Mutual Fund Performance and persistence evaluation evidence from Thai local and foreign Luxembourg UCITS

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การวิเคราะห์ผลประกอบการและความคงอยู่อย่างต่อเนื่องของผลประกอบการของกองทุนหลักฐานจากกองทุนในประเทศไทยและกองทุน Luxembourg UCITS

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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บรูโน่ โฟร์ควิน : การวิเคราะห์ผลประกอบการและความคงอยู่อย่างต่อเนื่องของผลประกอบการของกองทุนหลักฐานจากกองทุนในประเทศไทยและกองทุน Luxembourg UCITS. (Mutual Fund Performance and persistence evaluationevidence from Thai local and foreign Luxembourg UCITS) อ.ที่ปรึกษาหลัก : ผศ. ดร.นาถฤดี ศุภกิจจารักษ์

วิทยานิพนธ์ฉบับนี้มีวัตถุประสงค์หลักเพื่อเปรียบเทียบผลประกอบการและความคงอยู่อย่างต่อเนื่องของผลประกอบการระหว่างกองทุนหุ้นลักเซมเบอร์ก อิคิวตี้ และกองทุ้นหุ้นของประเทศไทย โดยทุกกองทุนในงานวิจัยจะต้องมีพอร์ตโฟลิโอการลงทุนในหุ้นของประเทศไทยอย่างน้อย 90 เปอร์เซ็น ข้อมูลในการวิจัยเป็นข้อมูลรายเดือนระยะเวลา 5 ปี (เดือนเมษายน 2556 – เมษายน 2561) ในการวัดผลประกอบการได้ใช้วิธีการดังนี้ 1. แบบไม่ผันผวน (static) หรือการวัดผลแบบไม่มีเงื่อนไข ประกอบไปด้วยอัตราส่วนชาร์ป เทรเนอ และเจนเซ่น 2. แบบผันผวน หรือการวัดผลแบบมีเงื่อนไข โดยใช้วิธีวิธีการของเทรเนอ-มาเซย์ และคณะ 3. การทดสอบความคงอยู่ของผลการดำเนินงาน โดยใช้วิธีวัดดัชนีความคงอยู่อย่างต่อเนื่อง ของ บราวน์ และโกซแมน และ เมอร์ธิและคณะ แหล่งข้อมูลหลักจากมอร์นิ่งสตาร์ ประกอบไปด้วยกองทุนลักเซมเบอร์ก 20 กองทุนและกองทุนเปิดของประเทศไทยที่ลงทุนในหุ้น 151 กองทุน ผลการทดลองพบว่าผลประกอบการระหว่างกองทุนทั้งสองประเภทโดยการวัดค่าเฉลี่ยบีต้า มีความแตกต่างกัน รวมถึงผลของความคงอยู่อย่างต่อเนื่องของผลประกอบการก็เช่นเดียวกัน

สาขาวิชา การเงิน ลายมือชื่อนิสิต .....

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Bruno Fourquin : Mutual Fund Performance and persistence evaluationevidence from Thai local and foreign Luxembourg UCITS. Advisor: Asst. Prof. NATHRIDEE SUPPAKITJARAK, Ph.D.

This paper aims to compare the performance and persistence of equity Mutual Funds between Luxembourg equity UCITS (Undertakings for Collective Investment in Transferable Securities) and Thai equity Funds that are investing a minimum of 90% of their total portfolio in Thai equity market during a 5 years period (May 2013- April 2018). The tests are conducted via (i) static or unconditional measures including the Sharpe, Treynor, Jensen ratios; (ii) dynamic or conditional measures using Treynor-Mazuy, K. Shukla and Gregory B. van Inwegen indicators; (iii) control - robustness measures with Brown and Goetzmann, Murthi et al. performance persistence indices. The paper is based on monthly data collected from Morningstar including 20 Luxembourg and 151 Thai open-end invested in Thai equity funds. The results show that, on average, Thai and Luxembourg funds perform equally well; still the most statistically significant difference, between the two countries, appears to be linked to the average Beta, as well as the results of DPEI – DEA Portfolio Efficiency Index robustness test which seems to be in line with Murthi (1997) with the correlation between DPEI and the Sharpe ratio while transaction costs variables appear to be significant with fund performance.

Field of Study:	Finance	Student's Signature .....
Academic Year:	2018	Advisor's Signature .....

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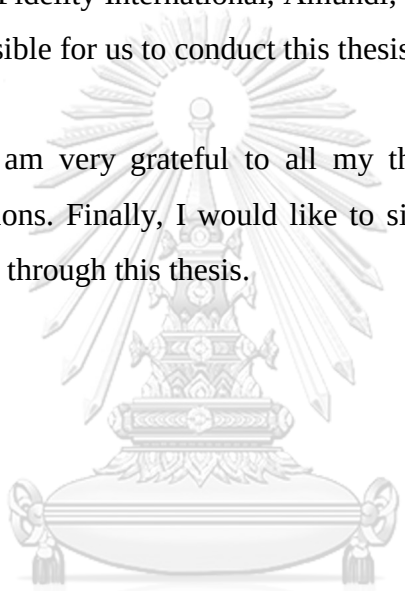
Bruno Fourquin



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1. RATIONALE

Literature Rationale

Some empirical evidence literature shows that local funds may outperform foreigners on average: Shukla and Van Inwegen (1995) in the United States; Hau (2001) in Germany; Choe, Kho, and Stulz (2005) in Korea; Dvorak (2005) in Indonesia; and Teo (2009) in Asia. From our best knowledge, there are no papers focusing on the comparison of equity mutual fund performance persistence between Luxembourg UCITS (Undertakings for Collective Investment in Transferable Securities) and Thai Non-UCITS Funds investing only in the Thai equity market and during a 5-year period from 2013-2018.

Cross-border Fund distribution rationale between Luxembourg and Thailand

Based on the fact that the ASEAN – CIS is expecting to challenge the UCITS Luxembourg format in Southeast Asia region, it seems useful for academics, fund professionals and investors to investigate the actual fund performance persistence determinants between Luxembourg UCITS and Thai funds investing mainly in the Thai equity market.

The choice of Luxembourg is due to its leadership (since 1985) of the UCITS or "Undertakings for Collective Investment in Transferable Securities" concept which brings favorable regulatory environment and scale economies, both in European and Asia.

The choice of Thailand is the fact that this country is one of the most active in developing the ASEAN CIS Framework, which was implemented in August 2014 (revised in 2018), enabling fund managers in Thailand, Singapore and Malaysia to offer challenging collective investment schemes or funds to retail investors.

Regulatory Rationale of Cross country

On the 28th November 2012, the "Commission de Surveillance du Secteur Financier" (CSSF) has signed a Memorandum of Understanding (MoU) with the Securities and Exchange Commission of Thailand (SEC) to promote collaboration between the fund sectors of Luxembourg and Thailand in exchanging information on regulation and supervision of mutual funds and mutual fund-related service providers. The MoU creates fund business opportunities for Thai and Luxembourg investment management companies.

2. INTRODUCTION

MUTUAL FUND MARKETS

More than 76,000 mutual funds worldwide generate about $30 trillion of AUM (assets under management), representing more than 20 percent of total global AUM on behalf of investors worldwide; if developed markets control more than 90 percent of mutual fund AUM, some developing countries including Thailand are developing their mutual fund sector to deliver cost-effective, diversification of risk to investors, even though supporting economic growth. ("Mutual Funds in Developing Markets", World Bank-2015).As Undertakings for Collective Investment in Transferable Securities (UCITS), the new cross-border schemes – Association of Southeast Asian Nations (ASEAN), Collective Investment Scheme (CIS), Asia Region Funds Passport (ARFP) and Mainland Mutual Fund Recognition of Funds (MRF) – are providing Southeast Asia regional growth possibilities, including increased liquidity, reduced costs for cross-border investing, improved efficiency and the ability to invest in funds previously unavailable to them are driving investors' desire for cross-border schemes. For instance, PwC Market Research's projection of the ASEAN CIS scheme should progress from USD 226bn in 2014 to USD 372bn by 2020 on an annual rate of 8.6%.

Southeast Asia is one of the most dynamic regions in the world with an average growth rate of 5% of AUM over the past 15 years (OECD Southeast Asia Regional Program - 2018 (SEARP).

But, in the future, we postulate that the future growth of the AUM industry in Southeast Asia should profit more to local, e.g. Thailand ASEAN funds than to foreign funds, e.g. Luxembourg funds (UCITS). In terms of implications, this perspective has the potential to redraw the Southeast Asia Equity Mutual Fund cross-border fund map. According to PwC and other consultants, we expect that within three to five years, there could be a significant challenge for UCITS fund managers and ASEAN Southeast equity fund managers, as well as Thai's domestic equity fund managers.

3. MUTUAL FUND PERFORMANCE MEASUREMENT

For over fifty years, measuring the performance of capital markets has been of decisive importance in AUM valuation. In this field, the study of Mutual Fund's performance persistence through (i) static or unconditional, (ii) dynamic or conditional measures, (iii) control measures performance indicators, have attracted much of the attention of academic research. In any case, the problems and limitations of these measures are well known and most of them are as a result of the high volatility of returns in the financial markets, as well as the properties of time aggregation of returns and volatilities, amongst other reasons. In terms of Mutual Fund persistence, the literature is divided on the question of whether mutual fund managers can persistently outperform their benchmarks. Several studies found that Mutual Funds and their managers do not outperform their benchmarks or earn positive persistent alphas. On the other hand, many studies document evidence of persistent outperformance and managerial skill. Nevertheless, there is still a deficiency of understanding and information around the performance persistence as detected in the U.S. fund industry in papers such as Carhart (1997), Fama and French (2010) and Berk and van Binsbergen (2015). Parallel theoretical work by Berk and Green (2004) shows no persistence in fund performance even in the presence of manager skill if the assumptions of perfect capital markets, rational learning of fund performance and

reducing returns to scale in fund management hold and if some previous papers applied numerous fund-specific characteristics to forecast mutual fund performance, such as the expense ratio, age, size, and turnover ratio (Białkowski and Otten (2011) Babalos, Kostakis and Philippas (2009)).

Some others found performance persistence, but only in short-term (monthly and quarterly) (Agarwaland Naik, 2000) which seems that on a yearly basis, the funds' performance persistence vanished. However, if Elton et al. (1996) and Drooms and Walker (2001) found past performance persistence for three years (nonetheless evidence beyond that period), Goetzmann, William N. and Roger G. Ibbotson, (1994) are positive on future persistence of funds and support for the conventional wisdom that a fund manager's background impact future performance. This thesis explores, measures and compares the performance of equity mutual fund between Luxembourg UCITS and Thai Non-UCITS Funds focusing only on open-ended Thai equity invested funds during 5-year period from 2013-2018; through econometric and statistical analysis.

In short, the paper is structured into the following sections: introduction section 1, the purpose in section 2; the overview of the Asia-Thai and UCITS-Luxembourg mutual fund markets in section 3; the objectives and contributions in section 4-5; the hypotheses in section 6; the literature review in section 7; the data and methodology in section 8-9. features and estimation models on efficiency and persistence. Section 10 shows the results of the empirical analysis of efficiency and persistence and the relationship between performance indicators and DPEI.

4. PURPOSE

We have intended to evaluate the Thai equity Mutual Funds performance as opposed to EU-UCITS fund performance, investing only in the Thai equity market. We also study their performance persistence and robustness. "Performance Persistence" generally refers to the aptitude of fund managers to generate persistent

and superior returns above the market returns as long as the similar fund strategy and allocation such as Thai equity funds are employed consistently over time. We predict that consistent outperformance or performance persistence of Thai equity funds are happening by endogenous skills of fund managers as market timing but also with exogenous factors as described into Morningstar fund characteristics such as fund size, benchmark-adjusted returns, which are possible factors of past and future persistent performance.

In this study, we are also identifying the existence of repeat winners and ensuring the robustness of our findings. At our best knowledge, there are no studies focusing on the comparison of equity mutual fund performance, UCITS and Non-UCITS Funds focusing only on open-ended Thai equity funds during 5 years period from 2013-2018. Therefore, since we have a clear hypothesis, we use a deductive approach (Robson, 2002) which involves a testable affiliation between at least two variables and ends with possible acceptance of the hypothesis (Saunders, M., Lewis, P., and Thornhill, A.,2016).

After reviewing theories and findings of others in order to clearly identify problems, we collect quantitative data, including performance determinants such as average return, volatility, timing ability, fund size, benchmarks, as well as Morningstar fund descriptors comprising Blend, Value, Growth, Log net asset value, Expense ratio and repeat performers: winners/losers; with significant sample size. Consequently, we hypothesize that the fund performance persistence of Thai equity funds is outperforming Luxembourg – UCITS invested in Thai equity and might conclude that some determinants of performance persistence at the fund and at country level have similarity, but also important differences which must be demonstrated.

5. MUTUAL FUND TARGET MARKETS

Over the last decades, the mutual fund industry all around the globe is growing substantially and becoming more and more crucial. Many authors, starting with Sharpe (1966), have discussed the performance of Mutual Funds worldwide. Although most of the analyses focused on the U.S. Mutual Funds industry, there

are also papers that studied mutual fund performance elsewhere in the world. Our study focuses on invested Thai equity fund. Generally, when investors seeking to allocate money to Thai equity funds, they will face a choice between investing via global asset management companies (for example, through a regulated Luxembourg UCITS) or investing through a Thai equity mutual fund via Thai banks or local asset management companies investing in the same type of Thai target securities. The choice of our study on Thai Equity Mutual Funds is built on the following market trends:

South-Asia vs. Thai vs. Luxembourg

Why Southeast Asia financial markets?

The gains from stock market rallies in 2017 are expected to spill over into 2018. By the end of December 2017, the MSCI All Country Asia Pacific Index hit 28.7% in returns, outperforming the MSCI All-Country World Index's 21.6% (PineBridge Investments-International Investment-, 2017).

Southeast Asia can broadly be divided into two groups of countries, based on the development of their asset management industries and the size of their middle class i.e – developed Asia with Hong Kong, Singapore, Taiwan and Korea and emerging Asia with China, Indonesia, Malaysia and Thailand (IPE- Investment Pensions Europe, 2013). Southeast Asia consists of $2trn (€1.5trn) of offshore AUM (Asset Under Management), mainly distributed in Hong Kong and Singapore, $1trn of domestic fund AUM and $2.5trn (not all third-party managed) of institutional assets concentrated among a few pension and sovereign wealth funds. (IPE-Investment Pensions Europe, 2013).

There are opportunities across the region to create new Southeast Asia cross-border funds frameworks such as ASEAN Collective Investment Scheme (Asia Region Funds Passport (ARFP), estimated at US $208 billion (Cerulli Associates, 2017). For instance, Ken Yap forecasts 13% annual growth in Asia mutual fund assets for the next five years. (Cerulli Associates, 2017). In the coming years, Asia's

highest growth in assets under management (AUM) is most likely to come from emerging Asia: China, Indonesia, Malaysia, and Thailand (Fitch Ratings, 2017). Levels of fund investment make up 5% of total financial assets, compared with 15% in the West, according to the Economist Intelligence Unit and Boston Consulting (2013).

Thailand's growth is expected to be at 3.6%, from the 2.9% average growth between 2011 and 2015. Recent regulations easing investment and trade should bring additional momentum (OECD, 2017). The asset management industry in Thailand has changed and shifted away from a fixed-income-driven core to equity markets. Thai investors are investing more and more on foreign funds to benefits of diversification. (World Finance Magazine, 2017).

Thailand's mutual fund industry raised 7%, or 300 billion baht (US$9.56 billion) through the first nine months of 2017, driven by gains in funds that invest abroad. (Asia Asset Management magazine, 2017).

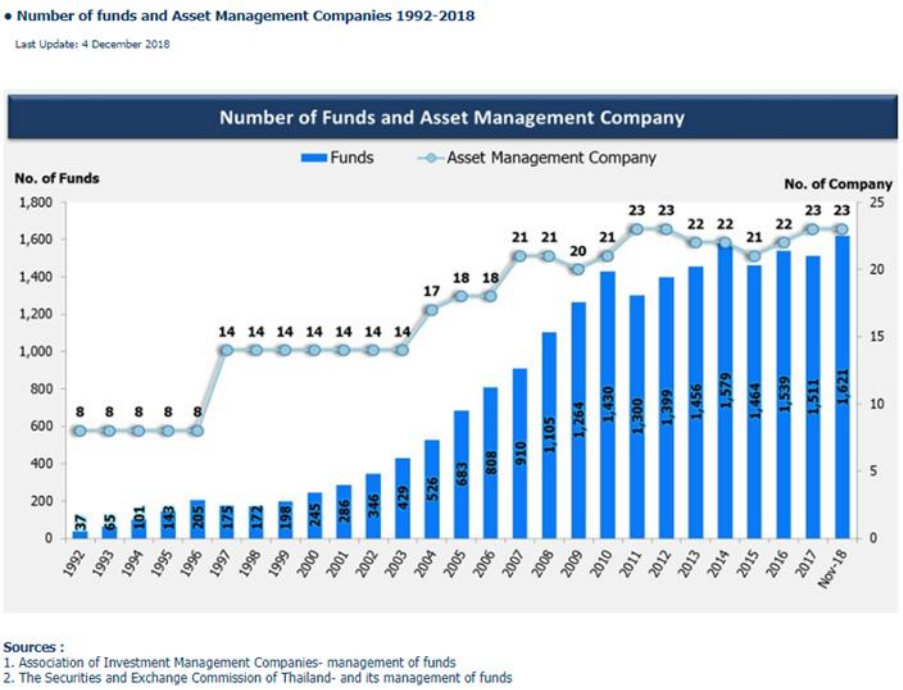
The Thai industry's AUM extended from 4.22 trillion baht to 4.52 trillion baht between January and September 2017. The Bank of Thailand's (BoT) 2018, notes that most of the progress came from foreign investment funds (FIFs) (Asia Asset Management magazine, 2017).

Assets in Thailand Mutual Funds grew by 12.5% in 2017, of which 11% can be attributed to net new inflows, according to estimated fund flow data from Morningstar. Total assets held in Mutual Funds amounted to THB 4.14trn ($132bn) at the end of 2018. The net inflows during the year added up to THB 403.6bn ($12.8bn). (SEC-2017).

For the year 2020, it is estimated that the value of mutual assets under management in Thailand will be worth 189 billion U.S. dollar (Statista, 2017).

Table1. Trends in the number of Thai funds and Thai management companies

This table shows that (for the observed period) the number of Management companies and a number of funds are constant +/- 23, but AUM is growing up to164 billion USD (AIMC, 2018).



Why Luxembourg UCITS Funds investing in Thai Market?

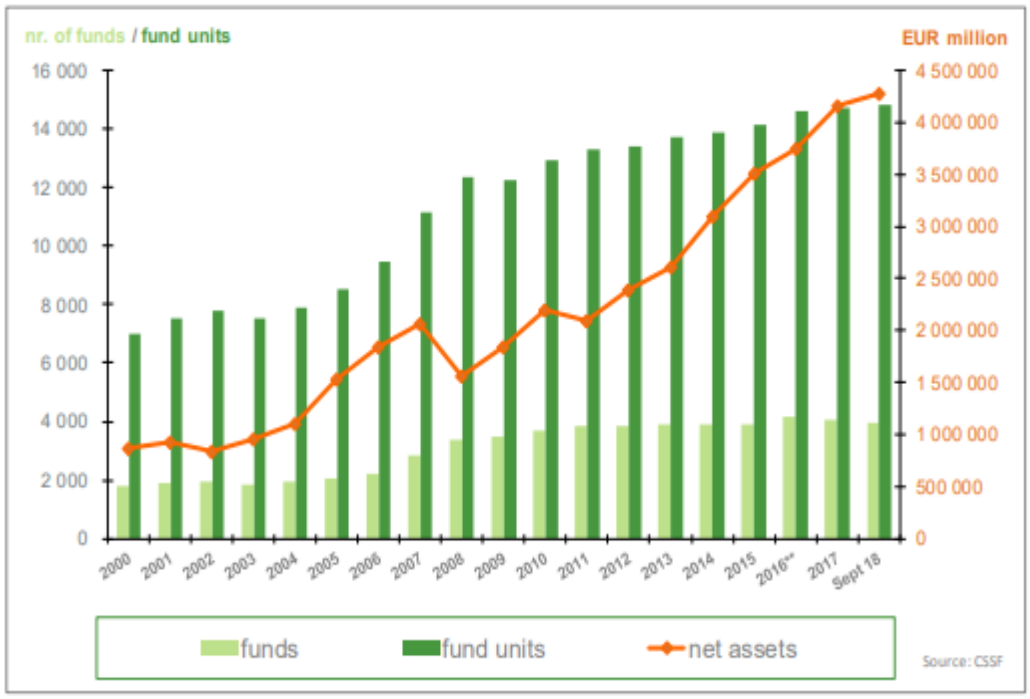
UCITS (Undertakings for Collective Investment in Transferable Securities) and NON-UCITS such as ASEAN (Association of Southeast Asian Nations) Mutual Funds play an important role in the Southeast capital market. With 75% of UCITS funds distributed internationally, Luxembourg is known as a worldwide hub for cross-border investment funds offering Southeast Asia asset managers a compliant fund distribution platform.

Asia represents more than $200bn of assets under management in terms of UCITS funds, more than 5 percent of the global total. Around 1,200 separate UCITS funds are offered and authorized in the Southeast region (FT,2017). After more than 25 years, UCITS still is the most used cross-border fund product in the Southeast

region. But if UCITS have embraced more than 40% of net sales into UCITS funds, that situation may be about to change due to the Asean-CIS's future competition.

Table 2. Trends of Luxembourg AUM:

This table shows that (for the observed period) the number of funds is growing to reach 4,279 billion EUR for 16,000 funds (Alfi-CSSF,2018).



More Asia native cross-border fund frameworks such as NON-UCITS Collective Investment Scheme – are targeting a fund market estimated at US $208 billion - (Asia Region Funds Passport - ARFP) (Cerulli Associates, 2017). EU UCITS fund with its requirements continually being enhanced from investor protection and regulatory perspective remains the "gold standard" for cross-border funds around the world. (Asia Asset Management magazine, 2018). UCITS Funds in Thai market represents +/-$775m.(SEC-Thai,2017).

6. OBJECTIVES

The main objective of this thesis is to investigate and compare the performance of local Thai equity fund to Luxembourg equity fund investing in the Thai equity market. The second objective of this study is upon the issue of mutual fund performance persistence of the above two countries during 2013 and 2018, by using performance of « repeat performers» winners/losers model via CPR- cross-product ratio. The third aim of the study is to examine the tests of robustness and effectiveness of Luxembourg and Thai fund managers by using DEA/DPEI.

7. CONTRIBUTIONS OF THE STUDY

This thesis makes several contributions to the literature, fund professionals and investors focusing on the Thai equity market. There is still an absence of evidence and information about the performance persistence as detected in the US fund industry in papers such as Carhart (1997), Fama and French (2010) and Berk and van Binsbergen (2015); most of the results of the papers which direct their attention on long-term equity fund performance persistence issues have not been conclusive.

At our best knowledge, there are no papers focusing on the comparison of equity mutual fund performance persistence between Luxembourg UCITS (Undertakings for Collective Investment in Transferable Securities) and Thai Non-UCITS Funds investing only in the Thai equity market and during a 5 year period from 2013-2018.

The results of this study will be useful to investigate fund characteristics that contribute to the fund performance and to the literature about the difference of performance between local and foreigners investing in the same capital market. Furthermore, this thesis applies a set of more performance and persistence measurement integrating the following approach:

Volatility tests- CAPM Beta.

Performance tests-risk-adjusted performance measures including Sharpe ratio, Jensen Alphas, Treynor ratio.

Critical Fund determinant tests: Market timing's Treynor-Mazuy and fund size characteristics.

Fund Persistence test: Repeat Performers- winners/losers via CPR- Cross-product ratio; concentrating only on open-ended invested Thai equity funds.

Robustness Test: DEA / portfolio efficiency index (DPEI) has a positive significant effect in explaining the robustness of fund performance return.

8. HYPOTHESES

As reported by Wermers (2000), Coval and Moskowitz (2001), Jan and Hung (2003) and Papadamou and Stephanidesz (2004) the returns of Mutual Funds can be foreseen on the basis of performance indicators such as performance persistence, turnover, expense ratio, asset size, load fee, investment style, mutual fund manager and ownership.

Reviewing the literature on mutual fund performance persistence reveals mixed findings. In particular, studies of mutual fund performance in Luxembourg and South-Asia are still narrow in scope. We examine the performance of UCITS open-end fund managers (Luxembourg) relative to Thai open-end fund (locals) investing in Thai equities.

We expect to find which determinants have a profound effect on the performance persistence over 5-year period on both Luxembourg UCITS and Thai equity Mutual Funds investing in the Thai equity market. Therefore, the main hypotheses in this paper are as follows:

Hypothesis I

Risk-Adjusted Return tests including Sharpe, Jensen Alphas, CAPM Beta, Treynor ratio.

H0: There is no difference in performance between UCITS vs Thai equity funds.

Reviewing the literature on risk-adjusted return as well as Jensen (1968), Grinblatt and Titman (1989) and Malkiel (1995), Dybvig and Ross (1985) and Kothari and Warner (2001) on Sharpe ratio, Jensen Alphas, CAPM Beta, Treynor ratio which have positive significant result in defining fund performance return. Our first hypothesis is to re-checked whether portfolios' risk-adjusted return to fund returns and performance is impacted by those determinants and has the ability to identify differences between Luxembourg - UCITS and Thai funds' investment skills.

Hypothesis II

Critical fund performance dynamic measures, i.e, "Market Timing, Fund Size",

HO: There is no relationship of fund conditional measures to the performance of UCIT and Thai equity fund.

Reviewing the literature as well as Brown (1999), Brown and Goetzmann (1997), Elton,Gruber and Goetzmann and Ibbotson (1994), note that future of performance may be due to the style of funds rather than skill and that the Morningstar ratings have been underscored (Blume,1998 and Sharpe,1998).

We hypothesized that managers managed funds using market timing skills should have superior performance.

Hypothesis III

Persistence where repeat performers either winners/losers have a positive significant effect in explaining fund performance return.

HO: There is no performance persistence of both Luxembourg UCITS and Thai equity funds.

Reviewing the literature, only a few papers try to relay performance to fund determinants. The literature on performance persistence suggests with Hendricks, Pateland Zeckhauser (1993), Goetzmann and Ibbotson (1994) that winning funds ("winners") over a reference period are better performing in the following period than in the worse performing group ("losers"). According to Carhart (1997), Chen et al., (2000), positive persistence is in the Mutual Funds but only for one year or less. However, Elton et al. (1996) and Drooms and Walker (2001) found the evidence of positive persistence up to three years but no evidence of the positive persistence was there beyond that period. Looking at more recent studies, the results are still somewhat contradictory. Whereas Avramov and Wermers (2006) find some evidence of performance persistence Fama and French (2008) do not. Our study applies the ''winner-winner, winner-loser'' methodology developed by Brown and Goetzmann (2001), Goetzmann and Ibbotson and Malkiel (1994). According to Brown et al. (1992), Brown and Goetzmann "Performance persistence" (1995) and in relation with Thai equity Mutual Funds, we study whether the best performing funds in the past period continue to perform well in the future period and inversely whether the worst funds in the past period continue to perform poorly in the future period.

Hypothesis IV

Robustness - Data Portfolio Efficiency index (DPEI)

HO: There is no relation of risk and transaction cost to performance of both UCITS and Thai equity fund.

We review the literature as well as papers that apply Data Envelopment Analysis (DEA) a non-parametric methodology used for productivity functions, Charnes (1978) and an explication to evaluate the performance of institutional portfolios, e.g Eling (2006),). We examine our hypothesis on DPEI index developed by Murthi, Choi and Desai (1997). The DPEI index reflects the excess return as output and the standard deviation of the return and some transaction costs as inputs. In the DPEI index, these transaction costs are amalgamated in some determinants as such turnover, loads and expense ratio indicators. Hence, we compare the DPEI robustness index to the static performance indicators such as Jensen's alpha, Treynor and Sharpe index and we also look at the importance of the risk and transaction cost to DPEI performance.

9. LITTERATURE REVIEW

Cross country literature review

While many papers have examined Mutual Funds from different countries, few have raised the question of performance comparison among countries and whether local managers do better than foreigners. There is still a deficiency of information on the performance comparison if Mutual Funds with a local fund manager perform better than international funds (with a fund manager abroad) to invest in the same types of shares and companies. Some data indicate that local investors overperformed foreigners: Shukla and Van Inwegen (1995) in the United States; Choe et al. (2005) in Korea; Dvorak (2005) in Indonesia and Teo (2009) in Asia.

Recently, a number of studies were conducted to explain differences in performance between residents and foreigners depending on the type of securities; Dahlquist and Robertsson (2001) and Kang and Stulz (1997).

According to this hypothesis, others found that foreign investors who participate in a market are better informed than local investors: Grinblatt and Keloharju (2000) in Finland; Froot et al. (2001); as well as for emerging markets;

Huang and Shiu (2005) in Taiwan; Bailey et al. (2007) in Singapore and Thailand; and Froot and Chris (2008) in closed funds from 25 countries.

Opposing this local information benefit hypothesis, Albuquerque et al. (2009) develop a theory that foreign investors have private information that is beneficial for global trading in countries at the same time. Sophisticated American investors can have a special advantage in foreign markets on local investors through global private information they have acquired in the US market. Brennan and CAO (1997), Covaal and Moscowitz (2001) and Hau (2001). Brennan and CAO (1997) examined, for example, U.S. funds in emerging markets and found solid evidence that U.S. investments are certainly linked with local market returns in many countries. However other authors found no modification between the performance of local vs. foreign investors: Kang and Stulz (1997) in Japan and Seasholes and Zhu (2010) using individual investor portfolios.

In short, the results are mixed and they do not show evidence on the question of whether local or foreign investors have an informational advantage.

Fund Performance literature review

Academic literature shows that various statistical tools and techniques have been used to evaluate the performance of Mutual Funds and to study their relationship with attributes. Traditional performance measures have been suggested by Jensen (1986), Treynor (1965), Sharpe (1966), Sharpe and Lintner (1964). The common problem with these measures is that they assume that portfolio risk levels are constant over time and therefore focus solely on the selection of managerial safety. However, many studies have shown that Mutual Funds change the risk level of their portfolios over time and are therefore engaged in the market calendar (see, for example, Miller and Gresis (1980) and Bos and Newbold (1984)). In this light, traditional measurements can give an inaccurate measure of performance.

In particular, researchers have shown that the Jensen Alpha will be skewed downward if the manager uses information on the timing of the higher market (theoretical evidence is provided by Dybvig and Ross (1985). Grinblatt and Titmann

(1989) and an Empirical "demonstration" is provided by Henriksson (1984), Lee and Rahman (1990). The first document that analyses the performance of the European Mutual Funds as a whole is Schweitzer (2002) and BAM (2002), whose paper is an overview of the European mutual fund industry, find a net positive alpha for all European countries studied, except for Germany. However, the majority of the Alphas were insignificantly different from zero, with the exception of the UK which was the only country to significantly outperform the market. Ferreira et al. (2008), whose sampling period was 1997-2007, focus their study on the Determinants of mutual fund performance worldwide. For each country of their study (27 countries), they calculated the returns of average national Mutual Funds and the Alphas. They find an average fund yield of 3.01% per quarter and a negative alpha for about 50% of the countries. Later, Garcia-Vidal (2012) focuses on the performance and persistence of European Mutual Funds using a sample of 1050 active funds from the six largest European markets. The sampling period is 1988-2010.

According to the document, the average performance calculated as Jensen's alpha is negative for all European countries at any time. It differs from the discovery of many authors such as BAMS (2002) who find a positive alpha for all European countries except German. With respect to Morningstar's performance measures, many types of research are investigating Morningstar's indicator. Christopher R. Blake and Matthew R. Morey (1999) study the relationship between Morningstar ratings and fund performance Common investment that also compares the predictive Morningstar rating system with others predictors such as historical average monthly reports. Therefore Morningstar's low ratings generally mean poor performance. Morningstar ratings seem only somewhat better than other predictors in terms of forecasting the future fund performance. Paul Gerrans (2006) studies on the Morningstar rating and the return on future funds in Australia also explain their relationship in a particular environment in the Australian market.

Diane del Guercio and Paula A. TKAC (2007) study on the form of effect on the flow of Mutual Funds that Morningstar “star rating” changes vs. allocation decisions of Retail mutual fund investors. They found that the discrete “star rating” change notation (not the modification in the underlying performance measures) drive the flow. Rashiqa Kamal (2013), in order to best-fit alpha and Sharpe ratio

indicators, used his alpha to illustrate the correlation between Morningstar “star rating” and the fund's future performance.

Portfolio volatility “Beta” literature review

Based on Markowitz work, Sharpe (1963, 1964) and Lintner (1965) suggested that all AUM can govern the risk and return of the entire portfolio. They established a general equilibrium model, the capital-asset pricing model (CAPM), assuming the ability of investors to invest funds at a common risk–free rate and to borrow funds at the same rate in order to determine the explicit contribution of each asset to the whole portfolio risk. Since, Beta measures the volatility, or systematic risk, of the portfolio in comparison to the total market.

Therefore, Beta can indicate a portfolio's market risk in comparison to the total market, since Beta equals the covariance of the asset with the market, divided by the variance of the market. Beta can measure the sensitivity of the asset and can be considered as a proxy for risk.

Performance “Alphas” literature review

Based on “The Performance Of Mutual Funds In The Period 1945-1964”, Jensen (1967), the Jensen's alpha measure, founded on the theory of the pricing of capital assets by Sharpe (1964), Lintner (1965) and Treynor (1965). Given the portfolio's beta and the average market, the return is a risk-adjusted performance representing the mean return on a portfolio, above or below that predicted by the capital asset pricing model (CAPM).

In fact, Jensen’s alpha attempts to clarify whether an investment has performed better or worse than its beta value. For example, a positive Jensen’s alpha advocates the fund manager’s selection skill has carried greater risk-adjusted returns.

Jensen measure (Jensen’s α) is greater to the Sharpe and Treynor measures for different reasons, including (i) the risk-adjusted excess return is measured in percentage, (ii) the measure is estimated from an asset pricing regression with

statistical significance, (iii) it can be measured relative to a benchmark. But they are some controversies, Eugene Fama (2012) argues that any portfolio manager's excess returns are originated from chance rather than skill; since the market has already been priced, to be "efficient". Some others guess that Jensen's alpha doesn't take the portfolio's volatility and drawdowns, only the expected return.

Alpha in conjunction with the Sharpe ratio and the Treynor ratio should be considered as a strong indicator to evaluate mutual fund and portfolio manager performance.

Performance "Sharpe ratio" literature review

Based on Sharpe, W. F. (1966). "Mutual Fund Performance", who recommended a measure for the performance of Mutual Funds as well as the term reward-to-variability ratio to measure the return of an investment relative to its volatility, adjusting for the underlying cost of capital; some other authors have finalized the original version of the Sharpe Index: Radcliff (1990) and Haugen [1993]), the Sharpe Measure (Bodie, Kane, and Marcus (1993), Elton and Gruber (1991) and Reilly (1989), or the Sharpe Ratio (Morningstar (1993)); and most of the literature in financial economics reports the issue of performance measurement in general and the ratio of Sharpe in specific.

In respect to the average variance theory settled by Markowitz (1952) and the capital pricing model developed by Sharpe (1964) and Lintner (1965), portfolios with the highest Sharpe ratio are mean-variance efficiencies.

According to Leland (1999), the Sharpe ratio can be evaluated under unsymmetrical distribution conditions and with derivatives by Spurgin (2001) and Goetzmann, Ingersoll, Spiegeland Welch (2002).

Performance “Treynor ratio” literature review

Established by Jack Treynor, the Treynor ratio (also known as the "volatility reward ratio") tries to measure how an investment has to counterweight its investors given its level of risk. Treynor, J., 1965. The Treynor report is a measure of efficiency using the relationship between annualized risk-adjusted return and risk. Distinct from the Sharpe ratio, the Treynor report uses the "market" (beta) risk rather than the total risk (standard deviation). A good yield is measured by a high ratio. Treynor, J. L.and Mazuy, K. K. 1966. The Treynor ratio is based on the beta which measures the sensitivity of investment to market movements, in order to gauge the risks.

The other principle of the Treynor ratio is that the systematic risk- (the beta)- should be disadvantaged since it cannot be diversified. However, the ratios which include the beta (the Treynor ratio), can be better adapted to the short-term performance comparison.

A number of long-term performance studies of stock markets – and a study of Buffett's file at Berkshire Hathaway –demonstrated that low beta stocks can perform better than high beta vs. Risk-adjusted or Raw Beta (historical Beta, based on the relationship between the security's return and the index). The Adjusted Beta is an estimate of a security's future Beta. unadjusted Performance. In fact, the linear relationship between higher beta versions and higher long-term returns may not bring evidence.

“Market timing” Treynor-Mazuy literature review

In accordance with Elton and Gruber (2013), market timing measures the fund manager changing sensitivity to a determinant or a factor over time in relation to manager’s belief about predictive return on that determinant or factor in the next period. According to Balsmeier and Broussard (2003), Market timing is shifting funds between a market index portfolio and a treasury bills, whether the total market

is anticipated to outperform the treasury bill or safe asset. Two different methods of measuring timing ability are quadratic equation model suggested by Treynor and Mazuy (1966) and Dummy variable regression by Henriksson and Merton (1981).

Some multi-factor extensions of the original market model used by Treynor and Mazuy can be derived from Jensen's alpha as evidenced in the comprehensive study by Kothari and Warner (2001). However, the quadratic regression of Treynor and Mazuy (1966) model is generally used to evaluating performance return to segregate market timing skills of CAPM. This model is superior to Jensen's Alpha Model since it exists a linear relation between market risk and portfolio return.

"Size vs. Performance" "literature review

So far, studies about the relationship between size and fund performance have not clear consensus and evidence showing if performance is affected positively or negatively by the size of mutual funds. Ciccotello and Grant (1996) proposed that smaller funds tend to outperform larger funds in relation to growth funds and long-term growth funds; whereas other results from Chen, Hong, Huang and Kubik (2004) argue that smaller funds perform better than larger funds since they can easily trade and modify their positions without affecting the market price. Other studies advocate that larger funds display better performance due because those small funds do not display all information, such as expenses. In addition, numerous literature found the negative impact of fund size on its performance. Berk and Green (2004). They proposed that fund flow is closely related to past fund performance regardless of its persistence.

Another explanation of the negative connection between fund size and return is about liquidity concern. Chen et. al. (2004) provided the evidence to show that the returns have been lower for funds with a larger size. On the opposite, Elton, Gruber, and Blake (2012) found that fund size has no impact on future fund performance. Moreover, different markets like Thai and UCITS may show varied results for the

relationship between size and performance where national differences seem to be smaller than the international differences. Our goal in this paper is to test the key assumption in the Berk-Green model by measuring the causal impact of fund size on fund performance.

Fund performance persistence literature review

Some studies show that the return of equity Funds persists from one period to the next. Elton and Gruber (1989) cite a study by the 1971 Securities and Exchange Commission (SEC) found a comparable persistence in risk-adjusted mutual fund rankings. Lehmann and Modest (1987) show evidence of persistent mutual fund alphas and Grinblatt and Titman (1988, 1992) report that the impact is statistically significant. Goetzmann and Ibbotson (1994) conclude that the persistence of performance is present in the gross and risk-adjusted yields of stock funds at observation intervals of one month to three years.

In a comprehensive Growth-fund study, Hendricks, Pateland Zeckhauser (1993) demonstrate that the persistence of performance is robust to different risk-adjustment measures. These studies provide strong support for the understanding that a fund manager's background contains key information about future performance. Some like Goetzmann, William N.and Roger G. Ibbotson, 1994, “do the winners repeat? Mutual fund performance trends, Journal of Portfolio Management 20, 9-17, are positive on the persistence of funds. Though Droms and Walker (2001) who examined the persistence of mutual fund declarations, expenditure ratios and Turnover rate of 151 share funds for the period 1971 – 1990 using multivariate models, they found no long-term persistence of returns, turnover rates or expenditures, they found strong evidence of short-term persistence for periods one, two and three years.

Brown and Goetzmann (1995) analyzed the surviving funds and not surviving over a period of 1976-1988 and found evidence of persistence of performance, especially in the loss of Mutual Funds. Hendricks et al. (1993) studied 165 No-Load growth-based Mutual Funds for 1974 – 1988; they measured the

degree to which the relative performance of these funds can be predicted and found the persistence of positive yields in yields in shorter periods. Wermers (1997) analyzed database on Mutual Funds for the period from December 31, 1974, to 1994; the results of its study confirmed the effects of momentum on stock yields and resolved that performance persistence was primarily in usage for active momentum investment strategies.

However, Christensen (2005) analyzed 47 Danish Mutual Funds for a period from January 1996 to June 2003 by applying parametric and non-parametric methods and concluded that the returns of Danish Mutual Funds were not persistent. Kaur A. (2011) tested 37 equity-based mutual fund plans for the period of eight years, from April 1, 2003, to March 31, 2011, using parametric and non-parametric techniques, found a little evidence of persistence of performance in mutual fund schemes sample. In short, the results are mixed on the question of whether short or long-term performance is persistent. Nevertheless, this thesis is based on the "win-win-win-lose" methodology developed by Brown and Goetzmann (1994), Goetzmann and Ibbotson and Makiel (1995) to test the persistence of medium-term performance in International Mutual Funds over the 5-year period from 2013 to 2018.

Our CPR methodology categorizes all the Thai invested funds of the sample in two groups; winners and losers. Winner's group must present a performance higher than the median of the sample. In contrast, the losers group will have a performance lower than the median.

This CPR method associates the consecutive fund winner's during two periods, designated WW. The consecutive fund loser's during two periods, represented as LL. Therefore, there is a possibility that a fund classified as winner become loser, (or vice versa). Funds will be given as WL (from being a winner to being a loser) and on the other hand, as LW (being a loser to being a winner).

Fund performance « robustness / DEA / portfolio efficiency index (DPEI)» literature review

The technique called Data envelopment analysis (DEA), which is widely used in operational research to calculate the relative measures of fund performance,

is used in terms of robustness. Charnes et al. (1978), Murthi et al. (1997), Banker and Maindiratta (1986), Banker and Thrall (1992); all of them argue that the DEA's mathematical programming approach is a more robust procedure for estimating an effective border than approaches Econometric. Also, in terms of Mutual fund efficiency and portfolio performance robustness measurement, we take part of the method of "A non-parametric approach" B.P.S. Murthi A, Yoon K. Choi A, Preyas Desai (1997) for estimating production frontiers and evaluating the efficiency of a sample of production units;

Murthi et al. (1997) highlight several shortcomings of the traditional approach and propose an index to measure performance, in which a relationship between performance and the expense ratio, transaction volume, risks, and costs is established. This efficiency index is known as the Portfolio DEA efficiency index (DPEI). In addition, this index is useful in the analysis of Mutual Funds in the context of its hypothetical efficiency in mean-variance space. This DPEI method assesses the performance of the Mutual Funds and compares the results with traditional indices of performance which means that the Mutual Funds are all approximately mean-variance efficient.

DPEI considers operational expenses, management fees and purchase and sale costs incurred by the management, which are costs that have already been deduced from the net return. In the DPEI index, subscription and redemption fees are part of the transaction costs and are born together in the turnover, loads and expense ratio indicators.

10. DATA

Based on Ravi K. Shukla and Gregory B. van Inwegen's paper on "Do Locals Perform Better Than Foreigners?"(1995) our sample selection consists of active Thai and Luxembourg open-end mutual funds investing mostly in Thai equity markets that meet the following criteria: (1) they have continuous monthly returns from 2012:5 to 2018:4; (2) they invest more than 90% of their assets in Thai equity securities; (3)

they classify themselves as "growth" and “ blend funds” (Morningstar); and returns include reinvested distributions, while both capital gains/dividends before taxes and fund expenses are deducted. Luxembourg and Thai fund returns are calculated in US dollars.

For this paper, we use monthly data from Morningstar, MSCI Equity Indexes, Fund annual reports, Thailand 3-months treasury bills (risk-free rate). This paper focuses on all Luxembourg and Thai equity funds investing at least 90% of their entire portfolio in the Thai market.

The UCITS / Luxembourg funds selection criteria are met by 20 funds open-ended actively invested into the Thai equity market (portfolio >90%) and the Thai equity fund sample consists of monthly returns of 151 open-ended actively managed Thai equity stocks or funds (portfolio >90%).

For each fund, we collect most fund data (88 criteria) from “Morningstar Direct” including Fund Age, Expenses, Loads, Past Performance and other Morningstar fund characteristics (Appendix 3). We use 3-months T-bills as a proxy of the risk-free rate and MSCI Thailand for the market return.

All equity fund styles are also collected and in order to ensure that we have sufficient time-series observations to calculate risk-adjusted performance measures, we impose a minimum of 60 continuous monthly observations for each fund.

Luxembourg fund data

For collecting data on Luxembourg funds, we use Morningstar Direct software allowing us to identify all equity funds whose investment focus is Thai equity.

In addition, we cross-check our information with funds’ management companies and found information either in funds’ prospectuses or funds’ reports. Also, we looked for information on the funds’ manager's profiles on the asset management companies’ sites and information on the companies’ offices.

Luxembourg Fund sample

Relating to UCITS / Luxembourg funds, based on 13.000 Luxembourg funds, we delete the funds that have been mistakenly repeated/with no return data information and/or with portfolio < 90% invested in the Thai equity market.

We finally select, form Morningstar's direct, 20 open-ended actively invested into the Thai equity market with inception date before first quarter 2013 and data are fully available for our consistent tests and analysis (portfolio >90% in the Thai equity market). The period covered by the sample is May 2013- April 2018.

Thai fund data

For collecting data on Thai equity funds we use Morningstar's Direct software allowing us to identify all equity funds whose investment focus is Thai equity. In addition, we complete our information with funds' management companies and found information either in funds' prospectuses or funds' reports. Also, we looked for information on the funds' manager's profiles on the asset management companies' sites and information on the company's offices.

Thai Fund sample

For Thai equity funds, the sample consists of monthly returns of starting with open-ended actively managed Thai equity stocks or funds (portfolio >90%). From 1364 funds, we remove Thai funds mistakenly repeated/with no return data information and/or with portfolio lower than 90% invested in the Thai equity market. We finally, keep only 151 funds with inception date before first quarter 2013 and data are fully available for our consistent tests and analysis (portfolio > 90%). The period covered by the sample is from May 2013 to April 2018.

Benchmarks

Market performance benchmark is needed to estimate Thai equity invested mutual fund performance in each tested country in this thesis we used the MSCI Thailand data collected from Morningstar direct software as a benchmark of the Thai market return.

Fund characteristics influencing performance / variables

Some restricting issues from fund characteristics can govern the performance persistence of Mutual Funds which are also discussed in the DEA / DPEI section, including the followings:

Systematic risk

When analyzing the correlation of a fund movement of the market, if we found that a beta of one it means that the fund's price is impeccably in line with its market. Contrary, a beta of less than one means that the return of the security will be less volatile than the return of the market. A beta greater than one shows that the fund's price will be more volatile than the market‘s price.

Fund Size

Berk and Green (2004) argue that more-skilled managers manage more assets but, diseconomies of scale, generate the same expected returns as less-skilled managers.

The causal impact of fund size on performance can be that changes in mutual fund returns can cause discrete movements in Morningstar ratings that can generate, on the other hand, discrete differences in mutual fund size. Fund size may erode performance, for funds that play small-cap stocks. This suggests that liquidity can be a factor for fund performance erosion. Fund size is limited by fund market opportunities. In some cases, big funds must take up larger positions than the optimal capacity in some stocks, while small funds can remain more agile and

allocate their assets to the best ideas. Big funds usually carried extra liquidity which calls for more investments.

Style

There are different styles in which the funds can be managed. In our thesis funds are categorized according to Morningstar equity styles.

Mutual fund style helps both investors and fund managers to effectively diversify their portfolio and select funds based on their risk preference. In terms of performance evaluation, mutual fund style permits to identify the appropriate benchmark. However, some studies disclose that some funds do not trail their style objectives and change often their style to make their performance look better.

Expenses

We try to analyze the relation between the ability to generate persistence performance and the fund expenses charged to investors and asset funds. The expenses covered by the investors of a company include sales fees, management fees, and, other trade fees. A sales fee is paid initially by the investors. The management fee is usually paid annually and is deducted from the fund‘s assets every year.

The transaction fee refers to the fee for buy/sell transactions performed by the fund manager. Commission or brokerage’ fees are paid throughout the year for any rebalancing or switching trades that take place on the portfolio.

From an efficiency point of view, higher expenses should be linked to better performance. Low expense funds may outperform high and very high expense funds.

Turnover

The fund turnover is the number measured as a multiple of times and the value of all transactions (buying, selling) which typically measures the movement of holdings in a fund as a percentage over a one-year period. If a fund has 100% turnover, means that the fund replaces all of its holdings over the year. Moreover, it can be an indication of a fund manager'skills. They have been some controversies among scholars on the issue of whether active and qualified managers actually add honest value to the assets they are managing with (Wermers, 2000). In fact, the skills of a manager to produce turnover successfully should have an important role in the success or failure of a company and on the fund performance.

11. METHODOLOGY

A variety of methods proposed in the literature on Mutual Funds performance is used to compare the performance of local and international funds. More specifically, we apply static or unconditional measures performance indicators (Beta, Sharpe ratio, Treynor ratio, and Jensen's alpha) and dynamic or conditional measures critical performance determinants including market timing, fund size.

Finally, we apply control performance indicators such as CPR-Cross-Product Ratio Goetzmann, William N.and Roger G. Ibbotson, (1994) and Test of « Robustness / DEA / portfolio efficiency index (DPEI)» defined by Murthi et al. (1997). In the interpretation of results, we focus on the comparison of the performance of Thai and Luxembourg UCITS funds investing in Thai funds or stocks.

Performance measurement

We use static or unconditional measures, dynamic or conditional measures, ranking and control test performance for the overall fund performance.

Static or unconditional measures performance indicators

Including some tests of performance “volatility / Beta”, «alphas» relative risk-adjusted performance measure (with reference to a benchmark) unconditional model (by Jensen (1986), Treynor (1965), Sharpe (1966) (eq.1-4).

Test volatility «CAPM Beta» of William Sharpe (1964) and John Lintner *(1965).* The Capital Asset Pricing Model (CAPM) defines the relationship between systematic risk and expected return for assets, particularly invested Thai funds.

Test performance «Jensen’s alphas», or relative risk-adjusted performance measure (with reference to a benchmark).

Test performance “Sharpe» ratio the absolute risk-adjusted performance *measure (without any reference to a benchmark)*

Test performance «Treynor» ratio *the absolute risk-adjusted performance measure (without any reference to a benchmark)*

Dynamic or conditional measures performance indicators

Market timing models Treynor and Mazuy (1966) (eq.5). A quadratic regression of model used return-based approach to segregate market timing skills, based on CAPM, and the assumption of linear relation between market risk and portfolio return: test fund size, an adapted regression of Jensen Alpha on Country / Size. *(eq.6).*

Test of "Market Timing/performance"

We use « Treynor-Mazuy » ratio to measure absolute risk-adjusted performance which gives the excess return.

Test of « fund size effects/performance»

We measure the effect of fund size on performance based on active equity Mutual Funds.

Persistence and robustness indicators

Including a test of «.persistence for repeat performers or winners/losers" via CPR-cross-product ratio *(eq.7)* from Brown and Goetzmann (1995), in order to consider whether the fund given, is a winner or a loser. The test of "robustness" or portfolio efficiency index (DPEI) *(eq.8)* is to compare the DPEI with static or unconditional measures and dynamic or conditional measures performance indicators, within the context of Mutual Funds' performance valuation; from Murthi et al. (1997).

Test of "Persistence" / performance

We measure the performance of « repeat performers» winners/losers via cross-product ratio "CPR".

Test of « Robustness / DEA / portfolio efficiency index (DPEI)»

We relate the DPEI with the traditional Jensen's alpha and the Sharpe index, within the framework of mutual fund performance assessment.

TESTS OF STATIC OR UNCONDITIONAL FUND PERFORMANCE

Test volatility « CAPM Beta»

« CAPM Beta» of William Sharpe (1964) and John Lintner (1965). The Capital Asset Pricing Model (CAPM) defines the relationship between systematic risk and expected return for assets, particularly invested Thai funds. Fund assets whose returns vary more than the market's returns over time may have a beta whose absolute value is greater than 1.0; on the other hand, funds with a beta of 2 have returns that modify by twice the size of the total market.

Q1. "Do Sharpe-Lindner's* CAPM Beta *significantly differentiate Fund Managers' volatility of Luxembourg domiciled UCITS vs. Thailand domiciled open-ended equity funds, investing only in Thai equity stocks?

H0 = There is ***no difference*** *of volatility in terms of portfolio Beta*, between UCITS vs Thailand funds.

H1 = There is **a *difference*** *of volatility in terms of portfolio Beta*, between UCITS vs Thailand funds.

$$\beta = \frac{Cov\,(\overline{R}_p, \overline{R}_{m,})}{Var\,(\overline{R}_m)}$$

(eq.1)

Where $\overline{R}_p$ is the average fund return and $\overline{R}_m$ is the average return on the market.

Test performance « Jensen’s alphas»

The Jensen's alpha measure is a risk-adjusted performance metric that signifies the average return on a fund, above or below that foreseen by the capital asset pricing model (CAPM), given the portfolio's or investment's beta and the average market return (with reference to a benchmark).

As well-defined by Jensen (1969), alpha is the difference between the mean return earned by a portfolio and the equilibrium return that should have been earned by the portfolio given the market conditions and the risk of the portfolio. A positive alpha shows that the mutual fund manager generates more return to be compensated for the risk over the year. The Jensen alpha is calculated as the intercept in the regression of portfolio excess returns on market excess returns. A positive alpha figure shows the fund has performed better than its beta would predict.

Contrary, a negative alpha indicates the fund's underperformance, given the expectations established by the fund's beta. In addition, a negative alpha might result from the expenses that are in a fund's returns, but not in the returns of its index. Alpha can be used to directly measure the value added or subtracted by a fund's manager. As Alpha hang on two factors: (i) the market risk, as measured by beta, (ii) the linear relationship between the fund and its index, measured by R-squared.

. Using Jensen's measure, we can determine if a Thai invested fund is earning the proper return for its level of risk. When the value is positive, Jensen's alpha means that a fund manager has "beat the market".

Q2. "Do Jensen Alphas significantly differentiate Fund managers performance of Luxembourg domiciled UCITS vs. Thailand domiciled open-ended equity funds, investing only in Thai equity stocks?

H0 = There is ***no difference of performance*** in terms of Jensen alphas**,** between UCITS vs. Thai local fund managers

H1 = There is ***a difference of performance*** in terms of Jensen alphas**,** between UCITS vs. Thai local fund managers

Jensen's alpha is calculated to determine the abnormal return of the fund over the theoretical expected return. It is the intercept in the regression of fund excess returns on market excess returns and the risk-free rate:

$$JA_\rho = \overline{R}_\rho - (\overline{R}_f + \beta_p(\overline{R}_m - \overline{R}_f))$$

(eq.2)

where *JAp* is the Jensen's measure for portfolio, $\overline{R}_p$ the fund return, $\overline{R}_m$ is the average return on the market**,** $\overline{R}_f$= the risk-free rate of return**,** β = the beta of the investment (or volatility relative to market volatility).

Since Jensen's alpha adjusts the return measure of a fund to account for beta-exposure risk, the beta should specify how strictly an investment follows the movements of financial markets. A beta of more than 1 means a fund is more volatile than the market which carries more levels of risk and consequently greater losses (or gains.

Test performance « Sharpe» ratio

The concept of the Sharp ratio calculation is linked to the Capital Asset Pricing Model (CAPM) that helps to find out what is the expected return according to its inherent risk level. The Sharpe ratio formula measures the excess return (or risk premium) per unit of deviation in a risky investment, compared to its risk-free rate of volatility per unit. It is calculated as a variance of expected portfolio return and risk-free rate divided by the standard deviation of the portfolio (Sharpe 1994). More a higher Sharpe metric is better than a lower one, better investment decisions are without being influenced by its risk associated.

Q3. "Does a risk/return Sharpe ratio significantly differentiate Fund managers performance of Luxembourg domiciled UCITS vs. Thailand domiciled open-ended equity funds, investing only in Thai equity stocks?

H0 = There is ***no difference in the Sharpe ratio*** between UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

H1 = There is ***a difference of Sharpe ratio*** between UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

The Sharpe indices measure risk-adjusted return performance. Generally, the Sharpe Ratio Grading Thresholds is <1: Not Good, 1 – 1.99: Ok 2 – 2.99: very Good >3: Extraordinary; while higher rates of risk may have a metric of 1, 2, or 3. Any Sharpe metric equal to or greater than 3 is considered as a good investment. A metric of 1, 2, or 3 expresses what additional return we need for holding a risky investment over a risk-free investment.

Apply to our paper, expected a return and standard deviation will depend on the preferred scale and any given desired level of risk, for instance, Thai fund invested A will provide higher expected return than one fund B if the Sharpe Ratio of A exceeds that of B. One expectation of this calculation is that an Invested Thai fund going in "zero risks" investments, such as the buying Treasury bills (since expected return is the risk-free rate), should have a Sharpe ratio of zero. As a metric, the higher the value of the Sharpe ratio, the more striking the risk-adjusted return.

Since the Sharpe ratio formula is the tangency point on the red curve, we calculate the average return beyond the risk-free rate of volatility by dividing the mean excess return of a fund by the standard deviation of its returns. The components of the formula are the Expected on the investment in months and years, to reach a standard value, the total return is generally annualized for uniformity; Risk-free Return: a benchmark that the level of risk is compared against; Standard Deviation: this value designates by how much is away from the mean and is calculated as the square root of the variance.

$$SI_p = \frac{\overline{R}_p - \overline{R}_f}{\sigma_p}$$

(eq.3)

where $\overline{R}_p$ is the average return of the portfolio, $\overline{R}_f$ = the best available rate of return of a risk-free security, σ_p = the standard deviation of the portfolio.

Test performance « Treynor » ratio

The volatility model developed by Jack L. Treynor, [1965] is a reward-to-volatility ratio measurement which relays excess return over the risk-free rate vs. the additional risk taken (only systematic risk) contrary to the Sharpe Ratio which utilizes total risk (standard deviation).

Performance efficiency is evaluated by a high ratio, for instance, a "good" Thai invested fund will have a higher Treynor ratio than the Indexes, as it delivers higher-returns (on a risk-adjusted basis) than the average fund market.

Since the Treynor ratio depends on beta, which measures an investment's fund sensitivity to market activities, (to measure the risk), the hypothesis underlying the Treynor ratio is that systematic risk is inherent to the entire market (beta). In our test, we measure the association between the return on the portfolio, overhead the risk- free rate and its systematic risk. This ratio is tired of the CAPM.

Q4. "Does risk/return Treynor ratio significantly differentiate Fund managers performance of Luxembourg domiciled UCITS vs. Thailand domiciled open-ended equity funds, investing only in Thai equity stocks?

H0 = There is ***no difference in the Treynor ratio*** between UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

H1 = There *is a* ***difference of Treynor ratio*** between UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

This metric measures the connection between the return on the portfolio, on the risk-free rate and its systematic risk. Calculating this metric needs a reference index to be selected to estimate the beta of the portfolio.

$$T = \frac{r_i - r_f}{\beta_i}$$

(eq.4)

where: T = Treynor ratio , r_i = Fund's return; r_f = risk free rate; β_i= Fund's beta which denotes the volatility of the investment portfolio in comparison to the total market.

TESTS OF DYNAMIC OR CONDITIONAL FUND PERFORMANCE

Test of "Market Timing/performance"

We apply « Treynor-Mazuy » (1966) conditional model as a portfolio performance measurement ratio to measure absolute risk-adjusted performance which gives the excess return obtained by the manager. Based on CAPM, this model tried to fix the weakness of Jensen's Alpha Model related to the supposition of the linear relation between market risk and portfolio return. They added the quadratic term on market risk premium in Jensen's Alpha model to find a relation (that is not linear) between risk and return. The Treynor-Mazuy metric hang on two variables: the return of the fund and risk sensitivities variability. The Treynor-Mazuy indicator measures the amount of convexity in the fund manager's returns. It can explain how a fund manager can successfully increase its exposure when markets are favorable, and decrease it if the market falls. Generally, the Treynor-Mazuy model implies that the manager has a linear beta functional response.

Our major objective is to tests the fund manager's Timing ability (adjust portfolio beta vs. forecast) with the magnitude timer in mind and its ability to anticipate the direction of market fluctuations by entering a bull market and determine whether the performance attributable to its fund would be altered by tactical asset allocation in adjusting the portfolio's sensitivity to the market vs. the expected market return.

Q5. "Does risk/adjusted Treynor-Mazuy ratio significantly differentiate Fund managers performance of Luxembourg domiciled UCITS vs. Thailand domiciled open-ended equity funds, investing only in Thai equity stocks?

H0 = There is ***no difference in Treynor-Mazuy ratio*** between UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

H1 = There is ***a difference of Treynor-Mazuy ratio*** between UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

We first apply the Treynor and Mazuy model on a set of market timing Thai equity funds. We examine how various ways to correct the alpha for the timing ability of the Luxembourg and Thai fund managers affect their performance.

In a second stage, we study the determinants of the adjusted performance and attempt to detect whether there exists a genuine "market timing skill" that can be pointed out for different types of funds. The Treynor-Mazuy model is essentially a quadratic extension of the basic CAPM. It is estimated using multiple regression.

The second term in the regression is the value of excess return squared. If the gamma coefficient in the regression is positive, then the estimated equation describes a convex upward-sloping regression "line".

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_p(R_{mt} - R_{ft}) + \tau(R_{mt} - R_{ft})^2 + \in_{pt}$$

(eq.5)

where a positive tau, τ, shows the timing ability of a portfolio manager

Test of « fund size effects/performance»

According to K. Shukla and Gregory B. van Inwegen (1995), we hypothesize that Thai fund managers' knowledge, information, and contacts drive to greater returns for local Thai mutual fund managers relative to Luxembourg foreign managers. To test this hypothesis, we study the performance of Thai invested Mutual Funds in two countries: the Luxembourg and Thailand. We explore the effectiveness of Luxembourg and Thai fund managers (foreigners) investing in the Thai equity market to measure the effect of fund size on performance based on active equity Mutual Funds in Thailand during 2013-2018. Some of the performance results related to UCITS and Thai fund managers may be driven by fund size discrepancy. In general, fund size is expected to positively contribute to funding performance as larger funds can achieve the size advantages.

Q6. Does « Fund Size» contribute to the performance of Luxembourg domiciled UCITS funds investing in Thai equity Mutual Funds vs. Thai domestic equity Mutual Funds?

H0 = There ***is no relationship between fund size vs. performance*** for UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

H1 = There is ***a relationship between fund size vs. performance*** for UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

To examine the effect of fund size on the fund performance measures, we regress Jensen alphas for and UCITS/Thai funds on a Luxembourg/Thai country dummy and fund asset size. Our sample consists of Luxembourg-UCITS and Thai open-end equity Mutual Funds that have the following criteria: (1) They meet continuous monthly returns; (2) they invest more than 90% of their assets in Thai securities. Adapted Regression of Jensen Alpha on Country and Fund Size. Our OLS

regression use country dummies set at 1 for Luxembourg alphas and 0 for Thai alphas. There are 20 and 151 observations for the UCITS and Thai, respectively.

$$\alpha = \beta_0 + \beta_1 D_1 + \beta_2 Size + \epsilon$$

(eq. 6)

Where D = country, ϵ = error

TESTS OF MUTUAL FUND CONTROL

To challenge the traditional performance measure pitfalls and our above hypotheses, we need to examine for other methods of analyzing financial data to the major issues of performance measurements. We added to check the robustness of our fund performance results and us broad our analysis with two additional tests.

Fund persistence test "*Repeat Performers"* and Fund Performance robustness: *"DEA / portfolio efficiency index (DPEI)"*.

Test of "Persistence" / performance or performance of « repeat performers» winners/losers via cross-product ratio "CPR"

A fund is considered to ''persist'' if, for successive time periods, it has returns above the median to comparable funds, Brown and Goetzmann (1995). We categorize funds as winners (W) if the funds' return for a given period is greater than the median in that same period.

This test does not take into account the magnitude of the positive or negative performance of a fund a given year. It solely considers whether the fund is a winner or a loser.

Q7. Does « Repeat Performers - Cross-product ratio or Odds ratio" contribute to the performance persistence across of Luxembourg domiciled UCITS funds and Thai Equity Mutual Funds investing in Thai equity?

H0 = There is ***no performance persistence*** across of Luxembourg domiciled UCITS funds vs. Thai domestic equity Mutual Funds investing in Thai equity.
H1 = There is ***a performance persistence*** across of Luxembourg domiciled UCITS funds vs. Thai domestic equity Mutual Funds investing in Thai equity.

CPR-Cross-Product Ratio reports the probabilities ratio of the number of recurrent performers to the number of those that do not repeat; that is, (WW *LL)/(WL*LW). The null hypothesis that fund performance in the first period is distinct to performance in the second period matches to an odds ratio of one. Mutual Funds are rank-ordered by 1-year total returns with 50% of the funds with the highest returns categorized ‘‘winners’’ and 50% of the funds with the lowest returns characterized ‘‘losers.’’

Mutual Funds that terminated operations in the following year are identified as ‘‘disappeared.’’ Two-by-three tables are built to identify funds that are ‘‘winners’’ and ‘‘losers’’ in 1 year and then ‘‘winners,’’ ‘‘losers,’’ or ‘‘gone’’ in following years. Statistical significance tests (Z-score and Chi-square) are used accordingly to the procedure defined by Brown and Goetzmann. A fund is categorized as a winner (W) if its risk-neutral performance, the Jensen's Alpha, for the given year is higher than or equal to the median of alphas for the given year and geographical region.

Consequently, a fund is categorized as a loser (L) if its risk-neutral performance for the given year and geographical region is lower than the median. Looking for evidence of one-year persistence in performance, the evidence of persistence is strengthened if the fund in question is categorized as either a winner for two consecutive years (WW) or a loser for two consecutive years (LL). The evidence of persistence is thus weakened if the fund is categorized as a winner and then a loser the following year (WL) or a loser and then a winner the following year (LW).

The CPR is calculated as follow:

$$\text{Cross Product ratio (CPR)} = \frac{N_{WW} \times N_{LL}}{N_{WL} \times N_{LW}} \quad \textit{(eq.7)}$$

where N_{WW} is the number of funds categorized as winners for the two consecutive years in question. N_{LL} is the number of funds categorized as losers for the two consecutive years in question, N_{WL} is the number of funds categorized as winners the first year and losers the second, N_{LW} is the number of funds categorized as losers the first year and winners the second year. If the number of funds classified as WW or LL is equally high as the number classified as WL or LW there is no evidence of persistence and the cross-product ratio will be equal to one.

A cross-product ratio higher than one indicates that there is persistence (the higher the share of funds in a given time period that are classified as either WW or LL the stronger the evidence of persistence becomes).A cross-product ratio is lower than one point towards a negative relationship between the performance in the two periods (the higher the share of funds that are categorized as either WL or LW the stronger the evidence of a negative relationship becomes).

Test of « Robustness / DEA / portfolio efficiency index (DPEI)»

They are some of the shortcomings of the traditional measures since that funds operate in increasing returns seeming successful in holding mean-variance efficient portfolios, often are ineffective in allocating transaction costs efficiently, proved by disproportionate turnovers and loads.

Therefore, we propose to use an alternative mutual fund performance index which reports the benchmark problem. Defined by Murthi et al. (1997) as the ratio of a weighted sum of outputs to a weighted sum of inputs: expense ratio, load, turnover, and standard deviation. We advance the concept of 'return-cost' or transaction fee efficiency as a determinant in assessing portfolio management.

Moreover to the concept of mean-variance efficiency in applying non-parametric mathematical programming techniques in the framework of performance evaluation such as Data Envelopment Approach (DEA) / DPEI provides interesting results in relation with traditional metrics of performance. The DPEI of the target fund j0 is described as the optimal value of the following DEA model. Therefore to check how the DPEI compares to existing indices such as Jensen's alpha, Treynor and Sharpe index, we demonstrate the correlations of DPEI index with these measures. In the DPEI index, a mutual fund has to be considered efficient when the function is equal to 1 and all the slacks are equal to 0; while it will be inefficient only when compared with other funds in the model.

Q8. Does « portfolio efficiency index (DPEI) » contribute to the robustness of Luxembourg domiciled UCITS funds investing in Thai equity Mutual Funds vs. Thai domestic equity Mutual Funds?

H0 = There is ***no correlation between DPEI vs. statistical methods*** such as Jensen's alpha, Sharpe index, Treynor ratio for UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

H1 = There is ***a correlation between DPEI vs. statistical methods*** such as Jensen's alpha, Sharpe index, Treynor ratio for UCITS / Luxembourg funds vs. Non UCITS /Thai funds

The DPEI index model is shown below:

$$\{DPEI\} \qquad Max \ \frac{R_{j0}}{\sum_{i=1}^{I} w_i x_{ij0} + v\,\sigma_{j0}}$$

$$\text{Subject To:} \quad \frac{R_J}{\sum_{i=1}^{I} w_i x_{ij} + v\sigma_j} \leq 1 \quad \text{j=1,…,J}$$

(eq.8)

Where Rj is the value of the return for the jth fund, xij is the value of the ith transaction cost for the jth fund, J is the number of funds in the category, I is the number of inputs, ε is a non-Archimedean infinitesimal (NAI).

More specifically, like Grossman, 1976; Grossman and Stiglitz, 1980; Ippolito, 1989; Elton et al., 1993, we examine the impact of transaction costs as a determinant in portfolio performance measurement and validate or not whether transactions costs are correlated or not with better efficiency scores (DPEIs).

We search whether there is a positive correlation between the DPEI and transaction costs between Luxembourg (UCITS) vs. Non-UCITS /Thai funds and if our results are different or not to Ippolito's study which finds positive coefficients for loads or is not related as Murthi, 1997.

Q9. Do DPEI "mean transaction costs" have an impact on the mean portfolio efficiency index of Luxembourg (UCITS) vs. Non-UCITS /Thai funds?

H0 = There is ***no relation between DPEI and transaction costs*** for UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

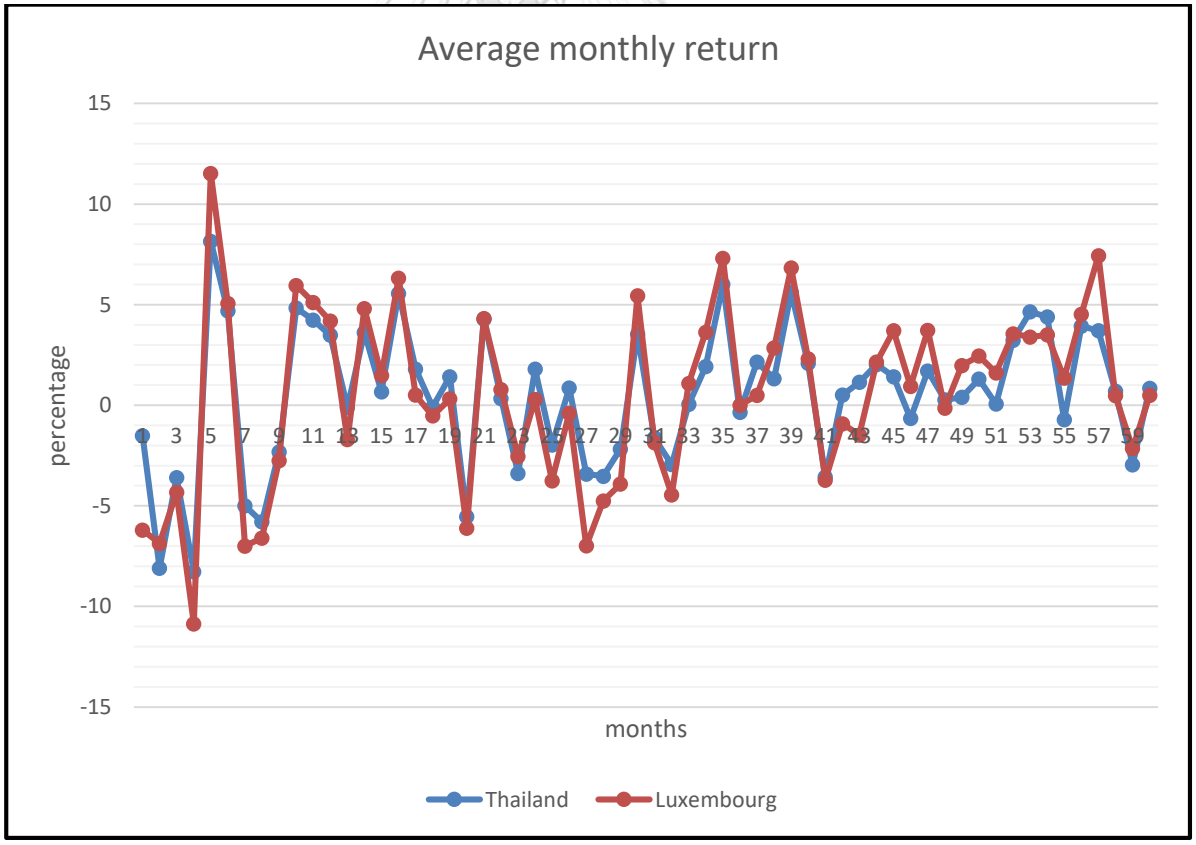
H1 = There is ***a relation between DPEI and transaction costs*** for UCITS / Luxembourg funds vs. Non UCITS /Thai funds.

12. EMPIRICAL RESULTS

The outline of this section "Empirical Results" follows the outline of the hypotheses section, ending with the results of the performance persistence comparison between Luxembourg funds and Thai funds invested in the Thai equity market.

Table 3. Thailand and Luxembourg funds average monthly returns per year

This table refers to the volatility "CAPM BETA" represents for the period of 58 months an average return between Thai and Luxembourg funds with minor spread.



The average monthly results over the full period is higher for Luxembourg Mutual Funds than for Thai Mutual Funds (total average monthly return of 0.531 % for Luxembourg and 0.518% for Thailand) however the average standard deviation of Mutual Funds return for the total period is also higher for Luxembourg funds than for Thai funds (4.45 for Luxembourg funds and 3.66 for Thailand).

When we observe the average monthly returns per year we can see that Thailand funds monthly average return were actually higher for the first three years than Luxembourg funds monthly average return and that the standard deviation of the average monthly return of Thailand funds was lower than the standard deviation of the average monthly return of Luxembourg funds for the first four years.

Table 4. Thailand and Luxembourg fund average returns vs. Thai MSCI and T-Bill

Results of this table report that Luxembourg and Thai funds most of the time outperform MSCI Thailand and 3-months T-Bill

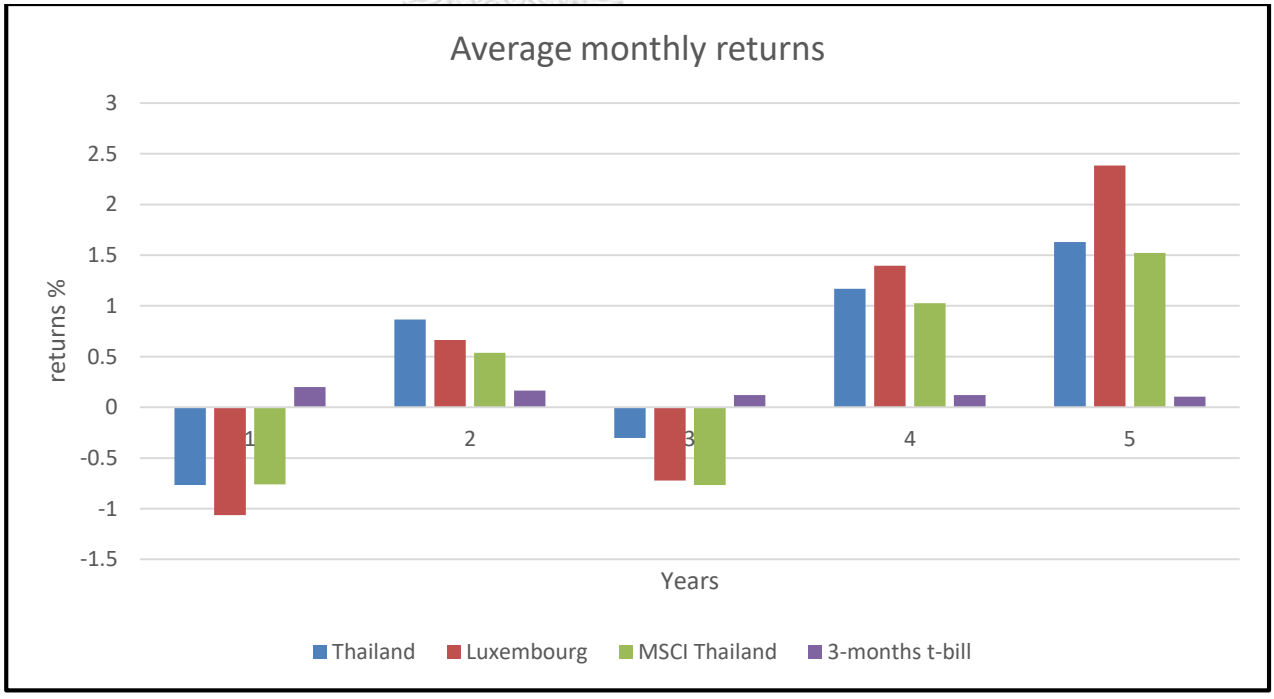
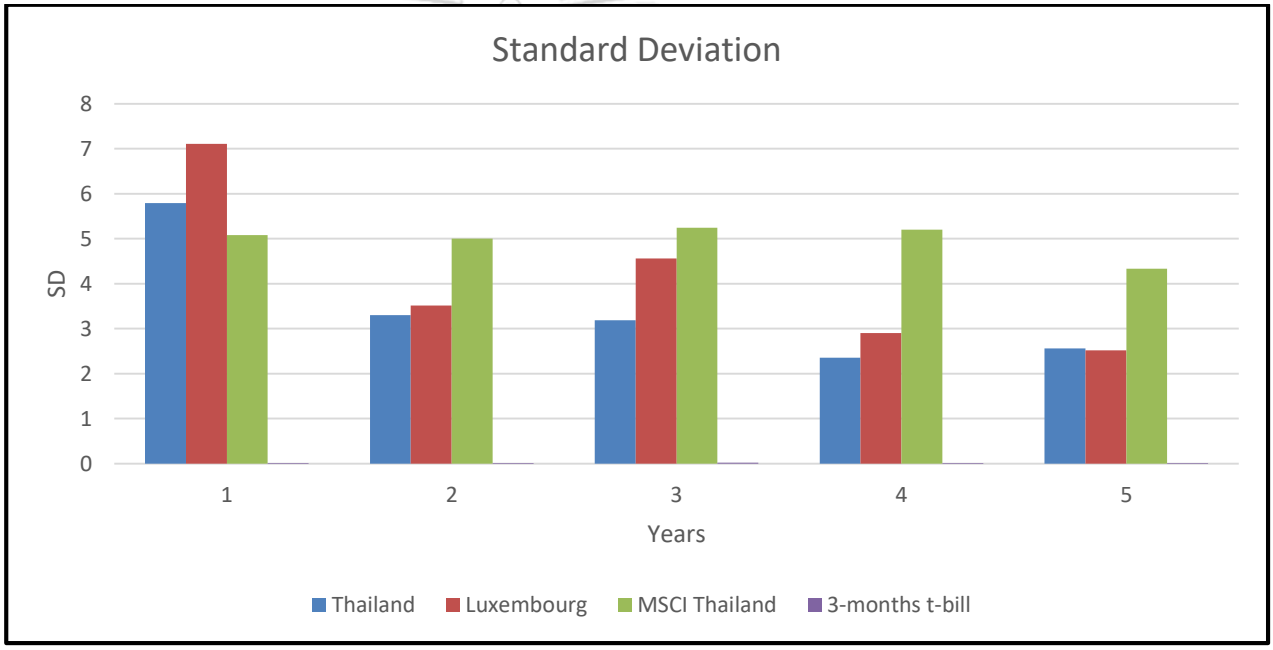


Table 5. Thailand and Luxembourg fund standard deviation vs. MSCI and T-Bill

This table represents that Luxembourg and Thai funds are most of the time, less volatile than MSCI Thailand



PERFORMANCE RESULTS

"STATIC PERFORMANCE RESULTS"

Table 6. Risk-Adjusted Return tests including Treynor, Sharpe, Jensen Alpha, CAPM

	Avg Thailand	Avg Luxembourg	(Avg TH – Avg Lux)
Treynor	.425978	.3426674	t = .01171
Sharpe	.108558	.0885703	t = .01095
Jensen Alpha	.225785	.1953976	χ^2 = .03
CAPM Beta	.885365	1.137958	χ^2 = 36.84

Treynor ratio is obtained by dividing the average mutual fund's excess return by their Beta and we do a T-test between Thailand's average Treynor ratio and Luxembourg's average Treynor ratio. The results show that average Treynor ratio for Thailand is higher than average Treynor ratio for Luxembourg (.425978 for Thailand Treynor and .3426674 for Luxembourg) however this difference is not statistically significant (t=0.1171). Treynor ratio is obtained by dividing the average mutual fund's excess return by their Beta and we do a T-test between Thailand's average Treynor ratio and Luxembourg's average Treynor ratio. The results show that average Treynor ratio for Thailand is higher than average Treynor ratio for Luxembourg (.425978 for Thailand Treynor and .3426674 for Luxembourg) however this difference is not statistically significant (t=0.1171)

We calculate the Sharpe ratio by dividing average Mutual Funds excess return with their standard deviation and we do a t-test between Thailand's average Sharpe ratio and Luxembourg's average Sharpe ratio. The results show that the average

Sharpe ratio for Thailand is higher than average Sharpe ratio for Luxembourg (.1085578 for Thailand Sharpe ratio and .0885703 for Luxembourg) however this difference is not statistically significant (t=.1095).

We regress the excess return of the Mutual Funds on the difference between MSCI Thailand and 3-months T-Bill to obtain the average beta and Jensen alpha. We find that Thailand Mutual Funds average alpha is higher than Luxembourg Mutual Funds average alpha (0.2257856 for Thailand average Mutual Funds alpha and .1953976 for Luxembourg average Mutual Funds alpha) and that 93.38% of Thailand funds and 85% of Luxembourg funds have a positive Jensen alpha.

We do a test of the difference between countries alpha coefficients after using the command suest on Stata between countries regression and this difference is not statistically significant (chi-square (1) =.03). Luxembourg Mutual Funds have an average beta higher than Thailand Mutual Funds (1.137958 for Luxembourg funds average beta and .8853653 for Thailand beta). We do a statistical test of the difference between countries beta coefficients after doing a test on "Stata" between countries regression and this difference is statistically significant (chi-square (1) =36.84).

"DYNAMIC PERFORMANCE RESULTS"

Table 7. Market Timing/performance

This table on « Treynor-Mazuy » Market timing performance obtained by the managers reports that both Luxembourg and Thai funds have a positive tau, τ which shows the timing ability of their portfolio managers.

	Avg Thailand	**Avg Luxembourg**	**(Avg TH – Avg Lux)**
TAU	.0116277	.0141099	$\chi^2 = .009$

In order to get the tau coefficient, we regress the excess return of the Mutual Funds on the difference between MSCI Thailand and 3-months T-Bill (RMRF) and the squared difference between MSCI Thailand and 3-months T-Bill $(RMRF)^2$.

A positive tau coefficient shows the timing ability of a manager, 74.83% of Thailand funds and 100% of Luxembourg funds have a positive tau coefficient. The tau coefficient is positive both for Thailand funds (.0116277) and Luxembourg funds (.0141099) however the difference between both countries' tau coefficient is not statistically significant (chi-square (1) =0.09).

Table 8. Fund size effects/performance

This table shows that the relationship between performance and fund size obtained by a regression of Funds size on Jensen Alpha, on Thailand/Luxembourg country dummy variable shows that performance is more driven by the country in which funds are based

	Intercept	**TH/LUX dummy**	**Size**	**R^2**
Full Period (2013:5-2018:4)	.2180962	.6798714	-4.44e-12	0.6508
	(5.40)	(16.82)	(-1.39)	

We regress Jensen alpha for Thailand and Luxembourg on Thailand / Luxembourg country dummy variable and funds size over the full period, we also do this regression for each period and write the results in the table below. The results from this multiple regression show on average that performance is more driven by the country in which funds are based (t-stat:16.82) than by the fund's size differential (-1.39).

What we observe when we do this multiple regression for every of our total period is that the significance of the size coefficient varies through the years and appears to be significant only for year one (t-stat:1.68) whereas the country dummy variable is significant for year 2 (t-stat: 2.44), year 3 (t-stat: 1.85) and year 5 (t-stat: -6.9).

CONTROL PERFORMANCE RESULTS

Table 9. Performance persistence CPR (Cross-product ratio)

This table reports that results on the performance of « repeat performers» winners/losers via cross-product ratio "CPR" are statistically significant. for both Thailand and Luxembourg on Thailand/Luxembourg

	Year	Winner-Winner	Loser-Winner	Winner-Loser	Loser-Loser	Cross-Product Ratio	Z-Statistic	χ^2
TH Avg return	2015	22	49	54	26	0.216175	-4.37008	20,062
TH Alpha	2015	29	30	40	52	0.4182692	-2.60395	6,891
TH Alpha	2018	29	31	64	27	0.5202546	-1.89102	3,616
TH Sharpe	2015	33	45	44	29	0.483333	-2.19478	4,871
TH Treynor	2015	28	32	41	50	0.437073171	-2.48025	4,768
TH Treynor	2017	34	25	38	54	0.414230019	-2.60747	4,995

Luxembourg funds appear to be more persistent than Thai funds over this time period, we observe a positive cross-product ratio every year for Luxembourg funds while the cross-product ratio of Thailand fund is positive only for the year 2016

however only the results of 2015 Thailand CPR appear to be statistically significant (z-stat: -4.37).

CPR-ALPHA

Results from Alpha CPR show persistence for Thailand funds in 2017 (CPR:1.56) and for Luxembourg funds in the year 2016 (CPR: 1) and 2017 (CPR: 2.66). Luxembourg's Alpha CPR in 2018 cannot be calculated as there is no Winner/Loser. However, none of that CPR calculated is statistically significant. Only Thailand Alpha CPR year 2015 and 2018 are statistically significant (z-stat: -2.60 and -1.89) with both of those years showing no persistence in terms of Alpha returns (CPR: 0.41 in 2015 and 0.52 in 2018).

CPR - SHARPE

Results show persistence in terms of Sharpe returns for 2016 Thailand funds (CPR: 1.40) and for Luxembourg funds in 2015 (CPR: 1.4), 2016 (CPR: 1) and 2018 (CPR: 2.66) however the results of these performance persistence test are not statistically significant.

The only statistically significant CPR is for Thailand CPR 2015 (z-stat: -2.19478) that show no persistence. Luxembourg's Sharpe CPR of 2017 cannot be calculated as it appears there is no "winner/loser".

CPR TREYNOR

Results from CPR Treynor show persistence for Thailand funds in the year 2016 and for Luxembourg funds in every year, however, these results are not statistically significant. Only Thailand's Treynor CPR results in the year 2015 and 2017 are statistically significant (z-stat; -2.48 and -2.60) and show no persistence in returns (CPR: 0.43 and 0.41).

ROBUSTNESS RESULTS

Table 10. Robustness / DEA / portfolio efficiency index (DPEI)

This correlation table reports that results on different equity styles between DPEI and traditional test of performance alpha, Treynor, Sharpe for Thailand and Luxembourg**.**

	Sharpe	**Treynor**	**Alpha**
All TH funds	0.8393	0.6982	0.7069
Large blend TH funds	0.8606	0.7089	0.7154
Large value TH funds	0.5203	0.4141	0.4756
Other equity style TH funds	0.9467	0.9133	0.8464
All LUX funds	0.5916	0.5822	0.6027
Large blend LUX funds	0.5825	0.5232	0.5769
Large value LUX funds	-0.3057	-0.3080	-0.3090

DPEI results

We conducted a data envelopment analysis in Stata to find DPEI results for both countries and because turnover and expense ratio are reported yearly, we selected the time period of January 2014 to January 2018 to conduct this test. After finding the DPEI score for each fund we calculated the correlation between the DPEI and the Jensen alpha, Sharpe and Treynor calculated for this period. The results of this

correlation matrix show that DPEI has a positive and significant correlation between Alpha, Treynor, and Sharpe for both Thailand and Luxembourg. The highest correlation for Thailand is between DPEI and Sharpe results (0.8393) and for Luxembourg, the highest correlation is between DPEI and Jensen Alpha (0.6027). We did a correlation table between DPEI and the Jensen alpha, Sharpe and Treynor separating funds by their equity style. Results show that the highest correlation appears to be between DPEI and Sharpe which is in line with the conclusion of Murthi 1997 as he considered DPEI to be a generalization of Sharpe index.

Results from these correlation tables show in general positive correlation between DPEI and Alpha, Treynor, Sharpe with the correlation being the highest between the DPEI of Thailand Large Blend funds and Sharpe (0.86) and the DPEI of Thailand funds classified as “others” and Sharpe (0.94). Luxembourg large value funds appear to be the only funds showing a negative correlation between DPEI and Treynor, Sharpe, Alpha. Following Murthi 1997, to test the relation between the efficiency score and transaction costs we regress DPEI results on the standard deviation, turnover, expense ratio and load of the funds.

Table 11. DPEI and Transaction costs variables following Murthi (1997)

This table represents a multiple correlations that results on different equity styles between DPEI and Transaction costs variables following Murthi (1997) results for Thailand (TH) and Luxembourg (LUX)

	Standard Deviation	Average Turnover	Expense Ratio	Load
All TH funds	-.106797	-0.0000746	-0.299585	-.0132559
	(3.73)	(-1.66)	(-3.82)	(-1.61)
Large blend TH funds	-.2358357	-.0000264	-.0235125	-.0125633
	(-4.33)	(-0.46)	(-2.68)	(-1.17)
Large value TH funds	-.0157529	.0000749	-.0547988	-.0085158
	(-0.45)	(1.06)	(-3.24)	(-0.79)
Other equity style TH funds	-.166424	-.0003634	-.0530485	-.0071024
	(2.43)	(-1.74)	(-1.78)	(-0.17)
All LUX funds	-.9498681	-.003172	-.0108231	-.0125043
	(-3.02)	(-3.09)	(-0.45)	(-1.09)
Large blend LUX funds	-.786058	.0019716	.0054031	.005988
	(-3.18)	(0.42)	(0.10)	(0.51)
Large value LUX funds	-.5249266	-.0019211	.0034208	-.0015385
	(-2.47)	(-2.77)	(2.21)	(-0.94)

Results from this multiple regression show that the significance of the coefficients differs between Thailand and Luxembourg funds. Thailand funds'

coefficients appear to be statistically significant for the standard deviation (t-stat: -3.73), the turnover (t-stat: -1.66) and the expense ratio (-3.82) whereas for Luxembourg funds only the standard deviation (t-stat: -3.02) and the turnover (t-stat: -3.09) appear to be statistically significant._We do the multiple regression between DPEI and transaction for the different equity style of Thailand and Luxembourg funds. The results of these multiple regressions show that the coefficients' significance varies among the equity styles of the funds.

For Thailand large blend funds the most significant coefficients in this multiple regression analysis are the expense ratio (t-stat: -2.68) and the standard deviation (t-stat: -4.33), for Thailand large value funds the most significant coefficients is the standard deviation (t-stat: -3.24) and for the other Thailand equity style funds the most significant is the expense ratio (t-stat: -1.78), the turnover (t-stat: -1.74) and the standard deviation (t-stat: -2.43). For Luxembourg large blend funds, the most significant coefficient in this multiple regression is the standard deviation (t-stat: -3.18) and for Luxembourg large value funds the most significant coefficients are the expense ratio (t-stat: 2.21), the turnover (-2.77) and the standard deviation (3.73).

We can see from these results that the standard deviation's coefficient, in general, appear to be the most statistically significant coefficient in this multiple regression analysis.

13. CONCLUSION

This is the first comprehensive comparison paper between Thai and Luxembourg funds focusing on open-ended equity invested Mutual Funds in Thailand. The paper investigated funds' performances covering eight different tests by using static or unconditional measures, dynamic or conditional measures and robustness metrics, including market timing, CPR persistence, and DEA/DPEI technique's correlation coefficients. We used a benefit/cost non-parametric model where a connection between return (benefit) and standard deviation, expense ratio, turnover, risk and loads (cost) is recognized. The prominent results from this paper show that if a difference exists in performance between Thailand Mutual Funds and Luxembourg Mutual Funds investing both in Thai equity, this difference is often not statistically significant.

As we can see in the summary table 1, coefficients are positive in both countries for the test of Treynor, Sharpe, Jensen alpha and CAPM beta. The TAU coefficient which measures the ability to time the market also appears to be positive for both countries and results of the multiple regression analysis between Jensen alpha, country dummy and funds size show that size is not statistically significant. If Thailand appears to have a lower CAPM beta, a lower TAU, and higher Jensen alpha, Sharpe and Treynor ratio than Luxembourg, the difference between countries is not statistically different except between countries average Beta (Chi-square:36.84).

Therefore, from the hypothesis 1 to 6 of our questions only hypothesis 1, "there is a difference of performance in terms of portfolio Beta, between UCITS Luxembourg funds vs Thailand funds", is accepted. Regarding the persistence of the funds, we found no statistically significant results in terms of persistence for Luxembourg funds. For Thailand funds, results appear to be significant only between specific years with no persistence of returns in terms of average return, Jensen alpha, Sharpe and Treynor. Consequently, we do not accept the hypothesis of question 7

standing that “There is a performance persistence across of Luxembourg domiciled UCITS funds vs. Thai domestic equity Mutual Funds investing in Thai equity”.

Finally, we conducted a robustness test (DPEI) for both countries and also between country different equity style funds.

The results of the correlation between DPEI results and our previous results of Jensen alpha, Sharpe and Treynor tests appear to be in line with Murthi (1997) about the connection between DPEI and the Sharpe ratio. As we can see in the DPEI correlation summary table, the Sharpe ratio appears to have the highest correlation coefficient with the DPEI test for all Thai funds and different Thai equity style funds and for every different Luxembourg equity style. Therefore, we accept hypothesis 8 that stands that “there is a correlation between DPEI vs. statistical methods such as Jensen's alpha, Sharpe index, Treynor ratio for UCITS / Luxembourg funds vs. Non UCITS /Thai funds”. We also performed a multiple regression analysis between the DPEI and transactions costs to observe if the transaction costs appear to have an implication on the performance of the funds. Contrary to Murthi findings, we found that transaction costs variables appear to have a statistically significant implication on the performance for both Thailand and Luxembourg funds which confirms our hypothesis of question 9 which stands that “there is a relation between DPEI and transaction costs for UCITS / Luxembourg funds vs. Non UCITS /Thai funds”. As we can see in the summary table 4, the most statistically significant transaction costs determinants appear to be the standard deviation having a negative impact on the performance of both Thailand and Luxembourg funds. We can also observe from this table that the transaction costs do not have the same impact between countries and different equity styles where for instance the expense ratio is statistically significant with a negative implication on the performance for all Thai funds on average and for all Thai different equity styles funds but only being statistically significant with a positive impact on the performance for Luxembourg Large value funds.

In brief, the unconditional average return on domestic portfolios is statistically indistinguishable from the average return on portfolios of Luxembourg UCITS funds. In terms of practical and professional implications to both Thai fund investors and fund managers, these results for investors, can suggest to fund investors to check

more carefully the fund investment's performance determinant factors, including cash inflows and outflows fund expenses and turnover costs, for instance in providing the choice of investing either directly to Thai or Luxembourg funds or indirectly via Thai Foreign Investment fund or Master-feeder. For fund managers, since the Thai fund industry and their managers already perform relatively well compared to their Luxembourg peers, they could expect to perform even better by challenging UCITS funds in distributing their funds to the CIS-ASEAN market.

Further research to complement this first paper should include: 1) the extension and comparison of our results with another type of funds investing in other asset classes such as bond funds and money market funds and countries; 2) broadening the sample, 3) more detailed consideration of the variables included other Morningstar fund determinants, and 4) a new set of robustness tests to gain accuracy in the results obtained.

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APPENDIX

APPENDIX A

Results extracted from STATA

Reports on Treynor indices

Two-sample t test with unequal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
treyno~I	60	.425978	.5065831	3.923976	-.5876923	1.439648
treyno~X	60	.3426674	.4994693	3.868872	-.6567684	1.342103
combined	120	.3843227	.354225	3.88034	-.3170782	1.085724
diff		.0833107	.7114042		-1.325466	1.492088

diff = mean(treynorTHAI) - mean(treynorLUX) t = 0.1171

Ho: diff = 0 Satterthwaite's degrees of freedom = 117.976

Reports on Sharpe ratio absolute risk-adjusted performance measure

Two-sample t test with unequal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
sharpth	60	.1085578	.1290994	1	-.1497696	.3668852
sharpLUX	60	.0885703	.1290995	1	-.1697571	.3468978
combined	120	.0985641	.0909073	.9958401	-.0814416	.2785697
diff		.0199874	.1825742		-.3415592	.381534

diff = mean(sharpth) - mean(sharpLUX) t = 0.1095

Ho: diff = 0 Satterthwaite's degrees of freedom = 118

Reports on Jensen's alpha ratio absolute risk-adjusted performance measure

Simultaneous results for thailand, luxembourg

Number of obs = 60

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
thailand_mean						
RMminusRF	.8853653	.0560098	15.81	0.000	.7755882	.9951424
_cons	.2257856	.1840341	1.23	0.220	-.1349146	.5864858
thailand_lnvar						
_cons	.6948909	.3137029	2.22	0.027	.0800444	1.309737
luxembourg_mean						
RMminusRF	1.137958	.0680823	16.71	0.000	1.004519	1.271397
_cons	.1953976	.2124601	0.92	0.358	-.2210166	.6118118
luxembourg_lnvar						
_cons	1.009449	.1682388	6.00	0.000	.6797069	1.339191

Reports on « Treynor-Mazuy » to measure Market timing performance obtained by the managers

Number of obs = 60

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
tau_mean						
RMminusRF	.9022134	.0567542	15.90	0.000	.7909772	1.01345
RMminusRF²	.0116277	.0111201	1.05	0.296	-.0101672	.0334226
_cons	.0752389	.2280807	0.33	0.741	-.3717911	.522269
tau_lnvar						
_cons	.6946737	.2996172	2.32	0.020	.1074348	1.281913
taul_mean						
RMminusRF	1.158403	.0714602	16.21	0.000	1.018344	1.298462
RMminusRF²	.0141099	.0153402	0.92	0.358	-.0159564	.0441763
_cons	.0127133	.2624795	0.05	0.961	-.5017371	.5271636
taul_lnvar						
_cons	1.007897	.1472858	6.84	0.000	.7192218	1.296572

Reports on fund size effects/performance of Thai invested Mutual Funds in two countries: the Luxembourg and Thailand

Source	SS	df	MS		Number of obs =	171
					F(2, 168) =	156.53
Model	8.53520678	2	4.26760339		Prob > F =	0.0000
Residual	4.5804024	168	.0272643		R-squared =	0.6508
					Adj R-squared =	0.6466
Total	13.1156092	170	.077150642		Root MSE =	.16512

AverageAlpha	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
COUNTRYdummy	.6798714	.0404201	16.82	0.000	.6000747	.7596681
SIZE	-4.44e-12	3.20e-12	-1.39	0.167	-1.08e-11	1.87e-12
_cons	.2180962	.0403551	5.40	0.000	.1384277	.2977647

Reports on fund size effects/performance of Jensen alpha regression for Thailand and Luxembourg on Thailand/Luxembourg country dummy variable

	Intercept	**TH/LUX dummy**	**Size**	**R^2**
Full Period (2013:5-2018:4)	.2180962	.6798714	-4.44e-12	0.6508
	(5.40)	(16.82)	(-1.39)	
1st Year	-.064027	.0647109	1.17e-11	0.0166
	(-0.73)	(0.75)	(1.68)	
2nd Year	.174593	.21332212	-6.70e-12	0.0528
	(1.98)	(2.44)	(-0.99)	
3rd Year	.0450407	.0450407	-4.61e-12	0.0278
	(0.71)	(1.85)	(-0.88)	
4th Year	.3768053	-.077894	1.87e-14	0.0059
	(4.89)	(-0.99)	(0.00)	
5th Year	.9559823	-.7836529	4.02e-12	0.2270
	(8.61)	(-6.90)	(0.51)	

Reports on Test Of "Persistence" / Performance Via Cross-Product Ratio "CPR" for Thailand and Luxembourg on Thailand/Luxembourg

The frequency of Repeat Performers

Thailand

Year	Winner-Winner	Loser-Winner	Winner-Loser	Loser-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	22	49	54	26	0.216175	-4.37008	20,06186
2016	38	41	33	39	1.095344	0.27886	0,077777
2017	35	38	44	34	0.711722	-1.03949	1,083163
2018	46	51	27	27	0.901961	-0.30372	0,09227

Luxembourg

Year	Winner-Winner	Loser-Winner	Winner-Loser	Loser-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	4	4	6	6	1	0	0
2016	4	6	4	6	1	0	0
2017	4	3	6	7	1.555555	0.467591	0,2197802
2018	5	7	2	6	2.142857	0.758536	0,5860806

CPR ALPHA

Table 13. Reports on Test Of "Persistence" / Performance Via Cross-Product Ratio "CPR-Alpha" for Thailand and Luxembourg on Thailand/Luxembourg

Thailand

Year	Loser-Loser	Winner-Winner	Loser-Winner	Winner-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	29	30	40	52	0.4182692	-2.60395	6,8913084
2016	37	37	45	32	0.9506944	0.1542	0,023777586
2017	46	36	23	46	1.5652174	1.322682	1,75823343
2018	29	31	64	27	0.5202546	-1.89102	3,616291528

Luxembourg

Year	Loser-Loser	Winner-Winner	Loser-Winner	Winner-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	4	4	6	6	1	0	0
2016	6	4	6	4	1	0	0
2017	8	4	2	6	2.666666	0.961012	0,952381
2018	12	6	2	0	X	X	X

CPR - SHARPE

Reports on Test Of "Persistence" / Performance Via Cross-Product Ratio "CPR-Sharpe" for Thailand and Luxembourg on Thailand/Luxembourg

Thailand

Year	Loser-Loser	Winner-Winner	Loser-Winner	Winner-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	29	33	45	44	0.483333	-2.19478	4,870665525
2016	39	43	34	35	1.409244	1.049333	1,103811621
2017	30	39	44	38	0.699761	-1.08628	1,183245691
2018	25	44	43	39	0.655933	-1.26218	1,599713987

Luxembourg

Year	Loser-Loser	Winner-Winner	Loser-Winner	Winner-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	7	4	4	5	1.4	0.336472	0,090236
2016	6	4	6	4	1	0	0
2017	6	10	4	0	X	X	X
2018	4	8	2	6	2.666667	0.961012	0,809524

CPR TREYNOR

Table 15. Reports on Test Of "Persistence" / Performance Via Cross-Product Ratio

Thailand

Year	Loser-Loser	Winner-Winner	Loser-Winner	Winner-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	28	32	41	50	0.437073171	-2.48025	4,768453
2016	37	38	41	34	1.008608321	0.026186	0,004402
2017	34	25	38	54	0.414230019	-2.60747	4,995868
2018	39	29	49	34	0.678871549	-1.16812	0,983387

Luxembourg

Year	Loser-Loser	Winner-Winner	Loser-Winner	Winner-Loser	Cross-Product Ratio	Z-Statistic	χ^2
2015	6	4	4	6	1	0	0
2016	6	4	6	4	1	0	0
2017	6	6	4	4	2.25	0.88833	0,6
2018	6	6	4	4	2.25	0.88833	0,6

ROBUSTNESS RESULTS

Thailand results

	dpeire~t	alpha	treynor	sharpe
dpeiresult	1.0000			
alpha	0.7069	1.0000		
treynor	0.6982	0.9723	1.0000	
sharpe	0.8393	0.9130	0.9012	1.0000

Luxembourg results

	dpei	alpha	treynor	sharpe
dpei	1.0000			
alpha	0.6027	1.0000		
treynor	0.5822	0.9970	1.0000	
sharpe	0.5916	0.9994	0.9953	1.0000

Correlation tables for Thailand different equity styles between DPEI and traditional test of performance alpha, Treynor, Sharpe.

Thailand equity style DPEI correlation table

LARGE BLEND

	dpei	treynor	sharpe	alpha
dpei	1.0000			
treynor	0.7089	1.0000		
sharpe	0.8606	0.9037	1.0000	
alpha	0.7154	0.9881	0.9062	1.0000

LARGE VALUE

	dpei	treynor	sharpe	alpha
dpei	1.0000			
treynor	0.4141	1.0000		
sharpe	0.5203	0.9338	1.0000	
alpha	0.4756	0.9819	0.9390	1.0000

OTHERS

	dpei	treynor	sharpe	alpha
dpei	1.0000			
treynor	0.9133	1.0000		
sharpe	0.9467	0.9210	1.0000	
alpha	0.8464	0.8973	0.9290	1.0000

Correlation tables for Luxembourg different equity styles between DPEI and traditional test of performance alpha, Treynor, Sharpe.

Luxembourg equity style DPEI correlation tables

LARGE BLEND

	dpei	treynor	sharpe	alpha
dpei	1.0000			
treynor	0.5232	1.0000		
sharpe	0.5825	0.9958	1.0000	
alpha	0.5769	0.9974	0.9997	1.0000

LARGE VALUE

	dpei	treynor	sharpe	alpha
dpei	1.0000			
treynor	-0.3080	1.0000		
sharpe	-0.3057	0.9997	1.0000	
alpha	-0.3090	0.9997	1.0000	1.0000

Regression of DEA / portfolio efficiency index (DPEI) on transaction costs for Thailand and Luxembourg

Thailand

Source	SS	df	MS	Number of obs =	151
				F(4, 146) =	12.42
Model	.726003789	4	.181500947	Prob > F =	0.0000
Residual	2.13437587	146	.014619013	R-squared =	0.2538
				Adj R-squared =	0.2334
Total	2.86037966	150	.019069198	Root MSE =	.12091

dpeiresult	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
stddev	-.106797	.0286331	-3.73	0.000	-.163386	-.0502081
averageturnover	-.0000746	.000045	-1.66	0.100	-.0001636	.0000144
expenseratio	-.0299585	.0078365	-3.82	0.000	-.0454461	-.0144709
load	-.0132559	.008228	-1.61	0.109	-.0295172	.0030055
_cons	1.231656	.0887322	13.88	0.000	1.05629	1.407021

Luxembourg

Source	SS	df	MS	Number of obs =	20
				F(4, 15) =	4.36
Model	.238332767	4	.059583192	Prob > F =	0.0154
Residual	.204879522	15	.013658635	R-squared =	0.5377
				Adj R-squared =	0.4145
Total	.443212289	19	.023326963	Root MSE =	.11687

dpei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SD	-.9498681	.3143104	-3.02	0.009	-1.619805	-.2799313
turnover	-.003172	.0010258	-3.09	0.007	-.0053585	-.0009855
expenseratio	-.0108231	.0239501	-0.45	0.658	-.0618715	.0402253
load	-.0125043	.0114811	-1.09	0.293	-.0369756	.0119671
_cons	4.470236	1.147063	3.90	0.001	2.025329	6.915143

Regression of « Robustness / DEA / portfolio efficiency index (DPEI) on Transaction costs for different Thailand funds equity style

REGRESSION BETWEEN DPEI AND TRANSACTION COST

THAILAND - LARGE BLEND

Source	SS	df	MS		Number of obs =	103
					F(4, 98) =	10.60
Model	.552632343	4	.138158086		Prob > F =	0.0000
Residual	1.27722988	98	.013032958		R-squared =	0.3020
					Adj R-squared =	0.2735
Total	1.82986222	102	.017939826		Root MSE =	.11416

dpei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
expenseratio	-.0235125	.0087715	-2.68	0.009	-.0409193	-.0061057
load	-.0125633	.0107299	-1.17	0.244	-.0338565	.0087299
turnover	-.0000264	.0000578	-0.46	0.649	-.0001411	.0000883
sd	-.2358357	.0544457	-4.33	0.000	-.3438815	-.1277899
_cons	1.603899	.1573219	10.20	0.000	1.291698	1.916099

THAILAND – LARGE VALUE

Source	SS	df	MS		Number of obs =	33
					F(4, 28) =	2.80
Model	.112811072	4	.028202768		Prob > F =	0.0450
Residual	.281982556	28	.010070806		R-squared =	0.2857
					Adj R-squared =	0.1837
Total	.394793628	32	.012337301		Root MSE =	.10035

dpei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
expenseratio	-.0547988	.0168989	-3.24	0.003	-.0894146	-.020183
load	-.0085158	.0107803	-0.79	0.436	-.0305982	.0135667
turnover	.0000749	.0000707	1.06	0.298	-.0000699	.0002196
sd	-.0157529	.0352534	-0.45	0.658	-.0879662	.0564604
_cons	1.126814	.1290966	8.73	0.000	.8623711	1.391256

Others

Source	SS	df	MS	Number of obs =	15
				F(4, 10) =	6.56
Model	.370268291	4	.092567073	Prob > F =	0.0074
Residual	.141016587	10	.014101659	R-squared =	0.7242
				Adj R-squared =	0.6139
Total	.511284878	14	.036520348	Root MSE =	.11875

dpei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
expenseratio	-.0530485	.0297605	-1.78	0.105	-.119359	.013262
load	-.0071024	.0420375	-0.17	0.869	-.1007678	.0865631
turnover	-.0003634	.000209	-1.74	0.113	-.000829	.0001022
sd	-.166424	.0686153	-2.43	0.036	-.3193085	-.0135396
_cons	1.625876	.2440397	6.66	0.000	1.082122	2.169631

Regression of « Robustness / DEA / portfolio efficiency index (DPEI) on Transaction costs for the different Luxembourg equity style

LUXEMBOURG – LARGE BLEND

Source	SS	df	MS	Number of obs =	10
				F(4, 5) =	3.22
Model	.083888498	4	.020972124	Prob > F =	0.1161
Residual	.03260445	5	.00652089	R-squared =	0.7201
				Adj R-squared =	0.4962
Total	.116492948	9	.012943661	Root MSE =	.08075

dpei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
expensratio	.0054031	.0542078	0.10	0.924	-.1339424	.1447487
load	.005988	.0116513	0.51	0.629	-.0239627	.0359387
turnover	.0019716	.0046922	0.42	0.692	-.01009	.0140332
sd	-.786058	.2475741	-3.18	0.025	-1.422467	-.1496485
_cons	3.670572	.8853668	4.15	0.009	1.394664	5.94648

LUXEMBOURG – LARGE VALUE

Source	SS	df	MS	Number of obs =	10
				F(4, 5) =	2.53
Model	.000353164	4	.000088291	Prob > F =	0.1682
Residual	.000174566	5	.000034913	R-squared =	0.6692
				Adj R-squared =	0.4046
Total	.00052773	9	.000058637	Root MSE =	.00591

dpei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
expensratio	.0034208	.0015506	2.21	0.078	-.0005652	.0074068
load	-.0015385	.0016357	-0.94	0.390	-.0057432	.0026661
turnover	-.0019211	.0006939	-2.77	0.039	-.0037049	-.0001374
sd	-.5249266	.2121372	-2.47	0.056	-1.070243	.0203894
_cons	3.009128	.8061122	3.73	0.014	.9369509	5.081306

APPENDIX B

VARIABLES / TESTS

STATIC TESTS	TYPES OF INDICATORS	TYPES OF VARIABLES	DESCRIPTION	SOURCES
Test performance « Sharpe» ratio	Static or unconditional measures indicator	Absolute risk-adjusted performance (without any reference to a benchmark)	where $\overline{R}_p$ is the average return of the fund , p = the investment, $\overline{R}_f$ = the best available rate of return of a risk-free security, σ = the standard deviation of the return	Source: Morningstar + OTHERS
Test Jensen's alphas	Static or unconditional measures indicator	Absolute risk-adjusted performance (with reference to a benchmark)	where *JAp* is the Jensen's measure for portfolio, $\overline{R}_p$ the fund return, $\overline{R}_m$ is the average return on the market**,** $\overline{R}_f$ = the risk-free rate of return**,** β = the beta of the investment (or volatility relative to market volatility)	Source: Morningstar + OTHERS
Test performance « Treynor » ratio	Static or unconditional measures indicator	Absolute risk-adjusted performance (without any reference to a benchmark)	where: T = Treynor ratio , r_i = Fund's return; r_f = risk free rate; β_i= Fund's beta	Source: Morningstar + OTHERS

DYNAMIC TESTS	TYPES OF INDICATORS	TYPES OF VARIABLES	DESCRIPTION	SOURCES
Test of "Market Timing/performance: Treynor-Mazuy » ratio	Dynamic or conditional measures performance indicators	Market Timing/performance Critical determinants for fund performance	where a positive tau, τ, shows the timing ability of a portfolio manager.	Source: Morningstar + OTHERS
Test of « Fund Size effects/performance	Dynamic or conditional measures performance indicators	Fund Size/performance critical determinants for fund performance	Adapted Regression of Jensen Alpha on Country and Fund Size Where D = country, ϵ = error	Source: Morningstar + OTHERS

CONTROL TESTS	TYPES OF INDICATORS	TYPES OF VARIABLES	DESCRIPTION	SOURCES
Test of Fund "Persistence" / Performance ratio	Cross-product ratio or Odds ratio	« repeat performers» winners/losers via CPR-cross-product	where NWW is the number of funds categorized as winners for the two consecutive years in question, NLL is the number of funds categorized as losers for the two consecutive years in question, NWL is the number of funds categorized as winners the first year and losers the second, NLW is the number of funds categorized as losers the first year and winners the second year	Source: Morningstar + OTHERS
Test of Fund "Robustness"	Test of « Robustness / DEA / portfolio efficiency index (DPEI)»	Value, transaction cost, number of funds in the category, other inputs	where Rj is the value of the return for the jth fund, xij is the value of the ith transaction cost for the jth fund, J is the number of funds in the category, I is the number of inputs, ε is a non-Archimedean infinitesimal (NAI).	Source: Morningstar + OTHERS

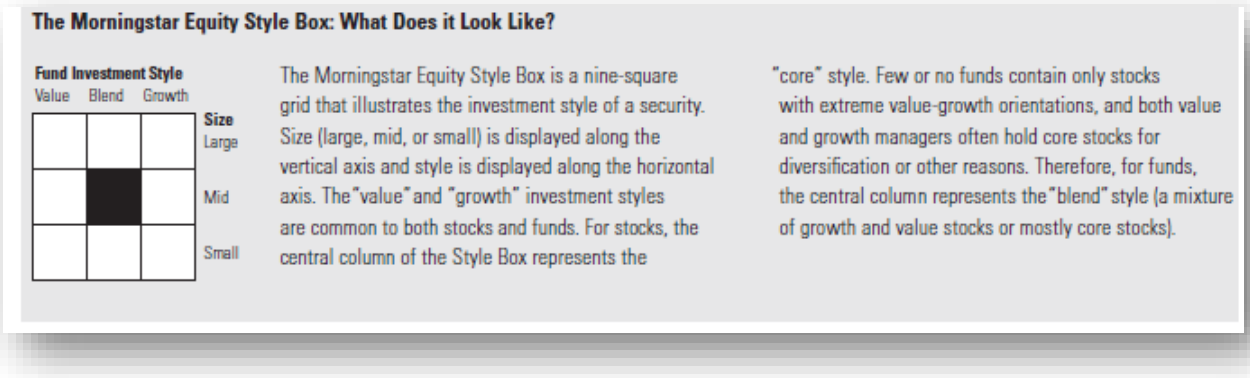
APPENDIX C

MORNINGSTAR EQUITY STYLE BOX TM SUMMARY METHODOLOGY

The Morningstar Equity Style BoxTM was introduced in 1992 to help investors and advisors determine the investment style of a fund. The Style Box is a nine-square grid that classifies equities by size along the vertical axis and by value and growth characteristics along the horizontal axis. Different investment styles often have different levels of risk and can lead to differences in returns. Therefore, it is crucial that investors understand style and have a tool to measure their style exposure.

Morningstar's equity style methodology uses a "building block," holdings-based approach that is consistent with Morningstar's fundamental approach to investing. The style is first determined at the stock level and then those attributes are aggregated to determine the overall investment style of a fund or portfolio. This unified framework can link what are often treated as separate processes—stock research, fund research, portfolio assembly and market monitoring in the belief that a shared analytical framework will lead to better portfolio construction and fund usage.

(source: http://news.morningstar.com/pdfs/FactSheet_StyleBox_Final.pdf).



The Morningstar Equity Style Box: What Does it Look Like?

Fund Investment Style

Size	Value	Blend	Growth
Large			
Mid		■	
Small			

The Morningstar Equity Style Box is a nine-square grid that illustrates the investment style of a security. Size (large, mid, or small) is displayed along the vertical axis and style is displayed along the horizontal axis. The "value" and "growth" investment styles are common to both stocks and funds. For stocks, the central column of the Style Box represents the "core" style. Few or no funds contain only stocks with extreme value-growth orientations, and both value and growth managers often hold core stocks for diversification or other reasons. Therefore, for funds, the central column represents the "blend" style (a mixture of growth and value stocks or mostly core stocks).

The Vertical Axis: Size

A stock is classified as large, mid, or small based on its position in the cumulative market capitalization of its style zone. Large-cap stocks are those that together account for the top 70% of the capitalization of each style zone; mid-cap stocks represent the next 20%; and small-cap stocks represent the balance. The market caps that correspond to these breakpoints are flexible and may shift from month to month as the market changes.

The Horizontal Axis: Style

Value Score Components and Weights		Growth Score Components and Weights	
Forward looking measures	**50.0%**	**Forward looking measures**	**50.0%**
▸ Price-to-projected earnings		▸ Long-term projected earnings growth	
Historical based measures	**50.0%**	**Historical based measures**	**50.0%**
▸ Price-to-book	12.5%	▸ Historical earnings growth	12.5%
▸ Price-to-sales	12.5%	▸ Sales growth	12.5%
▸ Price-to-cash flow	12.5%	▸ Cash flow growth	12.5%
▸ Dividend yield	12.5%	▸ Book value growth	12.5%

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