$\gamma + \varphi + \omega$

The detailed distributions for the four groups of corporates are provided in Appendix C, which shows that the distributions are similar across both sectors and regions. In particular, over 80% of sample firm observations are solvent (second column of Appendix C). Nevertheless, the ICR for corporates in emerging American economies are lower on average and at the same time more volatile than those in other regions, as reflected by a higher coefficient of variation (last column

[9] Our results remain largely robust to alternative thresholds of insolvency based on the ICR, specifically ICR below 1.5 and 2.

of Appendix C), suggesting that the solvency of these corporates could be more vulnerable to negative shocks.[10]

Finally, to investigate whether an increase in a corporate's weight in the CEMBI raises the probability of insolvency, we consider the following probit model;

$$\mathrm{P}(\mathrm{ICR}_{\mathrm{i,t}} < 1) = \Phi(\alpha + \gamma \Delta \mathrm{w}_{\mathrm{i,t-1}} + \Delta \mathrm{X}_{i,t-1}\, \beta + \Delta \mathrm{Z}_t \rho) \qquad (3)$$

Equation (3) states that the probability of a corporate being insolvent (where ICR is less than 1) is a function of the change in the CEMBI weight (i.e. Δw), changes in other corporate-specific (i.e. ΔX) and macro-economic variables (i.e. ΔZ). Under this set-up, we will observe a positive and significant γ if an increase in the CEMBI weight increases a corporate's probability of insolvency.

4. EMPIRICAL FINDINGS AND DISCUSSIONS

In short, our empirical analysis finds that an increase in corporates' weights in the CEMBI could drive up their long-term leverage. Nevertheless, the effect is significant only on solvent corporates, especially those with lower leverage.

4.1 Does a corporate's leverage increase with its weight in the CEMBI?

Corporates will increase their leverage when their bonds gain a higher weight in the CEMBI. Column (1) of Table 3 summarises the estimation results of equation (1). Focusing on the effect of the CEMBI weight, a positive and significant coefficient (i.e. 0.062) is observed. This indicates that on average, a corporate will become more leveraged when its bonds gain a higher weight in the CEMBI. An increase in the weight of bonds in the index will mechanically trigger more demand under passive bond investing, which could increase the respective corporate's access to the debt market through channels such as increased liquidity and lower cost of debt. Such increased access will lead to more debt issuance by corporates (Faulkender and Petersen, 2006).

[10] The coefficient of variation of the ICR, calculated as the ratio of the standard deviation to the average value of ICR, is used instead of the standard deviation, as the average ICR for each region or sector is substantially different from each other. The coefficient of variation takes this into account and provides a more comparable measure based on the relative volatility.

We further found that the CEMBI weight only increases corporates' long-term leverage. Columns (3) and (5) of Table 3 report the estimation results of equation (1) with corporate's leverage ratio split into long-term and short-term components. Only the long-term leverage increases with the CEMBI weight (i.e. the estimated coefficient of 0.078 in column 3), while no significant impact is observed for short-term leverage (i.e. the estimated coefficient of 0.026 in column 5). These suggest that the CEMBI weight only affects corporates' long-term financing decisions. Two possible reasons attributed to this result are: 1) the CEMBI only covers long-term bonds and the favourable effect of the CEMBI weight does not spill over to short-term bonds, therefore it has no impact on a corporate's short-term financing decision;[11] 2) The larger inclusion in the bond index may reduce information asymmetry between corporates and lenders through the increasing availability of public information, where past studies suggested that reduced information asymmetry could induce more financing by long-term debts (Berger et al., 2005; Goyal and Wang, 2013 and Abad et al., 2017).[12] Financing through long-term debt instead of in the short term could reduce corporates' exposures to frequent refinancing risks and possibly better match their debt repayments with the cash inflows from investments, which are mostly long-term in nature.

4.2 Is the effect the same on corporates with different debt burdens?

The effect of the CEMBI weight only appears on solvent and low-leveraged corporates. Column (2) of Table 3 breaks down this effect by the four groups of corporates described in Table 2. A significant positive effect is only found on solvent and low-leveraged corporates (i.e. the row highlighted in yellow, with an estimated coefficient of 0.09). This suggests that while an increase in corporates' weight in the CEMBI could improve their capability to issue bonds, the benefits to those highly-leveraged or insolvent corporates tend to be limited. This finding is consistent with the prediction by the trade-off theory (Kraus and Litzenberger, 1973), where the higher cost of financial distress for these corporates would prohibit them from raising further debt.[13] Empirical evidence from past

[11] Refer to appendix A for the selection criteria

[12] All three studies found that corporates with higher informational asymmetries, especially for those low-risk ones, tend to show shorter debt maturities even when they need to finance long-term projects. The rationale for this behaviour is that these corporates believe they can roll-over their debts at a lower cost when favourable information on these corporates is revealed to the market in the future. Along this argument, Berger et al. (2005) further showed that a reduction in informational asymmetries is associated with increased debt maturities for these low-risk corporates.

[13] By the trade-off theory, debt and equity are substitutes with each other. A corporate optimises its mix of debt and equity financing by balancing the benefits and costs. Debt financing generates benefits such as tax deduction, but at the same time incurs some distress costs like a higher risk of bankruptcy. A corporate needs

studies also show that factors favourable to debt issuances tend to be less evident on highly-leveraged corporates (Fattouh et al., 2008; Sanchez-Vidal, 2014).[14]

Consistent with equation (1), we also re-estimated equation (2) to separate the effect on long and short-term leverage and the results are reported in columns (4) and (6) of Table 3. Again, the positive effect of the CEMBI weight is only evident on long-term leverage, and exclusive to solvent and low-leveraged corporates.

4.3 Does the increase in the index weight raise the risk of insolvency?

No significant relationship is observed between the CEMBI weight and corporates' short-term solvency risks. Table 4 summarises the estimation results of the probit model in equation (3). Focusing on the full corporate sample, the coefficient for the change in the CEMBI weight is not significant (i.e. 0.03 in column 1), and the estimated effect remains insignificant (i.e. -0.001 in column 2) when we restrict the sample to those solvent and low-leveraged corporates, where the significant effect of the CEMBI weight on leverage is only found on these corporates.[15,16]

to consider which funding source is more beneficial (less costly) when it comes to fund-raising.

[14] Both Fattouh et al. (2008) and Sanchez-Vidal (2014) applied quantile regression on the determinants of corporate leverage and found that these determinants tend to have a less positive or even insignificant effect on leverage at higher quantiles (i.e. those more leveraged corporates).

[15] We also restricted the sample to the other three groups of corporates where the effects of the CEMBI weight are shown to be insignificant in Table 3 (i.e. corporates that are either insolvent or highly-leveraged), and found that the increase CEMBI weight would not raise the probability of near-term insolvency for these corporates either.

[16] The results are robust to alternative measures of solvency (specifically the quick ratio and cash interest coverage ratio).

Table 3: Estimated effect of CEMBI weight on corporate leverage

Dependent variable (leverage ratio)	(1)	(2)	(3)	(4)	(5)	(6)
	Debt-to-equity ratio		Long-term debt-to-equity ratio		Short-term debt-to-equity ratio	
CEMBI weight						
All observations (t-1)	**0.062****		**0.078***		0.026	
Solvent + low-leveraged (t-1)		**0.090****		**0.101***		0.009
Solvent + highly-leveraged (t-1)		0.0977		0.131		-0.192
Insolvent + low-leveraged (t-1)		0.0238		0.0248		0.0962
Insolvent + highly-leveraged (t-1)		0.0317		0.0546		-0.105
Corporate-specific variables						
Leverage (t-1)	**0.418*****	**0.426*****	**0.445*****	**0.412*****	0.069	0.061
Size (t-1)	0.131	0.127	0.024	0.082	0.045	-0.055
Profitability (t-1)	**-0.212*****	**-0.212*****	**-0.254*****	**-0.242*****	**-0.142****	**-0.176*****
Tangibility (t-1)	**-0.298*****	**-0.294****	**-0.307***	**-0.389*****	-0.155	-0.056
Market-to-book value ratio (t-1)	-0.059	-0.050	-0.036	-0.039	0.069	0.047
Median industry leverage (t-1)	-0.015	-0.049	-0.046	-0.029	0.066	0.035
Macro-economic variables						
Changes in Fed shadow interest rate (t-1)	**-0.039*****	**-0.036****	**-0.037****	**-0.034***	**-0.042****	**-0.040****
World real GDP growth rate (t-1)	**0.030*****	**0.032*****	**0.030****	**0.025****	**0.041*****	**0.047*****
Constant term	**0.022****	**0.024****	**0.033****	**0.025****	-0.001	0.007
No. of observations	2,041	2,041	2,032	2,032	2,032	2,032
p-value of Sargan test	0.525	0.734	0.504	0.246	0.508	0.678
p-value of Arellano Bond test	0.393	0.395	0.788	0.664	0.884	0.730

Notes: (1) GMM estimates on the dynamic panel model are based on Arellano and Bond (1991). (2) ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. (3) The null hypothesis of Sargan test assumes that the over-identifying restriction is not violated while that for the Arellano Bond test assumes that the first-differenced residuals given by AR(2) are not second-order serially correlated. (4) All corporate-specific variables (including CEMBI weight) are assumed to be endogenous

Table 4: Estimated effect of an increase in CEMBI weight on corporates' probability of insolvency

Dependent variable	(1)	(2)
	Dummy (ICR < 1)	
Changes in CEMBI weight		
All observations (t-1)	0.030	
Solvent + low-leveraged (t-1)		-0.001
Changes in corporate-specific variables		
Leverage (t-1)	**0.147*** **	**0.321***
Size (t-1)	**-0.226*** **	-0.091
Profitability (t-1)	**-0.088***	**-0.202***
Tangibility (t-1)	-0.037	-0.142
Market-to-book value ratio (t-1)	**-0.140*** **	-0.027
Median industry leverage (t-1)	-0.011	**0.178***
Changes in macro-economic variables		
Fed shadow interest rate (t)	**0.150****	**0.370****
World real GDP (t)	-0.170	0.301
Constant	**-2.105*** **	**-2.480*** **
No. of observations	2,376	1,172
Log pseudo-likelihood	-642	-186

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

5. CONCLUSION AND IMPLICATIONS

In summary, we find that an increase in the exposure of EMEs corporate bonds to passive bond investing could drive up the long-term leverage of respective corporate issuers. This suggests that the rising popularity of passive bond investing could help the long term financing of EMEs corporates and aid the development of corporate bond markets. More importantly, this effect is significant only on solvent corporates, especially those with lower leverage. In contrast, and possibly due to higher financial distress costs, the highly-leveraged or insolvent corporates are less able to raise further debt through a larger exposure to passive bond investing. Taking these findings together suggests the emergence of passive bond investing does not necessarily lead to a material increase in the solvency risk of EMEs

corporates.[17]

Despite the apparent limited risk to financial stability, policy-makers in EMEs should still pay close attention to the capital flows from passive bond investing and their potential impacts on corporate leverage. Massive investment outflows from these corporate bonds could be disruptive to corporate financing or even overall economic conditions.[18] Such events could raise concerns over the debt-servicing and refinancing abilities of corporates, in particular those in emerging American economies, even though the build-up of corporate leverage under passive bond investing tends to be confined to solvent and low-leveraged corporates. To reduce the negative externalities to aggregate corporate leverage or credit risks, bond index providers have been increasingly adopting alternative weighting schemes for their indices, by incorporating factors such as the credit quality or duration risks of bonds, instead of their outstanding market values only.[19] Nevertheless, in view of the continuing growth in corporate leverage and passive bond investing in EMEs, close monitoring of its impact on financial stability is warranted.

[17] In addition to the results presented in Table 3 and 4, we conducted a separate analysis (results not reported for brevity) by dissecting the effect between large and small corporates (based on the corporate's industry median size). Our results show that the effect is only significant on small corporates (i.e. those smaller than the industry median). Together with the minimal contribution to aggregate leverage by these corporates, this further suggests the effect on aggregate leverage is likely to be limited.

[18] Focusing on EMEs, Tam (2019) found that a sudden stop in debt-related capital inflows has a more damaging effect on economic growth than a sudden stop in equity-related capital inflows.

[19] Bond indices with alternative weighting schemes are attracting increasing recognition from passive bond funds. For instance, Burger (2018) reported that based on data compiled by Bloomberg, of the 48 fixed-income ETFs launched in the US in 2017, 27 chose a benchmark index with alternative weighting.

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Appendix

A. Selection criteria of JP Morgan CEMBI Diversified Core Index (CEMBI)

Bonds are eligible for inclusion in CEMBI if the following requirements are satisfied:

(i) The issuer is headquartered in an emerging market economy, which Gross National Income per capita is below the J.P. Morgan Index Income Ceiling for three consecutive years; or

(ii) The issue is 100% guaranteed by an entity within an emerging market economy; or

(iii) 100% of the issuer's operating assets are located within emerging market economies; and

(iv) The bonds must be USD-denominated and have a minimum of 5 years to maturity to enter the index and a remaining maturity of no less than 2 years at the time of rebalancing to remain in CEMBI.

(v) The bonds must have a minimum outstanding face value of $500 million or more.

(vi) There are no ratings restrictions on either the individual bonds or the country of risk.

Chart A.1: Composition of CEMBI by industry

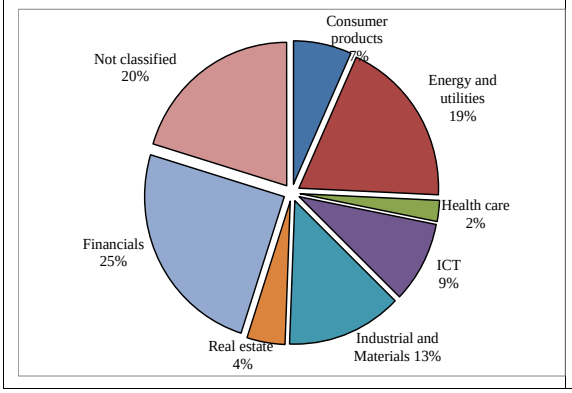
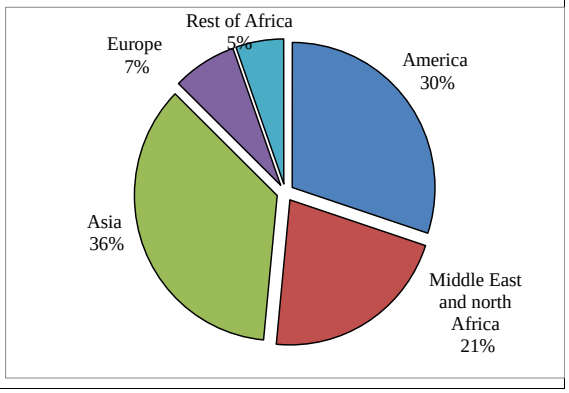


Chart A.2: Composition of CEMBI by region



Notes: 1) Figures denote the total weight in CEMBI by industry / region. 2) End-2017 position.

B: Definitions of data variables

Variable		Definition	Unit	Data sources
Corporate-specific	Leverage ratio	Total debt divided by equity in book value	%	Bloomberg
	Short-term leverage ratio	Short-term debt (interest-bearing obligations that are due within 1 year) divided by equity in book value	%	Bloomberg
	Long-term leverage ratio	Long-term debt (interest-bearing obligations that are not due within 1 year) divided by equity in book value	%	Bloomberg
	CEMBI weight	Total weight of corporate's all bond constituents in CEMBI at year-end and adjusted for changes in their prices during the year	%	J.P. Morgan and staff estimates
	Corporate size	Total asset (in USD) in natural logarithm	N/A	Bloomberg
	Profitability	Return to assets	%	Bloomberg
	Tangibility	Net property, plant and equipment divided by total assets (%)	%	S&P Capital IQ
	Market-to-book value ratio	Sum of market value of equity and book value of debt divided by book value of assets	%	S&P Capital IQ
	Interest coverage ratio	Earnings before interest and tax divided by interest expenses	times	Bloomberg
	Median industry leverage	Median leverage ratio for each industry	%	Bloomberg
Macro-economic	Growth of world real GDP	Annual growth of world GDP at constant prices	%	IMF World Economic Outlook
	Change in Fed shadow interest rate	Wu-Xia Fed shadow interest rate between 2009 and 2015, followed by effective Fed Funds rate (2016 – 2017).	%	Federal Reserve Bank of St. Louis and Wu and Xia (2015)

C: Distribution of firms by solvency and leverage level

	Solvent			Insolvent			Average ICR	Coefficient of variation of ICR
	All solvent	Low-leveraged	Highly-leveraged	All insolvent	Low-leveraged	Highly-leveraged		
All observations								
All observations (100%)	87	47	40	13	4	9	7.21	1.01
By regions								
America (24%)	84	41	43	16	5	12	**5.92**	**1.32**
Asia (61%)	87	49	39	13	3	9	7.38	1.02
Europe (6%)	88	47	41	12	5	7	7.13	0.70
MENA (9%)	93	51	42	7	2	5	6.78	0.81
By sectors								
Consumer products (17%)	88	46	42	12	4	8	8.51	0.91
Energy and utilities (21%)	84	47	38	16	4	11	6.90	0.99
Health care (1%)	86	43	43	14	4	11	6.22	0.81
ICT (14%)	87	51	36	13	2	12	8.83	1.04
Industrial and Materials (30%)	86	46	39	14	5	10	6.43	1.08
Real estate (18%)	90	45	45	10	3	7	6.84	0.95

Notes: (1) Solvent firms are defined as firms with ICR greater than 1, and vice versa. (2) Highly-leveraged firms are defined as firms whose leverage ratio is higher than industry median, and vice versa. (3) The average and coefficient of variation of ICR are based on the winsorized ICR of sample firms. (4) Coefficient of variation of ICR is calculated as the ratio of the standard deviation to the average value of ICR. (5) The standard deviation and average value are weighted by the size of firms. 6) Figures in parentheses next to region/sector denote the share of observations for that region/sector.