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Fundamental Factors of the Egyptian Stock Market

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Abstract This paper proposes twelve fundamental factors model in Egypt as price risk factors, which were formed according to [1]. Then, the paper examines fundamental factors after excluding medium-size stocks which were divided into three groups: top 30%, medium 40%, and bottom 30% and that most of the stocks lie in the medium which might lead to bias in measuring the effect of fundamental factors as a price of risk factors. The study utilized a sample of 48 companies out of 100 stocks listed on EGX100 index which were the active stocks among the study period. The study used monthly data from January 2005 until December 2016. And, data have been categorized within this research into five, whole period from January 2005 to December 2016, normal period from January 2005 to December 2007, post-global financial crisis period from January 2008 to December 2010, post-Egyptian revolution from January 2011 to December 2013 and the economic recovery period from January 2014 to December 2016. The study then Utilized Gibbons Ross Shaken (GRS) to determine which factor model can estimate the risk premium better than others for each proposed period. This methodology was repeated two times. The first which follow previous fundamental factors: three, four, five, six, eight, and twelve factors models. Second, repeating the same methodology but broking down the size into three groups excluding medium one to become (3×2) size portfolios. The results shows that the twelve-factor model of 3x2 proposed portfolios is the best model for estimating risk premium in the recovery period, six-factor model 3x2 portfolios is the most reliable for unstable periods and twelve-factor model of 2x3 portfolios for normal growing periods. Accordingly, we recommend using twelve-factor model of 2x3 portfolios for growing periods which addressing Egyptian current period.

Keywords: *fundamental factors, asset pricing, Egyptian Stock Market*

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1. Introduction

In recent years, it has been seen that Capital Asset Pricing Model (CAPM) can no longer be considered and effective model for estimating stock returns neither for developed countries [1] nor for developing countries [2] and others. This is further supported by what happen to the Egyptian Stock Exchange Market capitalization during the period from 2005 till 2016 as show in next figure.

As it can be seen in Figure 1, where nominal figures of market capitalization rose from EGP 234 billion in January 2005 to EGP 780 billion in January 2008 by 233.33%, then decline to EGP 488 billion in January 2011 by 37.4% and then to EGP 284 billion by 21% for the period from January 2011 to January 2013. Finally, it rose again to EGP 432 billion in January 2016 by 12.5%. This might raise an important debate about which fundamental factors could estimate risk premium in different circumstances and which ones are more powerful in each and in all cases.

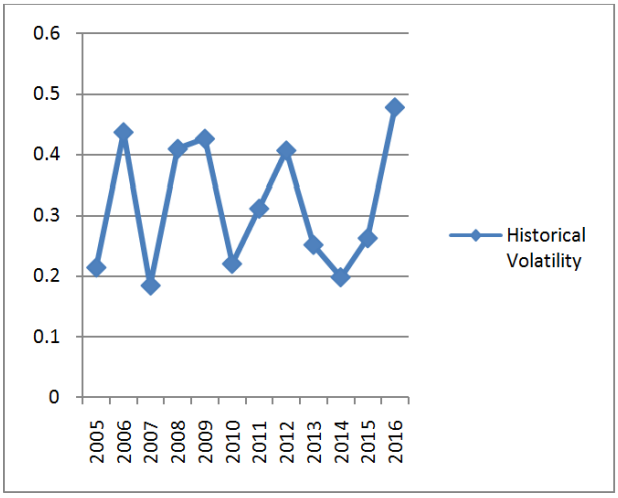

Figure 1. Market Capitalization Volatility

The main contributions of the current study is that it is the first to propose a more reliable fundamental factor model in all the different matters and crises facing Egypt in the previous twelve years (2005 - 2016) starting from

relatively stable conditions, to the global financial crises, to the Egyptian 25th of January Revolution, to the current market recovery. The second main contribution is in testing the same fundamental factors after excluding medium size stocks which are divided into three groups: the top 30%, the middle 40% and the bottom 30%; this division was made as it was found that most of the stocks lie in the medium which might lead to bias in measuring the effect of fundamental factors on risk premium.

The remainder of this study is organized as follows: Section 2 sheds light on the literature review. Section 3 describes the data, variables, and methodology. Section 4 focuses on the result analysis and discussion. Section 5 conclusion of the study.

2. Literature Review

CAPM started losing its ground due to empirical contradictions; there is also long standing evidence as [3,4] found that found that the relation between average return and market (β) is flatter than predicted by [5,6], and [7], and had different perspectives based on an extension of the single factor to be a multifactor model In the 1970s such [8,9,10,11,12] and others who introduce different thoughts for pricing assets in the capital market by adding some macroeconomic factors to explain behavior of the asset pricing in 1980's. Other empirical works demonstrated the existence of firm specific characteristics such as low market capitalization [13,14] and [15] while [16] found that market beta didn't fully explain the higher average returns of small stocks. [17,18] found that there is a positive relation between earning price ratio and average return. Also, the book-to-market equity ratio (value and growth effect) documented by [19] and [20] found positive relation between average stock return and book to market equity ratio.

In the 1990s, the three factor model (FF3M) of [1] received attentionattention for its ability to capture the relationship between risk and return. They built mimicking portfolios as a benchmark to capture risk factors related to size-value effects and found that these captures had strong explanation for stock returns. [21] applied the model on Australian Stock Market data and the results were consistent with the original study. [22] compared between three, four, five and macroeconomic factors in Indian Stock Exchange and results showed that (FF3M) performed better than others. [23,24] made a comparison between CAPM in explaining returns of most portfolios constructed based on Indian Stock Exchange Market data. [25] examined the size and price to book effect in Chinese markets and they found strong evidence for the size effect but little evidence for the price-to-book effect.

[26] added the concept of momentum to three factor model and found that mutual funds with higher returns in the previous year were likely to have higher than expected returns. This model was then named the Carhart Four Factor Model (CFFM). Some empirical studies were consistent with the results of original (CFFM). Also, [27,28] applied on the South African Stock Exchange and [29] on Hong Kong.

[30] and [31] proposed five factor models which include two additional variables, investment and profitability, and they found that five factor model (FF5M) was superior to the three factor model in explaining the cross section of average stock returns [32]. [33] found that five factor model outperformed the three factor model in Chinese equity markets. [34] proposed an extended five-factor model asset pricing model adding earning to price, sales to price and dividend to price. They concluded that a model which incorporated market factor, firm size, book to market, earning to price, and yields had better results than competing models. Fama after that followed the advice of [35] and considered anomalies not targeted by FF5M and known to cause problems for FF3M.

[2] compared five alternatives of asset pricing models (CAPM, FF3M, CFFM, and FF5M) and they found that three factor model are the best in the Egyptian Stock Market and rejected the other models.

[36] compared between five factor model and three factor model. They found that the profitability factor offered the most potential explanatory factor than others. Results showed that a portfolio on investment sort performs better than other models.

[37] examined the six factor model by adding a liquidity argument to Fama and French's five factor model and they concluded that the only consistent significant factor was the market factor.

[38] examined the fundamental factors of stock returns for nine Asian markets (Japan, China, South Korea, Hong Kong, Taiwan, Singapore, Indonesia, Malaysia and Thailand). They developed a model using eight factors: The market risk premium, size, book-to-market ratio (B/M), profitability, investment, momentum, price-to-earnings ratio (P/E), and dividend yield factors for each market. The empirical results suggested that the eight factor model can better explain stock returns when the market is under stress.

Most of the previous studies concentrated on outperforming one of fundamental factors models over the others for a single period in one or more countries. Meanwhile, this research focuses on examining different periods including dramatic changes which lead to market variations across different circumstances. In addition, the researcher added four factors to the eight factor model which are: liquidity, dividends, leverage, and sales to price. Besides this, the researcher made an empirical test by breaking down the different companies by size into three groups and the rest into two groups to be three by two (3X2) expecting that it would enhance the model estimation. This was addressed because most of stocks within Egyptian Stock Market are of medium size.

So, the following questions would be addressed:

- Which fundamental factor models outperform others for each single period?
- Which fundamental factor model could be most reliable for all cases (periods) in the Egyptian Stock Exchange Market?

3. Data, Variables and Methodology

3.1. Data

The study utilized a sample of 48 companies out of 100

stocks listed on EGX100 index which were the active stocks among the study period. We used monthly data from January 2005 till December 2016. Value weighted Market Index namely EGX100 was used as a market proxy and one month Treasury bill was used as a proxy for risk free rate.

The data have been categorized within this research into five as follows:

i The whole period from January 2005 to December 2016.
ii The normal period from January 2005 to December 2007.
iii The post-global financial crisis period from January 2008 to December 2010.
iv The post -Egyptian revolution period from January 2011 to December 2013.
v The economic recovery period from January 2014 to December 2016.

Following [1] the researcher utilized accounting data for fiscal year-end in December (t-1) to explain stock returns for the period from July of year (t) to June of year (t+1). So, the researcher left six months July-December for portfolio rebalancing. Monthly market returns were the differences of the natural logarithm of index value at the end of month (i) and the preceding month (i-1). The researcher then constructed two groups of portfolios, the first was conducted by using two by three grouping, as Fama and French, on size. The second, we broke down size into three groups: 30% for big companies, 40% for medium companies, 30% for small companies, and the rest was book-to-market (HML), momentum (WML), investment (CMA), profitability (RMW), price-earnings ratio (OMU), dividend yield (IMN), liquidity (HVMlV), Leverage (HLMLL), Sales to price (HSMLS), and earning price ratio (HEMLE) were grouped into two 50% for (H,W,C,R,O,I,HV,HL,HS and HE) and the remaining for (L,L,A,W,U,N,IV,LL,LS,LE) respectively.

3.2. Variables

3.2.1. Dependent Variable

i Stock risk-premium: is the monthly given stock return in excess of the risk free rate.

3.2.2. Independent Variables

i Market premium: is the monthly market return in excess of the risk free rate.
ii Size: small minus big (SMB) in two forms as follows:

First, all stocks were grouped into two stocks above the 50% size breakpoint were big and the remaining 50% were small and then we broke stocks into three book-to-market equity groups based on the breakpoints for the top 30% (High) middle 40% (medium) and bottom 30% (low). (SMB) were calculated as follows:

- For three factor model the difference between the weighted average of the returns on the three small-stock portfolio (S/L, S/M, and S/H), and the weighted average of the returns on the three big-stock portfolio (B/L, B/M, and B/H).
- For four factor model the difference between the weighted average of the returns on the three small-stock portfolio (S/L, S/M, S/H, S/W, S/M, and S/L), and the weighted average of the returns on the three big-stock portfolio (B/L, B/M, B/H, B/W, B/M, and B/L).
- For five factor model we sum the differences between the weighted average of the returns on the three small-stock portfolios for (S/L, S/M, S/H, S/C, S/M, S/A, S/R, S/M, and S/W), and the weighted average of the returns on the three big-stock portfolios for (B/L, B/M, B/H, B/A, B/M, B/A, B/R, B/M, and B/W).
- For eight factor model we sum the differences between the weighted average of the returns on the three small-stock portfolios for (S/L, S/M, S/H, S/W, S/M, S/L, S/C, S/M, S/A, S/R, S/M, S/W, S/O, S/M, S/U, S/I, S/M, and S/N), and the weighted average of the returns on the three big-stock portfolios for (B/L, B/M, B/H, B/W, B/M, B/L. B/A, B/M, B/A, B/R, B/M, B/W, B/O, B/M, B/U, B/I, B/M, and B/N).
- For twelve factor model we sum the differences between the weighted average of the returns on the three small-stock portfolios for (S/L, S/M, S/H, S/W, S/M, S/L, S/C, S/M, S/A, S/R, S/M, S/W, S/O, S/M, S/U, S/I, S/M, S/N, S/HV, S/M, S/IV, S/HL, S/M, S/LL, S/HS, S/M, S/LS, S/HE, S/M, and S/LE), and the weighted average of the returns on the three big-stock portfolios for (B/L, B/M, B/H, B/W, B/M, B/L, B/A, B/M, B/A, B/R, B/M, B/W, B/O, B/M, B/U, B/I, B/M, B/N, B/HV, B/M, B/IV, B/HL, B/M, B/LL, B/HS, B/M, B/LS, B/HE, B/M, and B/LE).

Second, all stocks were broken down into three groups 30% for top (Big), 40% for middle (medium) and 30% for bottom (small) and broke stocks into book-to-market equity groups based on breakpoints for top 50% and bottom 50%. (SMB) were calculated as follows:

- For three factor model the difference between the weighted average of the returns on the two small-stock portfolio (S/L, and S/H) and the weighted average of the returns on the two big-stock portfolio (B/L, and B/H).
- For four factor model the difference between the weighted average of the returns on the two small-stock portfolios for (S/L, S/H, S/W, and S/L), and the weighted average of the returns on the two big-stock portfolios for (B/L, B/H, B/W, and B/L).
- For five factor model we sum the differences between the weighted average of the returns on the two small-stock portfolios for (S/L, S/H, S/C, S/A, S/R, and S/W), and the weighted average of the returns on the two big-stock portfolios for (B/L, B/H, B/A, B/A, B/R, and B/W).
- For eight factor model we sum the differences between the weighted average of the returns on the two small-stock portfolios for (S/L, S/H, S/W, S/L, S/C, S/A, S/R, S/W, S/O, S/U, S/I, and S/N), and the weighted average of the returns on the two big-stock portfolios for (B/L, B/H, B/W, B/L, B/A, B/A, B/R, B/W, B/O, B/U, B/I, and B/N).
- For twelve factor model we sum the differences between the weighted average of the returns on the two small-stock portfolios for (S/L, S/H, S/W, S/L,

S/C, S/A, S/R, S/W, S/O, S/U, S/I, S/N, S/HV, S/IV, S/HL, S/LL, S/HS, S/LS, S/HE, and S/LE), and the weighted average of the returns on the two big-stock portfolios for (B/L, B/H, B/W, B/L, B/A, B/A, B/R, B/W, B/O, B/U, B/I, B/N, B/HV, B/IV, B/HL, B/LL, B/HS, B/LS, B/HE, and B/LE).

iii Market-to-book ratio:

High minus low (HML) for both forms of sizes were the difference for each month between the simple average of returns on the two high book-to-market (S/H and B/H) and the average of the returns on the two low (S/L and B/L).

iv Momentum:

Winners minus losers (WML) for both forms of sizes were the difference for each month between the simple average of returns on the two losers (S/L and B/L). Noting that at the end of each month all stocks were grouped on the previous eleven month return, lagging one month.

v Profitability:

Robust minus weak (RMW) for both forms of sizes were the difference for each month between the simple average of returns on the two robust profitability (S/R and B/R) and the average of the returns on the two weak profitability (S/W and B/W).

vi Investment:

Conservative minus aggressive (CMA) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/C and B/C) and the average of the returns on the two aggressive investments (S/A and B/A).

vii Price-earnings ratio:

Overvalue stocks minus undervalue stocks (OMU) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/O and B/O) and the average of the returns on the two aggressive investments (S/U and B/U).

viii Dividend yield:

Income stocks minus non-income stocks (IMN) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/I and B/I) and the average of the returns on the two aggressive investments (S/N and B/N).

ix Liquidity:

Where liquidity calculated by dividing traded volume multiply stock price over number of outstanding shares multiply by stock price. Liquid stocks minus illiquid stocks (HVMLV) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/HV and B/HV) and the average of the returns on the two aggressive investments (S/LV and B/LV).

x Earning-to-price ratio:

High earnings minus low earnings (HEMLE) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/HE and B/HE) and the average of the returns on the two aggressive investments (S/LE and B/LE).

xi Leverage:

Leverage calculated by dividing assets over equity. High leverage minus low leverage (HLMLL) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/HL and B/HL) and the average of the returns on the two aggressive investments (S/LL and B/LL).

xii Sales-to-price ratio:

High sales minus low sales (HSMLS) for both forms of sizes were the difference for each month between the simple average of returns on the two conservative investment (S/HS and B/HS) and the average of the returns on the two aggressive investments (S/LS and B/LS).

4. Methodology

[39] (GRS) utilized to determine which factor model can estimate the risk premium better than others for each proposed period [31]. The average of the least GRS for all periods was calculated to determine which factor model was more reliable. This required enforcing a rigid standard on evaluating any asset pricing model

This methodology was repeated two times the first which follow previous fundamental factors three, four, five, six, eight, and twelve factors models. Second, following the same methodology after broking down size into three groups excluding medium one to become (3×2) size portfolios and the models are:

$R_{it}-R_{ft} = \beta_0 + \beta_1(R_{mt}-R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{it}$ ---(1) following [1].

$R_{it}-R_{ft} = \beta_0 + \beta_1(R_{mt}-R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \varepsilon_{it}$------(2) following [26].

$R_{it}-R_{ft} = \beta_0 + \beta_1(R_{mt}-R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \varepsilon_{it}$------(3) following [31].

$R_{it}-R_{ft} = \beta_0 + \beta_1(R_{mt}-R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 WML_t + \varepsilon_{it}$ ------(4) following [31].

$R_{it}-R_{ft} = \beta_0 + \beta_1(R_{mt}-R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 WML_t + \beta_7 OMU_t + \beta_8 IMN_t + \varepsilon_{it}$----(5) following [38].

$R_{it}-R_{ft} = \beta_0 + \beta_1(R_{mt}-R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 WML_t + \beta_7 OMU_t + \beta_8 IMN_t + \beta_9 HVMLV_t + \beta_{10} HEMLE_t + \beta_{11} HLMLL_t + \beta_{12} HSMLS_t + \varepsilon_{it}$ ------(6) proposed model.

Where:

$R_{it}-R_{ft}$: Stock risk-premium

$R_{mt}-R_{ft}$: Market premium

SMB_t: Size; small minus big

HML_t: Market-to-book ratio; High minus low

RMW_t: Profitability; Robust minus weak

CMA_t: Investment; Conservative minus aggressive

WML_t: Momentum; Winners minus losers

OMU_t:Price-earnings ratio; Overvalue stocks minus undervalue stocks

IMN_t: Dividend yield; Income stocks minus non-income stocks

$HVMLV_t$: Liquidity; Liquid stocks minus illiquid stocks

$HEMLE_t$: Earning-to-price ratio; High earnings minus low earnings

$HLMLL_t$: Leverage;High leverage minus low leverage

$HSMLS_t$: Sales-to-price ratio; High sales minus low sales

5. Results

In case of applying GRS Table 1 and Table 2 show the following:

The whole period (2005-2016) for 2x3 for all portfolios had a significant effect except the eight factors model, where six factors model outperformed all of the significant ones. While 3x2 all portfolios also has a significant effect except eight factors model, where the six factors model outperformed all the significant ones. But 2x3 portfolios six factors model had better performance than the 3x2 portfolios six factor model.

The normal period (2005-2007) for 2x3 portfolios only four and twelve factors have significant effect, where twelve factor model outperform the four factors model. While 3x2 portfolios only five and eight factor models have significant effect and five factors model outperform the eight factors model. And 2x3 portfolios twelve factor model have better performance than 3x2 portfolios five factor model.

The post period of worldwide financial crisis (2008-2010) for 2x3 portfolio's there is no significant effect for any firm characteristic model while 3x2 portfolio's 6 and 8 factors models are significant and eight factor model are outperform over the six factor model.

The post of 25th of January revolution (2011-2013) for 2x3 portfolios is all significant where four factor models outperform all other models. While 3 x 2 portfolios is all significant where twelve factor models outperform all other models. However four factor model 2 x 3 portfolios outperform all of all.

The economic recovery period (2014-2016) for 2x3 and 3X2 all portfolios are significant where 3x2 twelve factors model outperform all other models.

Table 1. GRE test statistics Results2 by 3

Model	2005-2016	2005-2007	2008-2010	2011-2013	2014-2016
Three factors	50.54002 (3.489617e-12)	2.534587 (0.1136155)	0.3513027 (0.554326)	109.3227 (2.681036e-19)	134.4727 (2.975525e-22)
Four factors	40.62067 (3.807651e-10)	4.48534 (0.0359413)	0.979321 (0.3240617)	38.49319 (5.753876e-09)	217.1733 (2.452605e-30)
Five factors	12.70574 (0.0003950504)	3.397221 (0.06740614)	0.24826 (0.6190792)	160.3506 (5.085073e-25)	230.2017 (1.953968e-31)
Six factors	8.936184 (0.002916322)	3.76905 (0.05420361)	0.9813263 (0.3235685)	356.633 (1.930009e-40)	220.278 (1.331035e-30)
Eight factors	2.439063 (0.1189039)	2.214964 (0.1389113)	2.122899 (0.1473351)	294.9777 (2.226755e-36)	14.71636 (0.0001878566)
Twelve factors	366.2225 (1.827877e-63)	3.987682 (0.04775896)	2.805835 (0.09613839)	237.8787 (4.587101e-32)	(112.1632 1.201724e-19)

Table 2. GRE test statistics Results3 by 2

model	2005-2016	2005-2007	2008-2010	2011-2013	2014-2016
Three factors	46.7119 (2.109349e-11)	3.437846 (0.06580792)	1.052789 (0.3066607)	317.017 (6.806318e-38	16.52939 (7.928206e-05)
Four factors	52.03163 (1.744122e-12)	2.19403 (0.1407776)	1.120749 (0.2915675)	67.18753 (1.36419e-13)	6.224866 (0.01375056)
Five factors	50.81833 (3.080281e-12)	4.310364 (0.0396967)	1.76295 (0.1864025)	257.5887 (1.266629e-33)	23.12518 (3.848693e-06)
Six factors	23.1329 (1.938366e-06)	2.729031 (0.1007643)	4.947683 (0.02771529)	234.3155 (8.954604e-32)	24.78651 (1.841257e-06)
Eight factors	2.101096 (0.1477465)	4.615582 (0.03340338)	4.615582 (0.03340338)	157.5678 (1.100097e-24)	5.371044 (0.0219235)
Twelve factors	496.012 (2.810913e-79)	3.913197 (0.1973189)	1.371856 (0.2434829)	43.87402 (6.958613e-10)	4.507495 (0.0355059)

Table 3. Best performance factor model for each period

Period	2X3 portfolios best factor model	2X3 portfolios best factor model	Best of all
Whole period (2005-2016)	six factors model	six factors model	six factors model of 2x3 portfolios
Normal period (2005-2007)	twelve factor model	five factor model	twelve factor model of 2x3 portfolios
Post of Worldwide financial crisis (2008-2010)	N/A	eight factor model	eight factor model of 3x2 portfolios
Post of 25th Egyptian revolution (2011-2013)	four factor models	twelve factor models	four factor models of 2x3 portfolios
Economic recovery period (2014-2016)	eight factor model	twelve factor model	twelve factors model 3x2 portfolios

6. Conclusion

This study included two main contributions. The first is related to the Twelve Factor Model where its elements have been examined before but separately and not within the same model. Second, the size was broken down into three groups and the rest into two groups to be three by two (3X2) expecting that it would enhance the model's estimations. This was addressed because most of the stocks within Egyptian Stock Market are of medium size. In addition, the empirical study includes five different periods addressing circumstances facing the Egyptian market from 2005 to 2016: the whole period (2005-2016), normal period (2005-2007), post-global financial crisis (2008-2010), post -Egyptian revolution (2011-2013) and recovery period (2014-2016) to examine which fundamental factor models outperform others for each single period as well as which fundamental factor model could be most reliable for all cases (periods) in the Egyptian Stock Exchange Market.

Table 3 shows that three factor model has the worst performance for all, while six factor model of 2x3 portfolios has the best performance for the whole period, twelve factor model of 2x3 portfolios for the normal period, eight factor model of 3x2 portfolios, four factor models of 2x3 portfolios and twelve factors model 3x2 portfolios.

So, we can conclude that the proposed twelve factor model of 3x2 proposed portfolios is the best model for estimating risk premium in recovering period, six factor model 3x2 portfolios is the most reliable for instable periods and twelve factor model of 2x3 portfolios for normal growing periods.

Accordingly, we recommend using twelve factor model of 2x3 portfolios for growing periods which addressing Egyptian current period.

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