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The Effects of Pensions Administration on Earnings Management of Listed Pension Companies in Nigeria

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Abstract

Purpose: This paper examined the effect of pension administration on earnings management (EM) of listed pension companies in Nigeria.

Design/Methodology/Approach: This study employed an expo factor research design, and the study population was 35 listed pension companies in Nigeria over a study period of between 2013 and 2021. General least square (GLS) regression technique of analysis was employed to examine the study model.

Findings: Result from the generalised least squares regression documented contribution density, and exits had a significant positive relation with EM except for pension fund.

Practical Implications: The study might have practical implications for regulators and governance experts with understanding of related category of agency problems that might arise in the Nigerian context. The research highlighted the potential to improve the effectiveness of pension funds, contribution density, and exit age to achieve their ultimate objective in providing income replacement in retirement by developing portfolio strategies.

Original Value: The study suggested the need for governments and their pension supervisors to consider a more active role in evaluating and proposing the long-term objectives of pension funds, contribution density, and exit ages for various categories of workers, as well as reducing the effect of EM.

Keywords: Pension fund, contribution density, exits age and earnings management.

1.1 Introduction

The government is committed to ensure that older people can live after retirement with the dignity and respect they deserve. To deliver this commitment the government must provide pension contributions that are convenient for workers so that they will have an income or funds which they can draw to enjoy greater security and independence after retirement. The government is also concerned about the potential for low-income earners' take-home pay and how it affects them through the pension contribution (Central Bank of Nigeria, 2019; National Pension Commission, 2019).

These pension funds are affected by many issues. One of them is how managers opportunistically misappropriate the fund through EM, which is a management practice that affects a company's financial reports either to give a positive or negative impression of the periodic smoothing or annual earnings. The techniques adopted by managers included by showing high profits in a given year at the "expense" of lowering reported earnings shortly. Sometimes low profits were reported in a given year to avoid an increase in tax and debt covenant, while in future it was reported that profits would be higher, and this was in tandem with creative accounting (Amarjit, et al., 2013). Other techniques included a situation whereby managers used various accounting methods such as "big bath", "income smoothing", "income restatement", and "window dressing", to deceive investors. In addition, the opportunistic behaviour toward EM might mislead stakeholders about the true financial performance of the company, especially about pension fund that was left (Jahanzaib, et ai., 2012).

Furthermore, one of the major goals of management should be to pursue a continual growth of the firm as well as the maximisation of stakeholders' interest. However, due to the interest that managers may have in the firms, literature has shown that reports, which should ordinarily provide a fair view of the firm's performance and financial status at the reporting date, were manipulated over the years and across the world as such and failed to provide the true information. Therefore,this calls for the need to carry out a study on pension administration (Uwuigbe, et al., 2015). Also, the public, especially pension contributors, have lost confidence and trust in the integrity of accounting information after a scandal that rocked

the pension industry (Al-Dhamari & Ismail, 2014). The managers' opportunistic behaviour of managers led to a lack of confidence amongst contributors in the industry.

All the aforementioned factors may result in a conflict of interest between shareholders and managers, part of which has often been the presence of a pension when all profitable projects were financed but dividends or super-dividends were not paid. The shareholders would assume that managers would use the pension fund and engage in EM (Gregory & Wang, 2013). According to Helsingfors (2005), the prevalence of EM in the country could be explained by some local factors such as the flexibilities provided by regulatory bodies, lack of clear lines that could differentiate fraud from aggressive accounting (earning manipulation), weak market competition, information asymmetry, investors' lack of awareness about accounting concepts, and high emphasis of managers and accountants on reported earnings.

There is also a challenge in the pension fund, contribution density, and exit-age EM. This can be difficult as Nigeria is still recovering from the economic recession, and there is increasing manipulation by regulators and management of pension funds, which makes it even more difficult. In Nigeria, the low coverage of pension contributors amongst the working population suggests that the social statistics data which give a larger population may be misleading. This poses a challenge to Nigerian pension managers. Lack of trust in the country's financial system hinders the informal sector from joining the scheme. Another pressing issue is the high amount of unused cash within the system due to a lack of investible assets. Likewise, Nigeria has restrictions on asset allocation, which can only be beneficial to the industry in the short run. Regulatory restrictions and asset allocation continue to inhibit industry competitiveness. While the restriction has protected the industry from losses arising from the crash of equity market, it also inhibits benefiting from the equity market boom. In addition, owing to the restriction on excessive foreign investment, the Nigerian pension sector may lose out on huge potential returns on investment in other emerging developmental market projects, with the possibility of reprisal investments in Nigeria's infrastructural projects.

The motivation for this study is that despite the studies carried out on the effect of pension administration, scanty studies had attempted to establish the effect of pension administration on EM at listed pension companies in Nigeria. A knowledge gap on the subject is thus apparent, motivating the present study. Against this backdrop, the present study attempts to answer the question, "What are the effects of a pension fund, and contribution density, on EM?" This has been largely weak, inefficient, cumbersome, and manipulated due to poor staffing and equipping which led to poor record keeping. As a result, pensioners had to wait for years before their retirement benefits were paid. The exit phase was quite challenging, whereby the payment procedure was often very tedious and pensioners had to wait for months or even years to collect their entitlements. Similarly, the reimbursement process for the split of pension and gratuity payments in public service was very clumsy, untidy, and sometimes fraught with bribery and corruption.

The manipulation of financial statements in the pension industry has become a source of concern for academicians, practitioners, and policymakers. Despite the fact that the crisis periods of 1997-1998 and 2007-2011 had passed, the corporate party continues to manipulate the financial statements. According to studies, the practice of financial report manipulation was alleged. Abdulrasheed Maina, the former Chairman of the defunct Pension Reform Task Team (PRTT), was arraigned in 2019 before a Federal High Court on a 12-count charge bordering on money laundering of suspected pension funds to the tune of N2 billion. Meanwhile, in 2017, between the office of the Head of Service and the Police Pension Office, which were the two places PRTT had worked, a leakage of N5.32 billion permonth occurred. Former Director, Police Pension Fund, Esai Dangaba, was on trial alongside others for allegedly defrauding the Police Pension Scheme to the tune of N32.8 billion (Guardian, 2021).

As a result of EM, accrual income is considered a better measure of the firm's performance than operating cash flows. Accrual would reduce time and mismatching problems in the use of pensions (Subramanyam, 1996). Furthermore, EM by corporate management under Subramanyam (1996) had enabled the growing flexibility and desecration that allowed management to choose accounting policies from a variety of policy options.

The paper examines the effect of pension funds on EM of listed pension companies in Nigeria.

1. To what extent does a pension fund affect the EM of listed pension firms in Nigeria?
2. To what extent does contribution density affect the EM of listed pension firms in Nigeria?
3. To what extent does retirement age influence EM at Nigerian-listed pension firms?

The objectives of the study were:

1. To assess the effect of pension funds on the EM of listed pension firms in Nigeria.
2. To examine the effects of contribution density on the EM of listed pension firms in Nigeria.
3. To determine the exit age for EM at listed pension firms in Nigeria.

2. Literature Review and Theoretical Framework

2.1 Pension Funds and Earnings Management (EM)

From literature, there was no consensus on the definition of "earnings management". Healy and Wahlen (1999) opined that managers use judgement in their financial reporting to structure transactions or alter financial reports. Dechow and Skinner (2000) defined it as a financial fraud, whereby the term "earnings management" was centered on managerial intent, which was viewed as the intentional, deliberate misstatement or omission of material facts in the accounting data that misled all information that was expected to be made available to the readers. Meanwhile Beniesh (2002) said that there was no consensus on the definition of "earning management", it all depended on the author's perception. Therefore, Leuz et al. (2008) asserted that smoothing earnings will be less informative as a result of the noise

added by management intervention. According to McNichols (2009), managers used equity valuation to manipulate earnings. Mohammad, et al., (2010) stated that earnings management might occur when managers used judgement in financial reporting and structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or influence contractual outcomes that depended on reported accounting numbers.

However, the most widely recognised definition of “earnings management” is the one given by Torng-Her, et al., (2012), who focused their definition on purposeful intervention in the external financial reporting process with the intent of obtaining some private gain. Muhammad et al. (2015) viewed EM as a process of consciously taking steps in the area of accepted accounting principles to convert reported earnings into expected profit. Ronen and Yaari (2008) focused their definition on the tools used to flex accounting information to signal their exclusive information to the shareholder. Also, they applied the information for opportunistic and optimistic managerial goals, and lastly, manipulated the accounting data to decrease transparency in financial reports.

There are different definitions of "pension", but the most common ones simply refer to the amount set aside, either by an employer or an employee or both, to ensure that in retirement, there is something that employees will fall back on as income (National Pension Commission, 2019). It is also viewed as a provider of security by building up plans that are capable of providing guaranteed income to workers when they retire or to their dependents when death occurs (Nanshuwan et al., 2021). It can be referred to as the organisational moral obligation, which provides a reasonable degree of social security for workers, especially those who have served for a long period (Kingsley et al., 2021). It can be viewed in the note shell as the number of employee contributions based on payment based on a percentage of the employee's earnings computed on an average over several years multiplied by number of years the employee has served the company (CBN, 2019).

Managers appear to manipulate firm earnings by misclassifying pension assets, capital markets and alters investment decisions to justify and capitalise on these manipulations. Managers are more aggressive with the assumed long-term effect of pensions when their assumptions have a greater impact on reported earnings. Nanshuwan et al. (2021) investigated the impact of contributory pension fund investment on economic growth in Nigeria, and the study covered a period which was from 2012 to 2019. The study result showed that the pension fund had an insignificant impact on EM. A study carried out by Nwanna and Ogbonna (2019) showed that there was a positive relation between fund size and EM. The results indicated that the bigger the pension funds, the more managers were engaged in opportunistic behaviour. Meanwhile Fashaga and Dunmade (2019) conducted a similar study and found no association between fund size and EM, and thus the result showed that there was no significant relation between pension funds and EM. Nwanna and Ogbonna (2019) indicated that bigger pension fund, would give better fund performance. Meanwhile, a study by Fashaga and Dunmade (2019) found no association between fund size and performance.

Therefore, clarity on the relation between pension fund and pension fund size was still lacking. The issues of economic and efficient administration of pension funds and their relation to size were first documented in Caswell (1976), and thus, the study developed the following hypothesis:

H(1): There is no relation between pension fund and EM of listed pension firms in Nigeria.

2.2 Contribution Density and Earnings Management (EM)

According to Bodie et al., (2009) contribution density entails the amount that individual member contributes towards pension fund. Meanwhile, Bikker and Dreu, (2009) viewed it as an important factor that has affected the pension benefits in countries with large informal sectors. Therefore, this referred to individuals with a low contribution density who are likely to face low accumulated assets at retirement age, and thus they are likely to have low retirement incomes. Kingsley and Suoye (2021) asserted that contribution density can be viewed as the capacity of funded individual account system to deliver a retirement income as life expectancy continues to increase.

The density of contributions is a very important determinant of EM. Onakeke and Falope (2020) assessed the impact of contributory pension schemes on EM. The study used correctional research to see the managers' opportunistic behaviour and the result showed that there was a significant relation between contribution density and EM. Herrerias and Zamarripa (2017) examined the effect of contribution density on EM. The result showed that the contribution density had a significant relation with EM. In a related study carried out by Onakeke and Falope (2020) on the relation between contribution density and EM the result showed that contribution density had a significant relation with EM. Contribution density is also an important factor that has affected pension benefits in countries with large informal sectors. Individuals with low contribution density are likely to face low accumulated assets at retirement age, and thus are likely to have low retirement incomes (Odo, et al., (2019). For any given rate of turnover between covered jobs and other uses of time, average density falls when self-employment and informal employment expand and when activity outside the labour force (mainly home production) rises. The density may also change for a different reason: underreporting of earnings, keeping the headcount constant. Simbabrashe et al. (2014) conducted an empirical study on the efficiency of pension schemes in Zimbabwe in the post-multicurrency era from 2010 to 2013. The study relied on quantitative data, such as pension fund portfolio returns and asset sizes. The research sample consisted of 20 standalone pension funds and nine fund-pension funds by using a cluster sample. Based on data presented for the Zimbabwean pension fund, the analysis demonstrated that there was no relation between the contribution density and its investment performance. Therefore, the study established that the contribution density alone did not determine a pension performance. Therefore, based on the above arguments, the study hypothesized the following:

H(2): There is no relation between contribution density and EM at listed pension firms in Nigeria.

2.3 Exit Age and Earnings Management (EM)

According to Fashaga and Dunmade (2019) "exit age" is defined as a fixed amount other than wages paid at regular intervals, usually in monthly installments, to a person in consideration of past services, age, merit, injury, or loss sustained. It is a social security arrangement whereby workers draw retirement benefits for services rendered in the past. Onakeke and Falope (2020) viewed a pension as an amount of money paid regularly by a government or a company to someone who was officially considered to be too old to earn money by continuing to work.

Suh (2017) assessed the existence of funds that were introduced as social welfare programmes in association with retirement age and EM. The results of the study indicated that pension funds have a significant influence on the existing age and EM. Sawyer et al. (2018) conducted a similar study, claiming that population aging is a cyclical rather than a continuous process. The study examined the current aging crisis in the country and EM with regard to pensions. The study results showed that age had a significant relation with EM. Rabikauskait and Novickyt (2015) conducted a study to analyse the effect of fund size on government pension schemes over a period of 20 years, with retirement age used as the control variable. The purpose of this study was to evaluate the second pillar of pension fund performance and how fund differences were affected by pensioners' exit age. Fund returns were found to be reduced for pension schemes with an early exit age. Therefore, the study concluded that retirement age had a significant control effect on pension fund performance, with a difference of being as high or low as 30% for private and public pension funds. Petraki (2012) conducted a study in one of the leading pension industries in the world to investigate the performance of personal pension funds in the UK. The research identified two significant factors which were usually overlooked in related literature: fund age and management outsourcing. The outcome demonstrated that risk-adjusted returns were statistically insignificantly different from zero, but funds significantly outperform their benchmarks. Considering the above arguments, the study hypothesised the following:

H(3): There is no relation between the retirement age and EM of listed pension firms in Nigeria.

2.4 Theoretical Framework

The theory of financial intermediation was developed and traced to Gurley and Shaw (1960). The financial intermediation theory was based on the theories of informational asymmetry and agency. Therefore, most financial institutions existed to reduce information and transaction costs that arised from an information asymmetry between borrowers and lenders. In a financial context, the phrase "financial intermediary" refers to an individual, institution, or

company firm which conducts intermediation between two entities or more, and a pension fund is one of them (Allen & Santomero, 1998). Pension funds receive larger flows of savings compared to other institutional savings. Fiscal provisions of such a nature tend to increase the demand for saving through the channel of pension funds. Furthermore, the growth of pension funds usually depends on the liberality of corporate social security pensions, especially for particular benefit funds. Davis (2000) considered pension funds as types of institutional investors that pool, save, and invest money contributed by beneficiaries and sponsors to cater for the beneficiaries' pension entitlements in the future; as a result, this form a foundation for underpinning the paper with the theory of financial intermediation.

3.1 Methodology

This study employed ex-post facto research designs and utilized data from a secondary source. The data were obtained from the annual reports and accounts of the National Pension Commission (PenCom) over a period of nine (9) years (2013–2021). The population of the study consists of all thirty-five (35) registered pension administrators. Census sampling techniques were employed to select all thirty-five (35) registered pension administrators in Nigeria as of 2021. The data were analyzed with the aid of STATA 13.0 software. In the case of earnings management, residual DeAngelo's (1986) model was used by advancing the work of Healy (1985) by scaling the earnings management model developed by Healy by stating that it is the difference between total accrual in the current year and total accrual in the future that should be scaled by total assets for firm one in $year_{t-1}$.

DAit = (TAit -TAit -1) / Ait-1 - - - - - - - - - - - - - - -- --- ------- - - - equ (iii)

To realise the study objective, which was to examine the impact of pension on EM in Nigeria, the empirical form of model, as adopted from Mohammad and Azam (2014) with little modification, was stated as below:

$$DA_{i,t} = \alpha_O + \alpha_1 PFE_{i,t} + \alpha_2 CDE_{i,t} + \alpha_3 EAE_{i,t} + e_{i,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where;

DACi,t	= absolute value of discretionary accruals of Firm I at year t
α_0	= constant
$\alpha_{1,2,3,4,5}$	= coefficient of regression model
PFEI,t	= pension fund I at year t
$CDE_{i,t}$	= contribution density I at year t
$EAE_{i,t}$	= exits age I at year t
$e_{i,t}$	= error term of Firm I at year t

Table 1: Variable Measurements

S/No	Acronym	Measurement	Source
1.	Earnings Management (EMT)	Absolute values of the residuals of DeAngelo (1986)	DeAngelo (1986)
2.	Pension Fund (PFE)	Natural log of total pension fund contributions	Nanshuwan et al. (2021)
3.	Contribution Density (CDE)	Natural log of total pension contribution.	Herrerias and Zamarripa (2017)
4.	Exits Age (EAE)	Natural log of total contribution by retiree at the exits age of employment	Sawyer, et al. (2018)

Source: Author(s) compilation from literature 2022

4.1 Data Presentation and Analysis

Table 2: Descriptive Statistics

Statistics	EMT	PFE	CDE	EAE
Mean	0.9917573	0.9223802	0.0657448	0.8234988
Std. Deviation	0.071385	0.0530143	0.0382008	0.1819259
Minimum	0.4114006	0.6792868	0.0001681	0.016965
Maximum	1.146145	0.9999188	0.2596643	1.741178
Skewness	0.0000	0.0000	0.0000	0.1454
Kurtosis	0.0000	0.0095	0.0000	0.0000

Source: STATA Output 2022

Table 2 indicates that the average pension fund was 0.9223802 with a standard deviation of 0.053043 and a minimum as well as maximum of 0.6792868 and 0.9999188 respectively. This suggested a wide dispersion of data from the mean because the standard deviation was not close to the mean value. The peak of pension fund data was indicated by the kurtosis value of 0.0000, suggesting that most values were wider than the mean and data did not meet a normal distribution assumption. The coefficient of skewness of 0.0000 for pension funds implied that the data was positively skewed (that is, most of the data were on the right side of the normal curve), implying that the data did not meet the symmetrical distribution assumption.

Table 2 indicates that the average contribution density was 0.0657448 with a standard deviation of 0.0382008 and a minimum as well as maximum of 0.0001681 and 0.2596643 respectively. This suggested a wide dispersion of data from the mean because the standard deviation is not close to the mean value while, this suggests a wide dispersion of the data from the mean because standard deviation is not close the mean value. The peak of contribution density data was indicated by the kurtosis value of 0.0000, suggesting that most values were wider than the mean and data did not meet a normal distribution assumption. The skewness coefficient of 0.0000 for contribution density implier that the data were positively skewed (that

is, most of the data were on the right side of the normal curve), implying that the data did not meet the symmetrical distribution assumption.

Table 2 also indicates that the average exit age was 0.8234988, a standard deviation of 1819259 and a minimum as well as maximum of 0.016965 and 1.741178 respectively. This suggested a wide dispersion of data from the mean because the standard deviation was not close to the mean value. The peak of the exit age data was indicated by the kurtosis value of 0.1454 and the data did not meet the normal distribution assumption. The skewness coefficient of 0.0000 implied that the data were positively skewed (that is, most of the data were on the right side of the normal curve), implying that the data does not meet the symmetrical distribution assumption.

Table 3: Correlation Matrix

	EMT	PFE	CDE	EAE
EMT	1.0000			
PFE	-0.1547*	1.0000		
CDE	0.3633*	-0.0181*	1.0000	
EAE	0.2370*	0.1004	0.3403*	1.0000

Table 3 contains a correlation matrix which showed the relation between all pairs of variables in the regression model. The result revealed a positive correlation between independent variables and dependent variables, EM, except for the relation between PFE and EMT**.**

Table 4: Summary of Regression Result ($EMT_{it} = \alpha_0 + \beta_1 PFE + \beta_2 CDE + \beta_3 EAE + €_{it}$)

Variables	Beta	t-v	Prob.	Vif	1/vif
PFE	-0.2207906	-3.07	0.002	1.01	0.986823
CDE	0.5792877	5.59	0.000	1.13	0.88142
EAE	0.580689	2.73	0.006	1.15	0.87281
Cons	1.109505	15.96	0.000		
R2	0.1730				
F-Statistic	57.68				
1730F-Sig	0.0000				

Discussion of Findings

The result in regarding pension fund showed a coefficient value of -0.2207906 and a t-value of -3.07 which was significant at (0.000) 1%. This showed that the pension fund had a significant influence on EM in Nigeria. The statistical significance of the pension fund influence implied that any change in pension fund proportion would have a negative and statistical influence on EM in Nigeria. However, it was important to note that for every decrease in pension fund value -0.2207906, it was influenced by the opportunistic behaviour

perpetrated by the management of firms and reduced by -3.07; hence, negatively decreased the pension fund. The findings were inconsistent with those of (Nanshuwan et al., 2021; Nwanna & Ogbonna. 2019 and PenCom, 2019).

Contribution density was also discovered to have a coefficient value of 0.5792877 and a t-value of 5.59. Looking at their relation, a positive relationship with EM emerges, and the result showed a significant relation at (0.000)1%. Therefore, this result signified that any increase in contribution density would have a positive and significant impact on EM in Nigeria. This significant relation showed that, any increase in contribution density might have more resources, which was in line with (Onakeke and Falope, 2020).

Likewise, the exit age was found to have a coefficient value of 0.0580689 and a t-value of 2.73, which was a significant relation. Considering the significant relation between exit age and EM, it showed that pension fund and contribution density had a significant relation. Therefore, the result signified that any increase in the change of exit age had a significant impact on EM in Nigeria, and it was in line with the findings of (Sawyer,et al., 2018 and Suh, 2017)

The cumulative correlation between a dependent variable and all independent variables with 0.17% indicated that the relation between EM and pension fund, contribution density and exit age for this study was 17%, which was statistically positive at 1%. This implied that the pension fund, contribution density, and exit age in Nigeria, and their EM may be directly affected. Similarly, the F- statistic result which showed the overall fitness of the model, had a Wald chi2 (3) value of (52.68) implying that the model was well fitted and significant at 1% (.000). This provided evidence that the model fitted the data well and that the joint influence of the explanatory variables was statistically significant in explaining the dependent variable. The findings had several theoretical, practical, and regulatory implications.

The findings showed that model summary of the regression equation on how pension funds influenced EM. In this study, R square was 0.17%, which indicated that 17% of variation in the pension fund was accounted for by EM. The regression result showed that there was a negative relation between pension fund and EM. Therefore, the pension fund negatively affected EM and was statistically significant at (0.000)1% level. The regression result showed that the contributory density of a pension scheme influenced EM, which had a positive effect on EM. The effort of increasing contributory density was statistically significant at (0.006) 1%. The regression result showed that there was a positive relation between exit age and EM. Therefore, exit age positively affects EM and was statistically significant at (0.006)1% level.

Policy Implication

The research highlighted a potential to improve the effectiveness of pension funds, contribution density, and exit age to achieve their ultimate objective in providing income replacement in retirement by developing portfolio strategies. This pension fund, contribution

density, and exit age could provide a useful benchmark to evaluate the performance of fund managers which would be considerably useful in aiding EM. This suggested the need for governments and their pension supervisors to consider a more active role in evaluating and proposing the long-term objectives of pension funds, determining contribution density and exit age for various categories of worker and reducing the effect of EM.

5.1 Conclusion and Recommendations

The objective of this paper is to study the relation between pension funds, contribution density and exit age with EM. In particular, it tests whether EM has been controlled or increased with the presence of pension fund administration (PFA). The results showed that firms with many PFAs, were more inclined to reduce EM. They also showed that in the presence of PFA the propensity of corporate executives to use discretionary accruals depended on the governance mechanism and its effectiveness. More specifically, CDE and EAE, increased the extent of EM in the presence of PFA. The study recommended that on the basis of these results, the present research may have relevant implications for contributors, reformers, regulators, and governance experts who have a prerequisite understanding of related categories of agency problems that may arise in the Nigerian context.

5.2 Areas for Further Research

The researcher used discretionary accrual-based earnings management as a proxy for the dependent variable. However, other researchers can use actual EM as a dependent variable proxy to see the effects on independent variables, such as pension fund, contributory density and exit age. It is equally important to note that, this research work does not include other independent variables that may have an influence on EM in PFAs, such as PFA age or PFA net assets. Therefore, other prospect researchers are advised to incorporate more independent variables so that they can explore the extent to which independent variables influence EM amongst PFAs.

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Appendix

```
. summarize EMT PFE CDE EAE
```

Variable	Obs	Mean	Std. Dev.	Min	Max
EMT	312	.9917573	.071385	.4114006	1.146145
PFE	312	.9223802	.0530143	.6792868	.9999188
CDE	312	.0657448	.0382008	.0001681	.2596643
EAE	312	.8234988	.1819259	.016965	1.741178

```
. sktest EMT PFE CDE EAE
```

Skewness/Kurtosis tests for Normality

				joint	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
EMT	312	0.0000	0.0000	.	0.0000
PFE	312	0.0000	0.0095	31.89	0.0000
CDE	312	0.0000	0.0000	40.35	0.0000
EAE	312	0.1454	0.0000	46.58	0.0000

```
. swilk EMT PFE CDE EAE
```

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
EMT	312	0.89493	23.178	7.392	0.00000
PFE	312	0.93922	13.407	6.105	0.00000
CDE	312	0.95359	10.238	5.470	0.00000
EAE	312	0.83241	36.968	8.490	0.00000

```
. pwcorr EMT PFE CDE EAE, star(5)
```

	EMT	PFE	CDE	EAE
EMT	1.0000			
PFE	-0.1547*	1.0000		
CDE	0.3633*	-0.0181	1.0000	
EAE	0.2370*	0.1004	0.3403*	1.0000

```
. regress EMT PFE CDE EAE
```

Source	SS	df	MS
Model	.274294183	3	.091431394
Residual	1.31050494	308	.004254886
Total	1.58479912	311	.005095817

```
Number of obs =     312
F(  3,   308) =   21.49
Prob > F      =  0.0000
R-squared     =  0.1731
Adj R-squared =  0.1650
Root MSE      =  .06523
```

EMT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
PFE	-.2207906	.0702346	-3.14	0.002	-.3589909	-.0825904
CDE	.5792877	.1031333	5.62	0.000	.3763526	.7822227
EAE	.0580689	.0217624	2.67	0.008	.0152471	.1008908
_cons	1.109505	.0654207	16.96	0.000	.9807773	1.238233

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of EMT

         chi2(1)      =     8.67
         Prob > chi2  =   0.0032

. estat vif
```

Variable	VIF	1/VIF
EAE	1.15	0.872817
CDE	1.13	0.881421
PFE	1.01	0.986823
Mean VIF	1.10	

```
. xtset id years, yearly
       panel variable:  id (unbalanced)
        time variable:  years, 2013 to 2021
                delta:  1 year

.
. xtreg EMT PFE CDE EAE, fe

Fixed-effects (within) regression               Number of obs      =       312
Group variable: id                              Number of groups   =        35

R-sq:  within  = 0.0209                         Obs per group: min =         7
       between = 0.5495                                        avg =       8.9
       overall = 0.1435                                        max =         9

                                                F(3,274)           =      1.95
corr(u_i, Xb)  = 0.4324                         Prob > F           =    0.1223

------------------------------------------------------------------------------
         EMT |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         PFE |  -.1582231   .0839779    -1.88   0.061    -.3235471    .0071008
         CDE |   .1733236   .1305016     1.33   0.185    -.0835897    .4302369
         EAE |   .0145149   .0268841     0.54   0.590    -.0384107    .0674405
       _cons |   1.114351   .0805737    13.83   0.000     .9557288    1.272973
-------------+----------------------------------------------------------------
     sigma_u |  .03640818
     sigma_e |  .06124938
         rho |  .26108813   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(34, 274) =     2.22                 Prob > F = 0.0002

. est storefe
estimates: unknown subcommand "storefe"
r(198);

. eststore fe
unrecognized command:  eststore

. est store fe

. xtreg EMT PFE CDE EAE, re

Random-effects GLS regression                   Number of obs      =       312
Group variable: id                              Number of groups   =        35

R-sq:  within  = 0.0177                         Obs per group: min =         7
       between = 0.6473                                        avg =       8.9
       overall = 0.1730                                        max =         9

                                                Wald chi2(3)       =     41.43
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
         EMT |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         PFE |  -.2024262   .0731693    -2.77   0.006    -.3458355    -.059017
         CDE |   .4919996   .1084377     4.54   0.000     .2794656    .7045337
         EAE |    .050728   .0227446     2.23   0.026     .0061494    .0953067
       _cons |   1.104356   .0686869    16.08   0.000     .9697326     1.23898
-------------+----------------------------------------------------------------
     sigma_u |  .01582634
     sigma_e |  .06124938
         rho |  .06258758   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. est store re

. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        EMT[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                 --------+------------------------------
                     EMT |   .0050958        .071385
                       e |   .0037515       .0612494
                       u |   .0002505       .0158263

        Test:   Var(u) = 0
                                 chibar2(01) =     6.57
                              Prob > chibar2 =   0.0052
```

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
PFE	-.1582231	-.2024262	.0442031	.0412134
CDE	.1733236	.4919996	-.318676	.072608
EAE	.0145149	.050728	-.0362131	.014333

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 21.80
Prob>chi2 = 0.0001

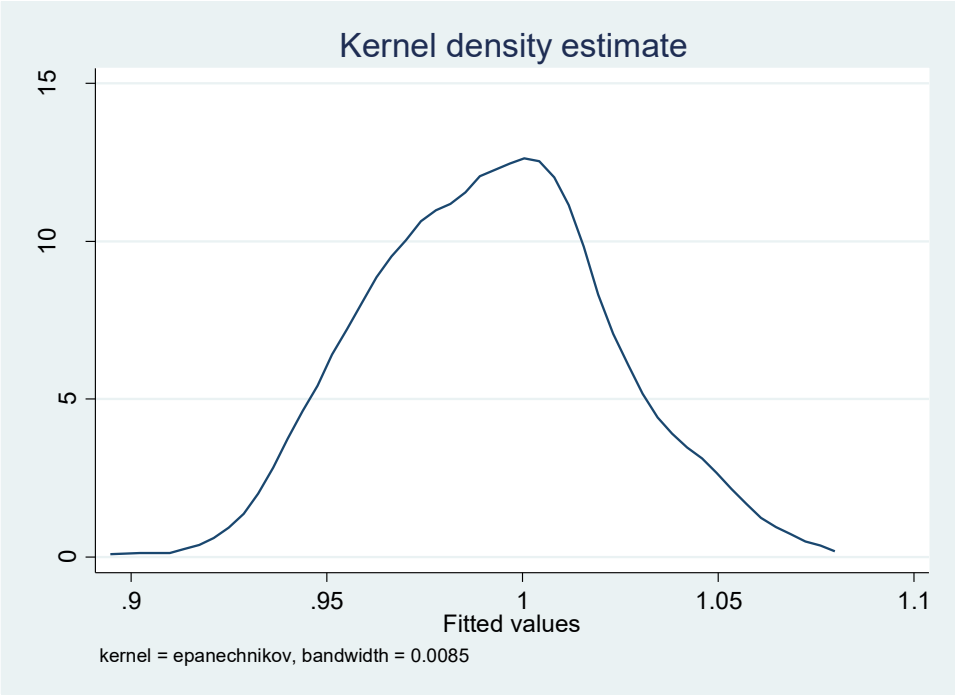
```
. xtpcse EMT PFE CDE EAE
```

Linear regression, correlated panels corrected standard errors (PCSEs)

Group variable:	id	Number of obs	= 312
Time variable:	years	Number of groups	= 35
Panels:	correlated (unbalanced)	Obs per group: min	= 7
Autocorrelation:	no autocorrelation	avg	= 8.914286
Sigma computed by casewise selection		max	= 9
Estimated covariances	= 630	R-squared	= 0.1731
Estimated autocorrelations	= 0	Wald chi2(3)	= 57.68
Estimated coefficients	= 4	Prob > chi2	= 0.0000

EMT	Panel-corrected Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PFE	-.2207906	.0718516	-3.07	0.002	-.3616172	-.0799641
CDE	.5792877	.1036596	5.59	0.000	.3761186	.7824567
EAE	.0580689	.0212917	2.73	0.006	.0163379	.0998
_cons	1.109505	.0695129	15.96	0.000	.9732626	1.245748

```
. predict e
(option xb assumed; fitted values)
. kdensity e
```



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