AESTIMATIO, THE IEB INTERNATIONAL JOURNAL OF FINANCE, 2012. 4: 52-81

An Empirical Look at Swiss Exchange Traded Funds Market

Rompotis, Gerasimos G.

RECEIVED: 3 AUGUST 2011
ACCEPTED: 22 JANUARY 2012

Abstract

In this paper, we study the performance and trading characteristics of Swiss Exchange Traded Funds. The first finding is that the Swiss ETFs underperform the underlying indexes in terms of average daily returns. On the other hand, the ETFs load investors with greater risk in comparison to indexes. Afterwards, we reveal that the Swiss ETFs do not follow full replication strategies in regard to the components of the benchmark portfolios. Furthermore, we estimate a significant tracking error, which is attributed to the non-full replication policy, the management fees, and the risk of ETFs. Moreover, we find a negative relationship between expenses and performance as well as a positive correlation between expenses and risk. In the next step, we find that the trading volume of Swiss ETFs is affected by the intraday price volatility, the number of the executed orders and their trading frequency. Finally, we find that Swiss ETFs are inferior to their US counterparts as far as return, risk, replication strategy, tracking error and volume are considered.

Keywords:

ETFs, Swiss Market, Performance, Risk, Tracking Error, Volume.

JEL classification:

E22, C23

Rompotis, G.G. ✉ Assistant Manager Auditor- BDO Greece. PhD Student- Department of Economics, National and Kapodistrian University of Athens, Greece. 25 Ypsilantou Street. Peristeri, Athens, Greece. GR 121 31. ✆ +0030 210 5776510. E-mail: geras3238@yahoo.gr

AESTIMATIO, THE IEB INTERNATIONAL JOURNAL OF FINANCE, 2012. 4: 52-81

Un estudio empírico del mercado de fondos negociados **en la Bolsa suiza**

Rompotis, Gerasimos G.

Resumen

En este artículo se estudia el rendimiento y las características de negociación de los fondos negociados en la Bolsa suiza. La primera conclusión es que tienen menor rentabilidad que los índices subyacentes en términos de rendimientos medios diarios. Por otra parte, cargan inversores con mayor riesgo en comparación a los índices. Se pone de manifiesto que no siguen estrategias de replicación completa en lo que se refiere a los componentes de las carteras objetivo. Se estima un error de seguimiento significativo, que se atribuye a la política de replicación no completa, a los gastos de gestión y al riesgo de tales fondos. Se encuentra una relación negativa entre gastos y rentabilidad, así como una correlación positiva entre gastos y riesgo. En la siguiente etapa, se encuentra que el volumen negociado de los fondos objeto de análisis está afectado por la volatilidad de los precios intra-día, el número de ordenes ejecutadas y su frecuencia de negociación. Finalmente, se concluye que los fondos negociados en la Bolsa suiza son inferiores a sus homólogos americanos en cuanto a rentabilidad, riesgo, estrategia de replicación, error de seguimiento y volumen.

Palabras clave:

Fondos negociados en la Bolsa suiza, mercado suizo, rentabilidad, riesgo, error de seguimiento, volumen.

1. Introduction

The inception of the Standard and Poor's Depository Receipts (SPDRs) on the American Exchange in 1993 and the subsequent rapid growth of Exchange Traded Funds (ETFs) with products known as Qubes (QQQ), Diamonds, and iShares, have enhanced investment choices and brought new challenges to the professional portfolio manager. This paper studies this alternative type of mutual funds in Switzerland.

ETFs are investment hybrids of ordinary corporate stocks and open-ended mutual funds. They are baskets of shares aimed to closely replicate the performance and risk levels of specific indexes. They are subject to exchange trading rules offering flexibility to investors along with the ability to buy or sell the entire market with a single transaction at any time during the trading hours.

The paper focuses on the ETFs traded in the Swiss Stock Exchange to examine a number of testable hypotheses related to: (1) the ability of ETF managers to replicate the behavior and performance of the underlying index, (2) the magnitude of the tracking error, (3) the role that expenses play on the ETF performance, and (4) the factors that affect the trading behavior of ETFs. Empirical evidence on some of these hypotheses exists on ETFs trading in the U.S., Canada, Australia, and Asian markets but academic research on Swiss ETFs is absent. The Swiss Stock Exchange is one of the four major players in the European ETF market with a turnover of 6.2 billion euros in 2005 and constantly growing with 99 ETFs currently traded. In addition, the Swiss market is of particular interest as Switzerland is considered to be the treasury of the global wealth and, therefore, the interest of international investors in investment products available in the Swiss market is very intense.

By analyzing the trading behavior of Swiss ETFs we not only provide market participants with information on the workings of the market but we allow for comparisons with ETFs in other developed markets. On that basis, both private and institutional investors, either in Switzerland or abroad, may benefit from our analysis because it will provide them with insights into alternative investment choices they can have. Insights relating to performance, risk, costs, trading activity and other institutional factors of Swiss ETFs will make investors acquainted with a new market they may have not already taken into consideration and may make them consider to channel some of their funds to this market exploiting of any particular local advantages of Swiss market over the US one or other national and international ETF markets.

The investors' needs to take positions in the entire market rather than in a specific portfolio is the result of empirical evidence on mutual funds that active management, on the average, does not produce above-normal returns. A number of authors

An Empirical Look at Swiss Exchange Traded Funds Market. *Rompotis, G. G.*
AESTIMATIO, THE IEB INTERNATIONAL JOURNAL OF FINANCE, 2012. 4: 52-81

(Malkiel (1995), Gruber (1996)) attribute the managerial inability to "beat the market" to the increased expenses incurred by the managers in an effort to do so. As a result, the above-normal returns thus achieved on a gross level are reduced to the normal level after expenses are deducted. This realization made investors direct most of their money to mutual funds that track a market index rather than search for a mutual fund that practices active management. These investors' preferences led to the growth of index funds making index providers the world's largest asset managers.

Yet, besides tracking the market, investors have shown strong preference to take positions in and out of the entire market quickly with just one order, with minimum transactions costs, lower tax burden and with greater risk diversification and flexibility. The attempt to incorporate these features in a product led to the development of ETFs.

The benefits and advantages ETFs offer to investors has been analyzed in an array of developed markets like the U.S., and Australia [Gastineau (2001), Carty (2001), Gallagher and Segara (2005)]. They find that their advantages like flexibility, risk diversification, tax efficiency and lower costs have contributed to their successful proliferation. A number of other studies have focused on the ETF pricing and performance [Ackert and Tian (2000), Elton, Gruber, Comer and Li (2002), Poterba and Shoven (2002)] suggesting that ETF pricing does not differ from their net asset value.

Following previous research, we estimate the risk, return, and performance of 36 Swiss ETFs available in the period 2001-2006. We provide three measures of tracking error, examine the tracking ability of ETF managers and assess the trading activity of ETFs and the factors which are likely to explain the growing activity of trading volume. In the last step, we perform a comparison of Swiss ETFs to competitive US ETFs benchmarked to the same indexes. The comparison regards return, risk, tracking error, volume and management fees. The rest of the paper is organized as follows: In Section 2 we develop the methodology followed in the empirical analysis and provide the rationale for regression relationships across tracking error, performance, risk, management fees and trading volume. Sample and data employed are described in Section 3 and Section 4 presents the discussion of the empirical results. In the final section 5 we summarize the main findings of the paper and offer some concluding comments and ideas for future research.

2. Methodology

In this section we develop the methodology that will be followed to examine a number of issues surrounding the Swiss ETF like statistical characteristics, tracking error, performance, expenses, risk, volume, and their interactions.

2.1 Statistical Characteristics

We first calculate the average daily percentage return and risk of Swiss ETFs and their corresponding indexes. We compute the percentage return of ETFs, using equation (1):

$$R_i = \frac{TV_i - TV_{i-1}}{TV_{i-1}} * 100 \quad (1)$$

where, R_i refers to the percentage return on day i, and TV_i refers to the trading price of ETF on day i.

The risk of ETFs and of the indexes is expressed by the standard deviation of returns:

$$\sigma^2 = \frac{\sum_{i=1}^{N} (R_i - \bar{R})^2}{N-1} \quad (2)$$

and

$$\sigma = \sqrt{\sigma^2} \quad (3)$$

where, σ^2 denotes the variance of an ETF's return around the average return $\bar{R}$ and σ expresses the percentage risk of portfolio in terms of returns' standard deviation. We also estimate the risk/return ratio by dividing the mean standard deviation of returns by the average percentage return. This ratio calculates the risk per unit of return, a useful measure when making comparisons across ETFs.

Next, we introduce regression models to analyze the interrelationships among the average daily trading turnover, the number of the mean executed trades, the volume of traded shares, the percentage management fee and the trading frequency of ETFs.

2.2 Regression Analysis

In this section, we perform an Ordinary Least Squares (OLS) simple regression in order to examine a variety of interesting issues. The OLS regression method adopted is the standard method used in the relevant financial literature. In addition, as it will be shown in Table 1, the return series of ETFs and indexes are stationary and, thus, can be used in an OLS regression model. The single index model is presented in equation (4):

$$R_{pt} = \alpha_i + \beta_i R_{bt} + \varepsilon_{pt} \quad (4)$$

where: R_{pt} indicates the raw return of the ETF on day t, R_{bt} presents the return of the tracking index portfolio on day t, and ε_{pt} is the residual error on that day. In this regression, the alpha (α) coefficient estimates the return an ETF could achieve above the return that relates to the index portfolio. However, since ETFs pursue a passive investment approach, alpha estimations are not expected to be statistically significant.

The beta (β) coefficient in equation (4) is an estimate for the systematic risk to which an ETF is exposed and reflects the aggressiveness of management strategy. Beta estimations are also viewed as indicators of an ETF's replication strategy. A beta of unity suggests a full replication strategy whereby the ETF invests to all components of the tracking index in the same weights. In contrast, a beta coefficient which significantly differs from unity represents a departure from a full replication strategy. In this case the ETF manager rather implements selection techniques choosing stocks expected to outperform.

2.3 Tracking Error

The deviation of the performance of index funds from the performance of corresponding indexes is defined as "tracking error" and this issue has attracted great interest in the literature. The most common issue in passive portfolio management is that fund managers usually fail to replicate accurately the return of their corresponding indexes.

Among the early studies on tracking error, Roll (1992) argued that the major challenge faced by the portfolio manager is the minimization of the tracking error. Roll argues that the derived portfolios under this strategy are efficient if the benchmark portfolio is efficient. However, such portfolios bear greater systematic risk than the benchmark's portfolio, which implies a beta greater than unity. Pope and Yadav (1994) investigate the restrictions in tracking error estimation which derive from the usage of high-frequency data like the daily or weekly returns. The major impact of high-frequently data is that they induce negative serial correlation with respect to the difference between the fund return and its benchmark. They suggest that unless the portfolio's composition exactly replicates the components of the tracking index, the return differences would be negatively serially correlated.

The impact of a portfolio's components on its tracking performance relative to a selected benchmark's return is the focus of a study by Larsen and Resnick (1998). Their investigation on both high and low-capitalization portfolios reveals that the high-capitalization portfolios present inferior tracking error and volatility than the low-capitalization counterparts. They also find that the magnitude of tracking error approximates zero when the composition of the stocks' portfolio reaches the absolute synthesis of the index portfolio.

Frino and Gallagher (2001) present the major factors that enlarge the size of tracking error such as the dividend payments arising from the stocks of an index as well as the size and the timing of index's rebalancing. They conclude that index funds face market frictions that hurt their ability to replicate exactly the performance of the underlying indexes which do not face any frictions at all. They also discover a seasonality effect in tracking error magnitude.

Kostovetsky (2003) demonstrates that index funds and ETFs' tracking error is affected by common as well as by different elements. The main factors that induce the tracking error of index funds are the bid-ask spreads, the obligation of index funds to maintain a significant amount of money in cash to meet redemptions, the dividend policies and the transaction costs arising from index changes or corporate activity. The cash drag effect is applicable to ETFs too, even if it is much smaller. ETFs performance is affected by the dividend policies, which usually obligate the ETFs managers to keep the received dividends from the index's stocks in non-bearing accounts.

Finally, Blume and Edelen (2004) study the impact of S&P 500 composition's change to the abnormal returns of index funds. These abnormal returns are attainable if the indexer chooses to adjust his portfolio immediately at the opening price on the consequent day of the change's announcement, rather than waiting until the closure on the day of change. This strategy induces the observed tracking error.

The literature suggests a variety of methods in tracking error estimations. For example, Ammann and Zimmermann (2001) recommend the correlation coefficient between the tracking portfolio and the benchmark. In our study, we choose the three most commonly used methods of tracking error measurement. The first one, $TE_{1,P}$, is straightforward and defined as the standard error of regression (4).

The second one, $TE_{2,P}$, computes the tracking error by calculating the average of absolute differences between the returns of ETFs and the corresponding indexes. We take into account the absolute value of returns' differences because either a positive or a negative difference reflects performance deviation. This estimation is expressed in equation (5):

$$TE_{2,P} = \frac{\sum_{t=1}^{n} |e_{Pt}|}{n} \tag{5}$$

where $|e_{Pt}|$ is the absolute return difference in day t.

Finally, the third method, $TE_{3,P}$, computes the standard deviation of return differences between ETFs and their indexes. This is the most commonly used method and, according to Pope and Yadav (1994), produces the same results in comparison to the first method only if equation's (4) beta is equal to unity. The estimation of this tracking error is presented in equation (6):

$$TE_{3,P} = \sqrt{\frac{1}{n-1} \sum_{t=1}^{n} (e_{pt} - \bar{e}_p)^2} \tag{6}$$

where e_{pt} is the difference of returns in day t and $\bar{e}_p$ is the average return's difference over n days.

4.4 Performance, Expenses and Risk

After estimating ETFs risk and return and the related tracking error components, attention is turned to the management expenses and their impact on ETFs ability to accurately replicate the performance of the selected benchmarks. The literature denotes that expenses count for a big portion of ETFs tracking error.[1]

As a proxy of Swiss ETFs expenses we use the published ratio of management fee.[2] The impact of expenses on ETFs performance is assessed with cross-sectional regression analysis. In the first step, we apply a single OLS regression of ETFs average daily return on their percentage management fee ratio with the method. This regression is appropriate, since the managerial fees are subtracted daily on a percentage basis. We expect the coefficient of fees to be negative and statistically significant since the expenses found on ETFs are reducing their performance relatively to the benchmark's performance which does not carry any expenses.

In addition, we estimate the quantitative relation between the tracking error measurements and the management fees. We perform single OLS regressions of tracking error on management fee ratio. We apply three distinct regressions for each one of the three tracking error estimates. Since management fees apply only to ETFs and not to the underlying index, the greater the management fees the greater the tracking error is expected to be and the coefficient of management fee ratio to be positive.

In our analysis of expenses, we consider the risk as a determinant factor of the fees imposed on an ETF investor. As the related risk of an investment increases, the imposed fees are expected to also increase. This influence is more evident in ETFs tracking benchmark indexes of international markets, which usually bear the higher expense ratios. We estimate the impact of risk on management fees by regressing the fee ratio on the standard deviation of ETF returns with the OLS method In the last step of our analysis, we assume that price risk affects the tracking ability of ETFs. We expect risk and tracking error to be positively related and explore this relation by regressing the three ETF tracking error estimates on the calculated level of risk with the OLS method.

2.5 Determinants of Volume

In this segment, we investigate the determinants of the daily volume of Swiss ETFs. The combination of trading volume and total assets under management reflects the attractiveness of ETFs and their acceptance by the investing community.

[1] *See for example, Elton, Gruber, Comer and Li (2002).*

[2] *Unfortunately, we are not provided with any information on transaction costs or brokerage commissions and it is not defined if the management fee ratio used here includes any of these costs. Further, we are not supplied with data concerning the bid and ask prices of ETFs shares on Swiss Exchange.This lack of data on expenses restricts our investigation only to management fees.*

The daily volume of ETFs shares is influenced by various factors. Elton, Gruber, Comer and Li (2002) connect volume size with market volatility and the arbitrage opportunity of ETFs. In a similar manner we treat the intraday volatility of ETFs as a determinant factor of volume in order to incorporate the inherent trading trend of ETFs. The intraday volatility is estimated by the ratio of the difference between the daily highest and the daily lowest price on any given day to the closing ETF price on that day.

The conventional hypothesis is that the number of trades has a positive effect on volume. Normally, both purchases and sales of ETFs induce the volume's configuration, implying a straightforward correlation among ETFs volume and the number of trades. Furthermore, one could assume that the return of ETFs on the previous trading day would probably induce the size of today's volume. This assumption is applicable both for short and long investors. Therefore, we expect a positive relationship between ETF volume and ETF one day lagged performance.

We examine the determination of Swiss ETFs volume with a time-series regression for each ETF that combines ETF volatility, the number of trades, and the lagged return. The OLS regression applied is as follows:

$$LnV_i = a_0 + a_1 \frac{DH_i - DL_i}{IC_i} + a_2\, TR_i + a_3\, LagRet_i + e_i \qquad (7)$$

The LnV_i variable refers to the natural logarithm of the daily volume for the ith ETF. DH_i , DL_i and IC_i denote the intraday highest, lowest and closing price of the ith ETF, respectively. The $(DH_i - DL_i)/IC_i$ ratio estimates the ETF's intraday volatility. TR_i is the number of executed trades for the ith ETF. Finally, $LagRet_i$ refers to the return in the previous day of the ith ETF.

Besides the above factors, we assume that trading frequency also influences the volume of ETFs. We examine this issue for the overall sample's ETFs by a cross-sectional regression. The model also includes the average ETFs volatility and the average number of trades as in equation (7). However, the average lagged return is not applicable and therefore not embodied in the regression. The trading frequency is noted as FREQ and is defined as the rate of the actual trading days of ETFs to the total actual trading days of the indexes. These influences are estimated in the following OLS regression:

$$LnV_i = b_0 + b_1 \frac{DH_i - DL_i}{IC_i} + b_2\, TR_i + b_3\, FREQ_i + u_i \qquad (8)$$

2.6 Comparison of Swiss and US ETFs

The last issue examined concerns the competition between the Swiss ETFs and the corresponding US listed ETFs tracking the same indexes. In this respect, we find 10 ETFs in the sample having corresponding US ETFs. In other words, the 10 Swiss ETFs and 10 US ETFs considered in this comparison in pairs track the same indexes. The comparison is performed in terms of the main trading statistics such as return, risk, systematic risk, tracking error, trading volume and management fees.

We note that there are some differences in the trading history between Swiss and US ETFs, namely there are working days in Switzerland on which the US market is closed and vice versa. So as to avoid any bias in the results of the comparison, we adjust the data for the two samples to each other. Thus, the results that will e reported only concern the days on which both the markets are open.

3. Data

We use daily data for a sample of 36 ETFs traded on the Swiss Stock Exchange during the period of August 2001 to April 2006. We note that this number does not reflect all available Swiss ETFs over that period. Particularly, the Swiss exchange offers trading opportunities for 49 ETFs of various investment styles, like equities, bonds or commodities. The majority of the non-included ETFs suffer from illiquid trading or were restrictions collecting the historical prices of the underlying indexes.

Beyond the listed Swiss ETFs, the sample encompasses four ETFs that do not currently trade on the Swiss exchange. These ETFs ceased their trading activity approximately at the end of 2004, but their previous history is significantly voluminous and cannot be ignored. We decided to include these non-survived ETFs, thus mitigating the survivorship bias problem. Overall, the sample of this study contains 36 ETFs that are mainly equity ETFs, while two bond ETFs are also included.

The trading data of the surviving and non-surviving ETFs were available at the Swiss exchange's webpage. The dataset encompasses historical information about the daily ETFs closing values, intraday high and low prices and the volume of the traded shares. Swiss exchange's webpage also offers data about the names of ETFs, tracking indexes and their management fee ratios.

The sample ETFs track various European, US and Asian indexes in growth and emerging capital or bond markets. A large part of the sample's ETFs try to replicate the performance of Morgan Stanley's international indexes. The daily closing values of these indexes are collected from the Morgan Stanley's webpage. Further, another

large part of the sample's ETFs follow the return of major regional or sector Dow Jones indexes. The Dow Jones webpage makes available the values of these indexes. Moreover, the sample includes ETFs that track four principal equity and bond indexes of Swiss markets, the data of which are collected from the web database of the Swiss exchange. Accordingly, one ETF follows the Nasdaq 100 index, one tracks the S&P 500 index and the other two track the movements of FTSE 100 and FTSEurofirst 100 index. The closing values of the above indexes are collected from finance.yahoo.

4. Empirical Results

4.1 Descriptive Statistics

Table 1 presents the risk and return characteristics of the sample. Results show that the average daily percentage return of the sample's ETFs is positive and equal to 3 basis points (b.p.). The average return of the corresponding indexes is a little higher than the average return of ETFs and equals 7 b.p. This comparison suggests that the sample's ETFs underperform, on the average, the return of the underlying indexes by an amount of 4 b.p.

Table 1. Percentage Daily Return and Risk of ETFs and Indexes

This table presents the calculations of ETFs and underlying indexes' average percentage return and risk. As the column of the number of observations implies the availability of ETFs data varies, reflecting the different inception day and trading activity of each one. The table also reports the risk/return ratio, which indicates the risk of one unit of return. In our estimations of return and risk we use daily data on trading days with nonzero trading volume.

			Return		Risk		Risk/Return Ratio	
ETF No	ETF Name	Underlying Index	ETF	Index	ETF	Index	ETF	Index
ETF1	DJ EU STOXX50 EX	DJ EU STOXX50	0.07	0.07	1.17	0.93	15.85	13.36
ETF2	DJ STOXX 50 EX	DJ STOXX 50	0.33	0.33	1.80	1.74	5.47	5.34
ETF3	FRESCO DJ UK 50	DJ UK 50	-0.04	-0.02	2.40	1.93	-60.32	-101.07
ETF4	ISHARES DJ EUMICAP	DJ Euro STOXX MC	0.19	0.19	1.43	1.43	7.62	7.69
ETF5	ISHARES EUR SM CAP	DJ Euro STOXX SC	0.23	0.23	1.68	1.38	7.28	6.03
ETF6	ISHARES DJ EUSTOXX50	DJ EUSTOXX50	0.05	0.05	0.97	0.85	17.89	15.96
ETF7	ISHARES DJ STOXX 50	DJ STOXX 50	0.05	0.05	0.90	0.82	17.40	16.77
ETF8	ISHARES FTSEUROFIRST 100	FTSEurofirst 100	0.20	0.20	1.24	1.26	6.12	6.27
ETF9	ISHARES MSCI BRAZIL	MSCI BRAZIL	-0.28	-0.17	3.48	2.97	-12.49	-17.07
ETF10	ISHARES MSCI EMG	MSCI EMERG. MARK.	-0.24	-0.07	1.50	1.57	-6.35	-24.17
ETF11	ISHARES MSCI EST EU	MSCI EAST. EUROPE	-0.20	0.02	2.78	2.76	-13.81	125.16
ETF12	ISHARES MSCI JAP FD	MSCI JAPAN	0.13	0.12	1.39	1.29	10.95	10.87
ETF13	ISHARES MSCI KOREA	MSCI KOREA	-0.11	0.08	1.55	1.54	-13.79	18.39
ETF14	ISHARES MSCI TAIWAN	MSCI TAIWAN	-0.05	0.19	1.47	1.33	-32.44	7.05
ETF15	ISHARES MSCI WORLD	MSCI WORLD	-0.19	-0.02	1.02	0.77	-5.32	-44.24
ETF16	ISHARES S&P 500	S&P 500	0.02	0.03	1.05	0.72	47.73	22.30
ETF17	LYXOR DJ EUROSTOXX50	DJ EURO STOXX 50	0.17	0.17	1.41	1.32	8.07	7.84
ETF18	NASD100 EUR TRACK	NASDAQ 100	0.03	0.05	1.47	1.14	42.26	24.39
ETF19	SMIEX FONDS	SMI®	0.05	0.04	1.79	1.78	36.00	43.14
ETF20	STOXX 50 LDRS	DJ STOXX 50	-0.03	-0.06	2.47	2.23	-96.62	-39.88
ETF21	UBS-ETF DJ INDU AVG	DJ INDU AVG	0.00	0.02	1.73	1.10	-348.71	57.53
ETF22	UBS-ETF DJ JAPAN 100	DJ JAPAN 100	0.03	0.05	1.57	1.31	52.35	28.06

ETF23	UBS-ETF DJ US LG CAP	DJ US LG CAP	-0.02	0.01	2.08	1.30	-123.25	92.52
ETF24	UBS-ETF DJ US TECH	DJ US TECH	-0.02	0.00	2.53	1.99	-111.36	868.87
ETF25	UBS-ETF EUSTOXX50 I	DJ EURO STOXX 50	0.20	0.19	1.33	1.28	6.50	6.72
ETF26	UBS-ETF EUSTOXX50	DJ EUSTOXX50	0.03	0.02	1.67	1.53	56.75	68.45
ETF27	UBS-ETF FTSE 100	FTSE 100	0.05	0.04	1.12	0.80	22.17	21.20
ETF28	UBS-ETF SMI	SMI®	0.06	0.06	0.72	0.72	11.90	12.25
ETF29	XMTCH DJ BANKS	DJ BANKS	0.14	0.26	3.42	3.32	24.35	12.80
ETF30	XMTCH DJ TECHNOLOGY	DJ TECHNOLOGY	0.10	0.24	2.97	2.58	30.94	10.82
ETF31	XMTCH DJ HEALTHCARE	DJ HEALTHCARE	-0.07	0.09	2.28	1.54	-33.93	17.43
ETF32	XMTCH MSCI Euro	MSCI EURO INDEX	0.06	0.08	1.23	1.07	19.87	12.98
ETF33	XMTCH ON SMIM	SMIM®	0.12	0.12	0.83	0.80	6.87	6.69
ETF34	XMTCH SBI DOM GOV3-7	SBI DOM GOV. 3-7 P	0.00	-0.01	0.24	0.11	-51.67	-14.13
ETF35	XMTCH SBI DOM GOV 7+	SBI DOM GOV. 7+ P	0.01	0.00	0.60	0.35	50.31	-186.64
ETF36	XMTCH SMI	SMI®	0.01	0.01	1.39	1.28	124.24	141.86
	Average		**0.03**	**0.07**	**1.63**	**1.41**	**-7.81**	**35.04**
	Min		**-0.28**	**-0.17**	**0.24**	**0.11**	**-348.71**	**-186.64**
	Max		**0.33**	**0.33**	**3.48**	**3.32**	**124.24**	**868.87**

	Skewness		Kurtosis		Jarque Berra Test Probability		Unit Root Test#		Obs.
ETF Name	**ETF**	**Index**	**ETF**	**Index**	**ETF**	**Index**	**ETF**	**Index**	
DJ EU STOXX50 EX	0.33	-0.52	12.54	4.46	0.00@	0.00@	0.00	0.00	542
DJ STOXX 50 EX	-0.35	-0.31	3.83	3.68	0.08	0.17	0.00	0.00	101
FRESCO DJ UK 50	0.06	-0.27	5.23	6.53	0.00@	0.00@	0.00	0.00	341
ISHARES DJ EUMICAP	-2.81	-3.32	23.31	28.44	0.00@	0.00@	0.00	0.00	136
ISHARES EUR SM CAP	-2.18	-2.10	17.60	17.32	0.00@	0.00@	0.00	0.00	122
ISHARES DJ EUSTOXX50	-0.16	-0.21	4.40	4.55	0.00@	0.00@	0.00	0.00	681
ISHARES DJ STOXX 50	-0.28	-0.09	3.85	4.33	0.00@	0.00@	0.00	0.00	589
ISHARES FTSEUROFIRST 100	-0.89	-0.92	6.50	6.30	0.00@	0.00@	0.00	0.00	99
ISHARES MSCI BRAZIL	-0.45	0.11	3.99	4.86	0.20	0.04@	0.00	0.00	43
ISHARES MSCI EMG	-0.48	-0.80	2.89	4.37	0.43	0.02@	0.00	0.00	43
ISHARES MSCI EST EU	0.15	0.27	5.17	5.70	0.01@	0.00@	0.00	0.00	44
ISHARES MSCI JAP FD	0.23	0.13	4.35	4.28	0.00@	0.00@	0.00	0.00	214
ISHARES MSCI KOREA	-0.45	-0.55	2.73	3.00	0.46	0.35	0.00	0.00	42
ISHARES MSCI TAIWAN	-0.60	-0.51	3.22	3.72	0.31	0.29	0.00	0.00	38
ISHARES MSCI WORLD	0.42	0.15	4.63	3.20	0.06	0.90	0.00	0.00	39
ISHARES S&P 500	-0.22	-0.12	3.28	3.19	0.11	0.47	0.00	0.00	390
LYXOR DJ EUROSTOXX50	-0.29	-0.02	5.24	4.04	0.00@	0.09	0.00	0.00	108
NASD100 EUR TRACK	-0.46	-0.11	3.72	4.24	0.00@	0.00@	0.00	0.00	255
SMIEX FONDS	-0.27	-0.90	8.78	9.33	0.00@	0.00@	0.00	0.00	534
STOXX 50 LDRS	-0.05	-0.13	4.85	4.81	0.00@	0.00@	0.00	0.00	289
UBS-ETF DJ INDU AVG	0.19	0.43	14.19	6.32	0.00@	0.00@	0.00	0.00	981
UBS-ETF DJ JAPAN 100	0.13	0.26	3.54	3.37	0.34	0.28	0.00	0.00	1038
UBS-ETF DJ US LG CAP	0.92	-0.27	18.16	7.51	0.00@	0.00@	0.00	0.00	740
UBS-ETF DJ US TECH	0.76	0.34	20.05	6.67	0.00@	0.00@	0.00	0.00	902
UBS-ETF EUSTOXX50 I	0.06	0.15	6.56	6.48	0.00@	0.00@	0.00	0.00	128
UBS-ETF EUSTOXX50	1.03	0.32	7.23	3.55	0.00@	0.15	0.00	0.00	991
UBS-ETF FTSE 100	-0.12	-0.55	4.05	5.37	0.06	0.00	0.00	0.00	116
UBS-ETF SMI	-0.30	-0.46	4.15	4.53	0.00@	0.00@	0.00	0.00	618
XMTCH DJ BANKS	0.50	2.39	16.77	26.47	0.00@	0.00@	0.00	0.00	107
XMTCH DJ TECHNOLOGY	0.09	0.36	3.50	4.36	0.26	0.00@	0.00	0.00	225
XMTCH DJ HEALTHCARE	-0.50	0.18	6.29	6.49	0.00@	0.00@	0.00	0.00	167
XMTCH MSCI Euro	0.34	0.09	6.23	5.28	0.00@	0.00@	0.00	0.00	903

XMTCH ON SMIM	-0.14	0.09	16.61	7.67	0.00@	0.00@	0.00	0.00	372
XMTCH SBI DOM GOV3-7	-0.90	-1.05	6.44	7.47	0.00@	0.00@	0.00	0.00	502
XMTCH SBI DOM GOV 7+	-0.04	1.01	4.19	9.04	0.00@	0.00@	0.00	0.00	233
XMTCH SMI	-1.33	0.15	10.99	7.57	0.00@	0.00@	0.00	0.00	1257
Average	**-0.22**	**-0.19**	**7.75**	**6.90**	**0.06**	**0.08**	**0.00**	**0.00**	**387**
Min	**-2.81**	**-3.32**	**2.73**	**3.00**	**0.00**	**0.00**	**0.00**	**0.00**	**38**
Max	**1.03**	**2.39**	**23.31**	**28.44**	**0.46**	**0.90**	**0.00**	**0.00**	**1257**

@ The hypothesis of normal distribution of returns is rejected.

 # The Unit Root Test performed is the Augmented Dickey-Fuller Test and the reported values are the probabilities of the relevant t-tests for the rejection of the null hypothesis of the existence of a unit root in return series. Probability<0.05 implies no unit root in returns.

The lowest return relates to the iShares MSCI Brazil and it counts for -0.28%. At the same time, the corresponding index presents the poorest return equal to -0.17%. On the contrary, the best average performer is the DJ Stoxx 50 whose return amounts to 33 b.p. exactly as much as its corresponding ETF.

Regarding the ETFs risk, we find that the daily ETFs standard deviation is 1.63% while indexes present a risk which is equal to 1.41%. The less risky ETF is the XMTCH SBI DOM GOV3-7, and the most risky is the iShares MSCI Brazil, also the one with the weakest performance. In this case, the common belief that the high risk usually compensates investors with higher returns on an ex ante basis, does not hold ex post.

The average ETF risk/return ratio is quantified to -7.81, while we observe a large range between the minimum and the maximum values. Specifically, the lowest risk/return ratio is equal to -348.71, related to the UBS-ETF DJ INDU AVG. This low value of the ratio emerges as an outlier when the daily average ETF risk of 1.73% is divided by a very minimal negative return of almost zero. On the other side, the maximum risk/return ratio concerns the XMTCH SMI which tracks the general index of the Swiss exchange market.

When it comes to the skewness in returns, Table 2 shows that skewness is not the case in our sample. On the contrary, kurtosis in returns is an issue in our sample. In particular, the average kurtosis for ETFs and indexes amounts to 7.75 and 6.90, respectively indicating that the return series are leptokurtic. As a result, the Jarque Berra Test performed on the normality in returns' distributions rejects this hypothesis, namely the returns of ETFs and indexes are not normally distributed for the majority of the sample's ETFs and indexes. However, the results of the Augmented Dickey-Fuller Test performed for examining the stationarity of return series indicate that there is no such problem in returns and can be used in a standard OLS regression analysis.

In Table 2, we find that the average daily turnover is equal to CHF 1,299,604.32. The minimum average daily turnover is connected with the XMTCH DJ HEALTHCARE. We notice that this ETF does not currently exist; this termination of ETF's trading activity could well be attributed to the lack of substantial daily turnover. In contrast,

the XMTCH SMI presents the greatest trading value. We note that this is one of the first three ETFs that were introduced on the Swiss exchange along with STOXX 50 LDRS and EU STOXX LDRS.[3]

Table 2. **Trading and expense characteristics of ETFs**

This table presents the average daily trading activity of ETFs, regarding the turnover, the number of trades, the number of traded shares (volume) and the trading frequency ratio. Further, the table reports the management fee ratios, which are collected from the webpage of Swiss Stock Exchange.

ETF Name	Daily Turnover (CHF)	Trades	Volume	Manag. Fee	Trading Frequency(%)
DJ EU STOXX50 EX	379,313.12	2.78	8,044.60	0.15%	74.12
DJ STOXX 50 EX	416,007.42	1.41	9,098.87	0.50%	15.81
FRESCO DJ UK 50	373,414.84	2.09	7,975.41	NA	33.66
ISHARES DJ EUMICAP	100,716.28	1.72	1,680.74	0.40 %	43.04
ISHARES EUR SM CAP	154,810.53	2.48	4,039.66	0.40 %	38.73
ISHARES DJ EUSTOXX50	3,585,222.18	17.88	78,398.99	0.35 %	93.67
ISHARES DJ STOXX 50	778,054.99	3.96	17,148.67	0.35 %	85.61
ISHARES FTSEUROFIRST 100	323,524.71	1.81	7,583.00	0.40 %	29.20
ISHARES MSCI BRAZIL	593,635.04	7.00	14,993.09	0.74 %	86.00
ISHARES MSCI EMG	444,349.20	4.91	11,910.12	0.75 %	86.00
ISHARES MSCI EST EU	479,972.48	5.86	12,448.89	0.74 %	89.80
ISHARES MSCI JAP FD	450,505.79	5.64	26,479.26	0.59 %	67.30
ISHARES MSCI KOREA	219,656.03	2.86	5,709.60	0.74 %	84.00
ISHARES MSCI TAIWAN	281,797.29	3.55	6,882.66	0.74 %	77.55
ISHARES MSCI WORLD	148,840.30	2.82	4,060.03	0.50 %	81.25
ISHARES S&P 500	799,784.15	7.43	49,657.50	0.40 %	79.11
LYXOR DJ EUROSTOXX50	442,897.25	1.62	8,561.52	0.25 %	34.95
NASD100 EUR TRACK	1,380,557.93	2.80	29,319.16	0.20 %	59.44
SMIEX FONDS	507,246.03	3.79	8,132.65	0.50 %	44.39
STOXX 50 LDRS	1,241,113.51	3.98	34,812.83	NA	86.53
UBS-ETF DJ INDU AVG	561,613.58	3.93	2,214.29	0.50 %	85.90
UBS-ETF DJ JAPAN 100	1,499,536.44	17.08	25,898.58	0.50 %	88.04
UBS-ETF DJ US LG CAP	455,105.41	2.59	6,564.00	0.30 %	50.68
UBS-ETF DJ US TECH	320,377.84	3.79	5,476.60	0.60 %	61.87
UBS-ETF EUSTOXX50 I	1,460,025.86	2.04	26.22	0.10 %	34.22
UBS-ETF EUSTOXX50	916,004.93	7.99	19,733.08	0.30 %	95.47
UBS-ETF FTSE 100	269,954.63	3.37	2,033.34	0.50 %	88.55
UBS-ETF SMI	1,625,599.56	10.21	25,518.51	0.35 %	97.63
XMTCH DJ BANKS	57,330.00	1.54	350.17	NA	15.07
XMTCH DJ TECHNOLOGY	104,561.13	2.01	574.86	NA	31.42
XMTCH DJ HEALTHCARE	52,215.82	1.57	368.84	NA	23.42
XMTCH MSCI Euro	5,314,786.63	33.26	39,727.68	0.40 %	96.17
XMTCH ON SMIM	2,782,734.69	26.00	26,226.33	0.45 %	88.78
XMTCH SBI DOM GOV3-7	1,031,769.24	4.77	10,439.64	0.08 %	77.83
XMTCH SBI DOM GOV 7+	256,252.46	1.67	2,443.80	0.08 %	36.52
XMTCH SMI	16,976,468.29	111.02	292,162.03	0.35 %	99.13
Average	**1,299,604.32**	**8.87**	**22,408.20**	**0.33%**	**65.58**
Min	**52,215.82**	**1.41**	**26.22**	**0.08%**	**15.07**
Max	**16,976,468.29**	**111.02**	**292,162.03**	**0.75%**	**99.13**

Note:The NA term refers to ETFs that have not survived.

[3] *The first day of trading for these three ETFs is 1/6/2001.*

Besides the daily turnover, the numbers of trades and the volume of shares also reflect the marketability of ETFs. The average values of these variables are respectively 8.87 and 22,408.20. The maximum values of these factors reconfirm the trading superiority of XMTCH SMI.

The mean management fee ratio of 32 existed ETFs is equal to 33 b.p. Unfortunately, the data about the fees for four ETFs that no longer exist are not available. The lowest ETF expense ratios are these of the bond ETFs whose fee ratio amounts to 8 b.p. The highest fee ratios are associated with the ETFs which track the international indexes of Morgan Stanley. Finally, regarding the percentage trading frequency, it ranges from 15.07% to 99.13%, while the average trading frequency is 65.58%.

4.2 Regression Analysis

In this section, we present the results of the time-series performance regression (4) in Table 3. The mean alpha estimate of the entire ETF sample is negative and statistically significant at the 5% level or better. However, only two of the 36 ETFs have alphas statistically different from zero at the 10% level. This finding is in accordance with our expectations, since all of the sample's ETFs are passive indexers and they do not have any material trading flexibility to produce superior returns than their indexes.

● Table 3. **Performance Regression Results**

$$R_{pt} = \alpha_i + \beta_i R_{bt} + \varepsilon_{pt} \quad (4)$$

This table presents the results of performance regression. Particularly, we regress the ETF's daily return on the return of the underlying index.

ETF Name	α	*T*-stat	β	*T*-stat	R^2	Heteroske dasticity Test	Lags	Obs.
DJ EU STOXX50 EX	0.01	0.52	1.01	0.39	0.62	0.46	4	542
DJ STOXX 50 EX	0.04	0.87	0.91	-1.47	0.80	0.03^	3	101
FRESCO DJ UK 50	-0.01	-0.29	0.96	-1.00	0.59	0.41	3	341
ISHARES DJ EUMICAP	0.01	0.50	0.95***	-1.76	0.88	0.67	2	136
ISHARES EUR SM CAP	-0.03	-0.78	1.05	1.22	0.79	0.31	2	122
ISHARES DJ EUSTOXX50	0.00	0.06	1.01	0.51	0.75	0.77	3	681
ISHARES DJ STOXX 50	0.01	0.49	0.90*	-3.85	0.58	0.01^	3	589
ISHARES FTSEUROFIRST 100	0.02	0.64	0.92	-1.43	0.70	0.61	3	99
ISHARES MSCI BRAZIL	-0.08	-0.41	0.88	-1.42	0.48	0.00^	2	43
ISHARES MSCI EMG	-0.19***	-1.87	0.72*	-3.34	0.64	0.92	3	43
ISHARES MSCI EST EU	-0.22	-1.33	0.93	-1.14	0.84	0.52	0	44
ISHARES MSCI JAP FD	0.06	0.98	0.68*	-5.84	0.42	0.54	1	214
ISHARES MSCI KOREA	-0.17	-0.99	0.71**	-2.55	0.49	0.38	0	42
ISHARES MSCI TAIWAN	-0.21	-1.32	0.85	-1.28	0.59	0.91	0	38
ISHARES MSCI WORLD	-0.18	-1.28	0.71	-1.56	0.28	0.14	0	39
ISHARES S&P 500	0.01	0.29	0.32*	-8.42	0.52	0.02^	1	390
LYXOR DJ EUROSTOXX50	0.01	0.35	1.03	0.67	0.79	0.08	1	108
NASD100 EUR TRACK	0.00	0.03	0.71*	-4.33	0.29	0.04^	1	255
SMIEX FONDS	0.01	1.04	0.96***	-1.87	0.78	0.00^	4	534

STOXX 50 LDRS	0.03***	1.81	1.01*	0.43	0.77	0.14	4	289
UBS-ETF DJ INDU AVG	-0.02	-0.73	0.76*	-4.70	0.21	0.00^	4	981
UBS-ETF DJ JAPAN 100	-0.04	-0.71	1.06	1.59	0.84	0.32	1	1038
UBS-ETF DJ US LG CAP	-0.03	-0.81	0.80*	-2.98	0.26	0.00^	3	740
UBS-ETF DJ US TECH	-0.03	-0.84	0.81*	-3.87	0.31	0.00^	4	902
UBS-ETF EUSTOXX50 I	0.07	1.07	0.63*	-3.43	0.34	0.00^	3	128
UBS-ETF EUSTOXX50	0.01	1.00	1.02	1.16	0.76	0.00^	1	991
UBS-ETF FTSE 100	0.02	0.63	0.82**	-2.54	0.59	0.36	3	116
UBS-ETF SMI	0.01	1.29	0.92*	-4.75	0.79	0.03^	4	618
XMTCH DJ BANKS	-0.07	-0.66	0.88	-1.63	0.79	0.01^	1	107
XMTCH DJ TECHNOLOGY	-0.10	-1.01	0.84*	-3.01	0.48	0.95	2	225
XMTCH DJ HEALTHCARE	-0.14	-1.43	0.76**	-1.99	0.33	0.00^	2	167
XMTCH MSCI Euro	-0.01	-0.29	0.84*	-4.52	0.53	0.00^	2	903
XMTCH ON SMIM	0.00	0.49	1.00	0.00	0.91	0.00^	4	372
XMTCH SBI DOM GOV3-7	0.04	0.73	1.08	1.15	0.35	0.00^	4	502
XMTCH SBI DOM GOV 7+	0.01	0.90	1.09	0.87	0.40	0.00^	3	233
XMTCH SMI	0.00	0.42	0.97	-0.78	0.81	0.79	1	1257
Average	**-0.03**	**-0.02**	**0.88**	**-1.87**	**0.59**	**0.26**	**2**	**386.94**
***t*-test**	**-2.48****		**-4.78***		**-11.77***			

Note:

The t-tests of the entire alpha and beta columns test the hypothesis whether the average alpha and beta are statistically different from zero. The t-test for R^2 column reflects the possibility the average R^2 to be statistically different from unity.

For Heteroskedasticity the reported values are the probabilities on the significance of the relevant F-statistics. Lags refer to the ARs included in the model for the correction of autocorrelation.

** Statistically significant at the 1% level. **Statistically significant at the 5% level. ***Statistically significant at the 10% level.*

^ Heteroskedasticity corrected with White correction.

In contrast to alpha values, the estimations of all beta coefficients are economically significant and statistically differ from zero at the 1% level. The mean measurement of beta is equal to 0.88, indicating that the sample's ETFs, on average, are more conservative in comparison to their related benchmarks. Furthermore, t-statistics indicate that a good number of ETF betas are different from unity. This result suggests that many Swiss ETFs do not follow a full replication strategy. Possibly, this insufficient replication of indexes explains partially the underperformance of ETFs relative to the corresponding index returns which was discussed in subsection 7.1.

Viewing the individual beta estimations, we see that the most substantial beta deviation from unity concerns mainly the ETFs which track the international capital indexes of Morgan Stanley. Moreover, the S&P 500 index, the Nasdaq 100 index and some of the Dow Jones sector indexes seem to not be fully replicated by the relevant ETFs. This fact implies that the regional, geographic and time differences between the Swiss listed ETFs and their corresponding indexes restrict ETFs from efficient replication of index portfolios.

As a last examination of ETFs replication policy, we use the value of R-square. The average R-square is 0.59, which implies a very good regression fit. On the other hand, the difference of the average R-square from unity, statistically significant at the 1% level, indicates that Swiss ETFs are not fully invested on the assets of their underlying

index portfolio. The size of the average R-square confirms the deviation of ETFs components from those of their respective indexes.

When it comes to the value of the results just presented, we should refer to the results of the Heteroskedasticity test applied as well as the number of lags included in the model for the correction of autocorrelation in returns when necessary. Heteroskedasticity was corrected in 18 out of 36 cases with the White method while the average number of lags used for the correction of autocorrelation is two. Therefore, our results are meaningful and powerful in any statistical sense.

4.3 Tracking Error

This segment of the study presents the three different estimates of the tracking error in Table 4. The first three columns show the results of each one of the three types and the fourth column is the average tracking error of the three estimates. The last column exhibits the number of trading observations for each one of the ETFs in the sample.

Table 4. Trading and expense characteristics of ETFs

This table presents the estimations of Tracking Error, which reflects the deviation between the return of ETFs and their underlying indexes. We apply three distinct methods in tracking error estimating, labeling them as TE_1, TE_2, and TE_3.

ETF Name	TE_1	TE_2	TE_3	Average $TE_{(1+2+3)}$	Obs.
DJ EU STOXX50 EX	0.72	0.60	0.89	0.74	542
DJ STOXX 50 EX	0.81	0.70	0.80	0.77	101
FRESCO DJ UK 50	1.56	1.26	1.73	1.52	341
ISHARES DJ EUMICAP	0.51	0.44	0.60	0.52	136
ISHARES EUR SM CAP	0.79	0.62	0.88	0.76	122
ISHARES DJ EUSTOXX50	0.49	0.39	0.55	0.48	681
ISHARES DJ STOXX 50	0.58	0.50	0.67	0.58	589
ISHARES FTSEUROFIRST 100	0.70	0.64	0.84	0.73	99
ISHARES MSCI BRAZIL	2.69	2.05	3.14	2.63	43
ISHARES MSCI EMG	0.95	0.76	1.09	0.93	43
ISHARES MSCI EST EU	1.11	0.90	1.11	1.04	44
ISHARES MSCI JAP FD	1.06	0.88	1.20	1.05	214
ISHARES MSCI KOREA	1.12	0.92	1.20	1.08	42
ISHARES MSCI TAIWAN	0.95	0.83	0.96	0.91	38
ISHARES MSCI WORLD	0.88	0.69	0.90	0.82	39
ISHARES S&P 500	1.03	0.95	1.22	1.07	390
LYXOR DJ EUROSTOXX50	0.66	0.58	0.79	0.68	108
NASD100 EUR TRACK	1.24	1.10	1.40	1.25	255
SMIEX FONDS	0.82	0.70	1.10	0.87	534
STOXX 50 LDRS	1.21	1.15	1.52	1.29	289
UBS-ETF DJ INDU AVG	1.54	1.28	1.78	1.53	981
UBS-ETF DJ JAPAN 100	0.81	0.74	0.96	0.84	1038
UBS-ETF DJ US LG CAP	1.80	1.39	1.99	1.73	740
UBS-ETF DJ US TECH	2.11	1.74	2.59	2.15	902
UBS-ETF EUSTOXX50 I	1.07	0.87	1.25	1.06	128
UBS-ETF EUSTOXX50	0.81	0.71	0.97	0.83	991
UBS-ETF FTSE 100	0.74	0.71	0.93	0.79	116

UBS-ETF SMI	0.33	0.30	0.41	0.35	618
XMTCH DJ BANKS	1.60	1.36	1.75	1.57	107
XMTCH DJ TECHNOLOGY	2.13	1.91	2.44	2.16	225
XMTCH DJ HEALTHCARE	1.89	1.67	2.08	1.88	167
XMTCH MSCI Euro	0.86	0.68	0.90	0.81	903
XMTCH ON SMIM	0.26	0.25	0.33	0.28	372
XMTCH SBI DOM GOV3-7	0.19	0.08	0.20	0.16	502
XMTCH SBI DOM GOV 7+	0.47	0.24	0.51	0.41	233
XMTCH SMI	0.60	0.28	0.78	0.55	1257
Average	**1.03**	**0.86**	**1.18**	**1.02**	**386.94**
Min	**0.19**	**0.08**	**0.20**	**0.16**	**38**
Max	**2.69**	**2.05**	**3.14**	**2.63**	**1,257.00**

Note: TE_1 refers to the standard errors of regression (4). TE_2 is the average of the absolute return difference between ETF and index. TE_3 is the standard deviation of the return difference between ETF and index.

Depending on the method of estimation, the average tracking error ranges from 0.86 to 1.18. The mean tracking error of the three estimates is equal to 1.02 considered to be significant, reflecting the substantial deviation in the performance of the ETFs and the corresponding indexes.

The existence of large tracking errors is partially attributed to the inadequate replication of index components by Swiss ETFs. It may also be attributed to the trading infrequency of some ETFs.[4] Regarding individual ETFs, the minimum tracking error concerns XMTCH SBI DOM GOV3-7, which tracks the DOM GOV3-7 bond index. The mean tracking error of this ETF counts for 16 b.p. The fact that a bond ETF, in relevance to the equity ETFs, presents the minimum tracking error is reasonable, since a bond index's price exhibits lower fluctuation than an equity index. From the bundle of equity ETFs, XMTCH ON SMIM is the best tracker, with an average tracking error of 28 b.p. In parallel, the percentage trading frequency of XMTCH ON SMIM in Table 3 reaches 89%, suggesting that trading frequency is likely to reduce the tracking error.

The maximum tracking error relates to ETFs that track non-European indexes. Specifically, the weakest tracker of the sample is the Barclay's iShares which tracks the Brazilian index of Morgan Stanley. The average tracking error of this ETF is significantly high and counts for 263 b.p. and the large trading frequency of iShares MSCI BRAZIL does not seem to assist in a better replication of the tracking index's return.

The fact that the ETFs tracking non-European indexes are associated with large tracking error is not surprising, since the international ETFs face some restrictions that negatively influence ETF efforts to replicate their benchmark's performance. Chief among these restrictions is the time delay between the European and the US and

[4] *We applied a single cross-sectional regression of tracking error estimations on the records of trading frequency. The coefficient of trading frequency was negative being in line with our assumption, but the statistical significance of estimation was weak.*

Asian markets. The time delay results in a lag in formations' inflow, which constrains the trading ability of ETFs. Further, the international ETFs are associated with greater management fee ratios. In the following section, we report statistical evidence that confirm the direct relationship between tracking error and expenses.

4.4 Performance, Expenses, Risk and Tracking Error

The influence of expenses on ETF performance is crucial. In Table 5 we report the results of a single cross-sectional regression of ETF percentage return on management fees. The results show a negative impact of expenses on performance with a regression coefficient of -0.35, statistically significant at the 1% level. This finding means that an increase of expenses per one unit results in a reduction of the return by 0.35 units. It should be noted that the results do not suffer from any Heteroskedasticity, autocorrelation and ARCH effect bias as indicated by the reported relevant figures in Table 5. In addition to the regression, we have also performed a Granger Causality Test in order to determine if the one variable is useful in forecasting the other. The results show that no such issue exists.

Table 5. Performance, Tracking Error, Risk and Management Fees of ETFs

This table presents the estimations of various cross section regressions between return, tracking error, risk, and management fees of ETFs.

Estimated Model	α	*T*-stat	β	*T*-stat	R^2	Heteros kedasticity Test	Autocor relation Test	LM ARCH Test	Number of funds
$R_i = a_i + b_i MF_i + \varepsilon_i$	0.18*	3.42	-0.35*	-3.08	0.25	0.74	0.84	0.65	31
Granger Causality Test Results									
Null Hypothesis			***F*-Statistic**				**Probability**		
MF does not Granger Cause *R*			0.47				0.63		
R does not Granger Cause *MF*			0.29				0.75		
$TE_{1i} = a_i + b_i MF_i + \varepsilon_i$	0.42***	2.03	1.18**	2.63	0.19	0.34	0.43	0.76	31
$TE_{2i} = a_i + b_i MF_i + \varepsilon_i$	0.33***	1.99	1.00*	2.82	0.22	0.48	0.17	0.68	31
$TE_{3i} = a_i + b_i MF_i + \varepsilon_i$	0.52**	2.09	1.28**	2.40	0.17	0.21	0.36	0.79	31
Average	**0.42**	**2.04**	**1.15**	**2.62**	**0.19**	**0.34**	**0.32**	**0.74**	**31**
Granger Causality Test Results									
Null Hypothesis			***F*-Statistic**				**Probability**		
MF does not Granger Cause TE_1			0.13				0.88		
TE_1 does not Granger Cause *MF*			0.88				0.43		
MF does not Granger Cause TE_2			0.16				0.85		
TE_2 does not Granger Cause *MF*			0.71				0.50		
MF does not Granger Cause TE_3			0.23				0.80		
TE_3 does not Granger Cause *MF*			0.60				0.56		
$MF_i = a_i + b_i RISK_i + \varepsilon_i$	0.22*	2.84	0.15*	3.44	0.46	0.88	0.76	0.34	31
Granger Causality Test Results									
Null Hypothesis			***F*-Statistic**				**Probability**		
RISK does not Granger Cause *MF*			0.54				0.59		
MF does not Granger Cause *RISK*			0.31				0.74		

$TE_{1i} = a_i + b_i\, RISK_i + \varepsilon_i$	-0.08	-0.53	0.69*	5.84	0.70	0.65	0.80	0.70	31
$TE_{2i} = a_i + b_i\, RISK_i + \varepsilon_i$	-0.04	-0.34	0.55*	6.34	0.68	0.53	0.44	0.52	31
$TE_{3i} = a_i + b_i\, RISK_i + \varepsilon_i$	-0.09	-0.49	0.79*	5.04	0.68	0.59	0.99	0.59	31
Average	-0.07	-0.45	0.68	5.74	0.69	0.59	0.74	0.60	31

Granger Causality Test Results

Null Hypothesis	***F*-Statistic**	**Probability**
RISK does not Granger Cause TE_1	0.36	0.70
TE_1 does not Granger Cause *RISK*	0.52	0.60
RISK does not Granger Cause TE_2	0.48	0.62
TE_2 does not Granger Cause *RISK*	0.58	0.57
RISK does not Granger Cause TE_3	0.28	0.76
TE_3 does not Granger Cause *RISK*	0.64	0.54

Note:
R *is the average daily return of ETFs.*
MF *represents the management fee ratio of ETFs.*
TE_1 *is the tracking error defined as the standard errors of regression (4).*
TE_2 *is the tracking error defined as the average of the absolute return difference between ETF and its corresponding index.*
TE_3 *is the tracking error defined as the standard deviation of the return difference between ETF and its corresponding index.*
RISK *is the standard deviation of daily returns.*
For Heteroskedasticity, autocorrelation (serial correlation LM test) and ARCH effect the reported values are the probabilities on the significance of the relevant F-statistics.
**Statistical significant at the 1% level. **Statistical significant at the 5% level. ***Statistical significant at the 10% level.*

Prior literature considers that a large part of the tracking error is due to ETF expenses. To examine the magnitude of management fees' effect on ETFs tracking error, we apply a single model of tracking error's estimations on the management fee ratio (MF). We run the regression separately for each one of the three estimation methods of tracking error. The results in Table 6 indicate that management fees affect positively the size of tracking error with statistical significance at the 1% or 5% level. The average regression estimation is equal to 1.15, implying that the management fees count for a large slice of ETFs tracking error.[5] It should be pointed out that the results on the relationship between tracking error and expenses do not suffer from any Heteroskedasticity, autocorrelation and ARCH effect bias as indicated by the reported relevant figures in Table 5. Going further, the results of the Granger Causality Test performed between management fees and tracking error reveal that there is no such kind of relation between these factors.

Next, we introduce the risk of an ETF's return as a basic determinant of management expenses. We investigate the relation between risk and expenses by regressing the management fee of ETFs against the return's standard deviation (RISK). According to the results, the coefficient of risk which is statistically significant at the 1% level is equal to 0.15, implying that when the risk of an investment increases the investor bears increased administrative expenses. The results of the Heteroskedasticity, autocorrelation and ARCH effect tests indicate the lack of any such issue. Moreover, the outcomes of the Granger Causality Test demonstrate that there is no such relationship between risk and expenses.

[5] *The average regression coefficient of the three regressions is approximately equal to the regression estimation when we regress the average three types of ETFs tracking error.*

In the last step, we explore the relationship between ETFs tracking error and risk by regressing the three tracking error measurements to the standard deviation of ETFs returns. According to the results, the coefficients of risks are significant at the 1% level. The average estimation of beta is 0.68, suggesting that the presence of risk affects the replication ability of ETFs. The results of the Heteroskedasticity, autocorrelation and ARCH effect tests indicate the lack of any such impact on the examined set of variables. In addition to these results, the Granger Causality Test applied results in no causality impact from tracking error to risk and vice versa.

4.5 Determinants of Volume

In this section, we present the estimations of volume determinants shown in models (7) and (8). Model (7) explores the relation between volume on the one hand and intraday ETFs volatility, number of trades and lagged return, on the other. This model is applied on a time-series basis for each ETF in the sample. Model (8) examines the cross-sectional dependence of ETFs volume on the average intraday volatility, the mean number of executed orders and the trading frequency of the entire sample's ETFs.

Table 6 exhibits the time series estimations of regression (7). The results reveal that the constant coefficient a_0 is positive and statistically significant at the 1% level. Its mean value is 6.60, implying that there is a significant constant proportion of shares that are traded independently of the influence of intraday volatility, the number of trades and the lagged return. This independent trading activity reflects the great interest that investors demonstrate in allocating funds on ETF products. This investing interest is likely to arise from the trading convenience, the flexibility in executed intraday orders, the tax efficiency and the liquidity of ETFs.

● Table 6. **The Determinants of Volume – Time Series Analysis**

$$LnV_i = a_0 + a_1 \frac{DH_i - DL_i}{IC_i} + a_2\, TR_i + a_3\, LagRet_i + e_i \quad (7)$$

This table presents the results of the time series regression which analyzes the factors that affect the volume of each ETF.

ETF No	α_0	*T*-stat	α_1	*T*-stat	α_2	*T*-stat	α_3	T-stat	R^2	Heteroske dasticity Test	Lags	Obs.
ETF1	6.08*	40.72	109.08*	4.29	0.35*	5.16	0.03	0.62	0.35	0.00^	0	542
ETF2	6.30*	18.56	-179.14	-0.29	0.79*	3.29	-0.04	-0.30	0.19	0.00^	0	101
ETF3	6.04*	30.08	36.45**	2.17	0.35*	3.76	-0.05	-1.00	0.19	0.00^	0	341
ETF4	4.96*	23.20	-68.86	-1.05	0.92*	7.01	-0.02	-0.26	0.35	0.69	0	136
ETF5	5.98*	33.00	179.71*	3.08	0.22*	5.43	-0.04	-0.40	0.33	0.70	0	122
ETF6	9.72*	98.62	70.40*	7.21	0.01*	2.93	0.05	1.23	0.12	0.06	0	681
ETF7	7.36*	45.47	38.7***	1.82	0.24*	4.95	0.04	0.67	0.31	0.00^	0	589
ETF8	7.96*	17.03	105.38	1.37	-0.20	-0.95	0.30***	1.96	0.13	0.70	1	99
ETF9	6.96*	15.05	-2.31	-0.15	0.26*	4.77	0.00	-0.02	0.60	0.41	1	43
ETF10	6.76*	19.56	31.27	0.73	0.24*	3.30	-0.01	-0.09	0.39	0.55	0	43

ETF11	7.33*	32.31	4.07	0.58	0.25*	6.64	0.05	1.10	0.62	0.40	0	44
ETF12	8.14*	47.90	51.39*	2.61	0.17*	6.43	0.03	0.63	0.48	0.00^	2	214
ETF13	6.13*	15.66	34.57	0.89	0.49*	3.96	-0.03	-0.21	0.37	0.33	0	42
ETF14	6.47*	13.15	56.59	1.11	0.34*	3.20	0.02	0.12	0.37	0.01^	0	38
ETF15	5.66*	26.77	128.1**	2.63	0.39*	6.82	0.19	1.37	0.72	0.72	0	39
ETF16	8.21*	53.19	266.69*	7.70	0.02***	1.76	0.07	0.73	0.34	0.00^	1	390
ETF17	5.11*	15.69	53.69	0.78	1.06*	6.05	-0.05	-0.33	0.34	0.80	0	108
ETF18	6.31*	27.55	23.55	0.70	0.72*	10.56	0.00	0.02	0.40	0.01^	0	255
ETF19	6.96*	56.92	93.388*	4.90	0.04*	4.35	-0.03	-0.52	0.14	0.06	1	534
ETF20	7.60*	37.16	33.41*	2.78	0.15*	2.68	0.01	0.15	0.30	0.00^	1	289
ETF21	6.84*	49.88	21.34**	2.41	0.00	-0.14	-0.03	-0.99	0.08	0.99	4	981
ETF22	6.19*	24.21	1.50	0.05	0.35*	4.13	-0.08	-1.33	0.37	0.00^	1	1038
ETF23	5.84*	48.18	14.68	1.27	0.38*	8.85	-0.04	-1.00	0.28	0.00^	1	740
ETF24	6.23*	69.80	27.89*	4.05	0.23*	8.76	0.01	0.38	0.38	0.00^	4	902
ETF25	1.73*	12.08	39.98	0.89	0.10*	3.37	-0.25**	-2.52	0.18	0.00^	0	128
ETF26	7.76*	65.71	4.16	0.92	0.14*	13.43	0.03	1.32	0.33	0.46	0	991
ETF27	4.79*	20.49	52.7***	1.94	0.35*	5.23	0.00	-0.03	0.36	0.00^	0	116
ETF28	8.22*	57.96	-5.40	-0.65	0.10*	10.19	-0.10	-1.52	0.26	0.00^	4	618
ETF29	5.59*	19.03	-13.97	-0.46	-0.46**	-2.45	-0.03	-0.73	0.11	0.20	0	107
ETF30	4.62*	32.63	26.73**	2.19	0.25*	4.99	0.00	0.12	0.27	0.87	1	225
ETF31	4.11*	23.38	-25.55	-1.09	0.61*	5.15	0.02	0.44	0.19	0.79	0	167
ETF32	8.15*	49.60	4.89	0.97	0.04*	10.85	-0.02	-0.46	0.36	0.00^	2	903
ETF33	9.31*	66.53	11.33	1.02	0.01***	1.84	0.08	1.31	0.11	0.00^	4	372
ETF34	6.33*	37.97	68.23	0.78	0.22*	6.98	-0.32	-1.02	0.27	0.89	2	502
ETF35	4.96*	24.73	6.46	0.12	0.68*	6.15	-0.25	-1.37	0.18	0.94	0	233
ETF36	10.88*	114.9	0.26	0.10	0.01*	18.91	-0.02	-1.64	0.57	0.00^	0	1257
Average	**6.60**	**38.5**	**36.15**	**1.62**	**0.27**	**5.51**	**-0.01**	**-0.10**	**0.32**	**0.29**	**1**	**387**

Note:
LnV_i *is the natural logarithm of the daily shares volume of* ETF_i.
DH_i *is the daily intraday high price of* ETF_i.
DI_i *is the daily intraday low price of* ETF_i.
IC_i *is the daily closing price of* ETF_i. TR_i *is the daily number of trades of* ETF_i.
$LagRet_i$ *is the one-lagged return of* ETF_i.
For Heteroskedasticity the reported values are the probabilities on the significance of the relevant F-statistics. Lags refer to the AR_s *included in the model for the correction of autocorrelation.*
**Statistically significant at the 1% level. **Statistically significant at the 5% level. ***Statistically significant at the 10% level.*
^Heteroskedasticity corrected with White correction.

The mean of the α_1 coefficient of regression (7) is positive and equal to 36.15, indicating a positive influence of intraday volatility on the determination of ETFs volume. Looking at the statistical importance of the estimations, we see that a sufficient number of the individual α_1 coefficients are positive and statistically significant at the 1%, 5% or 10% level. Furthermore, the majority of the non-significant estimations are also positive, confirming the positive influence of volatility to volume.

In accordance with our expectations, the coefficients of the number of trades are positive and statistically significant at the 1% level. The mean of α_2 coefficient of model (7) is equal to 0.27, indicating that an increase of the executed orders by one unit, on the average, could increase ETFs volume by 0.27 units.

Concerning the lagged return's coefficient α_3 , there is no statistical evidence that the previous trading day affect the magnitude of ETFs volume. The significance of the

estimations is poor, suggesting that the previous return does not sufficiently motivate the investors to trade on an ETF. This finding is in line with the nature of ETFs whereby investors can trade freely within the day and not only at the end of the day as it is the case with conventional mutual funds. As a result, the previous day price change carries no significant information that may bolster trading during the day. Finally, the *R*-square of all time-series regressions are significant with an overall average of 0.32 implying a good regression fit.

As far as the value of the reported regression results on the determination of volume is concerned, we should refer to the results of the Heteroskedasticity test applied as well as the number of lags included in the model for the correction of autocorrelation in the regression's results when necessary. Heteroskedasticity was corrected in 18 out of 36 cases with the White method whereas, on average, we had to use one lag to correct autocorrelation. Autocorrelation was an issue in 15 out of 36 cases. Given the corrections we made, our results are meaningful in statistical sense.

The cross-sectional estimations of regression (8) are presented in Table 7. Viewing the regression results of Table 7, we see that the constant coefficient b_0 is equal to 6.52 and is statistically significant at the 1% level. This value is just 8 b.p. less than the average a_0 on Table 7. So, we reconfirm that there is a definite trading activity of ETFs not related to other factors but due probably to their unique trading characteristics.

Table 7. **The Determinants of Volume – Cross-sectional Analysis**

$$LnV_i = b_0 + b_1 \frac{DH_i - DL_i}{IC_i} + b_2\, TR_i + b_3\, FREQ_i + u_i \quad (8)$$

This table presents the results of the cross-sectional regression, which combines the factors that affect the average volume of the sample's ETFs.

PANEL A: Regression Results		
Variable	**Coefficient**	***T*-statistic**
Constant	6.52*	10.99
ETFs Volatility	-23.82	-0.31
Number of Trades	0.03**	2.19
Trading Frequency	0.03*	3.11
R^2	0.48	
Heteroskedasticity Test	0.71	
Autocorrelation Test	0.40	
LM ARCH Test	0.46	
Obs.	36	
PANEL B: Granger Causality Test Results		
Null Hypothesis	***F*-Statistic**	**Probability**
LNVOLU does not Granger Cause *ETFVOL*	1.57	0.23
TRADES does not Granger Cause *LNVOLU*	0.90	0.42
LNVOLU does not Granger Cause *TRADES*	0.73	0.49
FREQ does not Granger Cause *LNVOLU*	0.02	0.98
LNVOLU does not Granger Cause *FREQ*	0.96	0.39

TRADES does not Granger Cause *ETFVOL*	2.28	0.12
ETFVOL does not Granger Cause *TRADES*	0.72	0.49
FREQ does not Granger Cause *ETFVOL*	1.23	0.31
ETFVOL does not Granger Cause *FREQ*	0.51	0.61
FREQ does not Granger Cause *TRADES*	0.87	0.43
TRADES does not Granger Cause *FREQ*	0.40	0.68

Note:
LnV_i *is the natural logarithm of the daily shares volume of the ith ETF.*
DH_i *is the average daily intraday high price of the ith ETF.*
DL_i *is the average daily intraday low price of the ith ETF.*
IC *is the average daily closing price of the ith ETF.*
TR_i *is the daily number of trades of the ith ETF.*
$FREQ_i$ *is the percentage trading frequency of the ith ETF, which is expressed by the rate of trading days of an ETF to the trading days of its benchmark index.*
For Heteroskedasticity, autocorrelation (serial correlation LM *test) and* $ARCH$ *effect the reported values are the probabilities on the significance of the relevant F-statistics.*
In the case of Granger Causality Test, probabilities >0.05 reflect no rejection of the null hypothesis and vice versa.
** Statistically significant at the 1% level. **Statistically significant at the 5% level.*

Further, the coefficient of ETFs mean intraday volatility is negative but insignificant at any acceptable statistical level. In contrast to the adequately positive estimations of individual ETFs in Table 6, we relate the insignificance of the cross-sectional estimation to the fact that the intraday volatility for all ETFs in Table 7 is not entirely influential.

The statistical significance for the coefficient of the average number of trades indicates that the increase of executed orders induce the overall volume of the sample's ETFs. This finding is similar to the time-series results of Table 6 although the magnitude of estimates differs. Finally, the last determinant examined in Table 7 is the trading frequency of ETFs. The coefficient of trading frequency is equal to 0.03 and it is statistically significant at the 1% level, indicating that the percentage of trading frequency is an important determinant of trading volume.

It should be noted that the regression results on the cross-sectional determination of ETFs' volume, we should note they are biased by any Heteroskedasticity, autocorrelation and ARCH effect as indicated by the reported relevant figures in Table 7. In addition to these tests, we have also performed a Granger Causality Test in order to examine if there is any such relationship among volume, volatility, number of trades and trading frequency. The outcomes of the tests lead us to accept the hypothesis of non-Granger Causality among the variables.

4.6 Comparison of Swiss and US ETFs

The final researching issue of this paper concerns the comparison between Swiss and US ETFs. The comparison is applied for a set of 10 couples of Swiss and US ETFs that track the same indexes. The comparison's results are reported in Table 8. The table presents the average daily return and risk, the beta coefficients from the estimation of model (4), the calculations of tracking error, the average daily volume, the management fees and the number of trading observations for both Swiss and US ETFs.

Table 8. Comparison of Swiss and US ETFs Statistic Characteristics

The Table presents a quantitative comparison between Swiss and US ETFs that track the same indexes.

PANEL A

ETF Name			Return		Risk		Beta		TE_1	
Swiss	US	Underlying Index	Swiss	US	Swiss	US	Swiss	US	Swiss	US
UBS-ETF DJ INDU AVG	DIA	DJ INDU AVG	0.00	0.02	1.73	1.10	*0.75	*1.00	1.54	0.26
ISHARES MSCI JAP	EWJ	MSCI JAPAN	0.13	0.13	1.39	1.43	*0.68	*0.95	1.06	0.86
ISHARES MSCI TAIWAN	EWT	MSCI Taiwan	-0.05	0.14	1.47	1.77	*0.85	*1.00	0.95	1.08
ISHARES MSCI BRAZIL	EWZ	MSCI Brazil	-0.34	-0.18	3.67	3.51	*0.83	*1.06	2.52	0.89
ISHARES DJ STOXX 50	FEU	DJ STOXX 50	0.05	0.07	0.90	0.96	*0.90	*0.59	0.59	0.83
ISHARES DJ EUROST 50	FEZ	DJ EURO STO 50	0.06	0.05	0.98	0.87	*1.00	*0.72	0.49	0.84
ISHARES S&P 500	IVV	S&P 500	0.02	0.03	1.05	0.74	*0.32	*1.01	1.03	0.14
NASD100 EUR TRACK	QQQ	NASDAQ 100	0.03	0.04	1.47	1.10	*0.71	*0.98	1.24	0.13
ISHARES S&P 500	RSP	S&P 500	0.02	0.06	1.05	0.79	*0.32	*1.07	1.03	0.21
ISHARES S&P 500	SPY	S&P 500	0.02	0.03	1.05	0.73	*0.32	*1.00	1.03	0.15
Average			**-0.01**	**0.04**	**1.48**	**1.30**	**0.67**	**0.94**	**1.15**	**0.54**
***T*-statistic[2]**				***-2.07		***2.13		**-2.31		**2.79

PANEL B

TE_2		TE_3		Average TE		Volume		Management Fee		Observations[1]	
Swiss	US	Swiss	US	Swiss	US	Swiss	US	Swiss	US	Swiss	US
1.28	0.18	1.78	0.36	1.53	0.27	4,209.23	7,052,195.37	0.50	0.18	979	979
0.89	0.84	1.21	1.12	1.51	0.94	26,388.81	21,896,207.18	0.59	0.74	209	209
0.83	0.86	0.96	1.10	0.91	1.02	6,882.66	3,452,663.16	0.74	1.03	38	38
2.20	0.68	3.56	0.94	2.76	0.84	14,305.57	4,591,689.19	0.74	0.74	38	38
0.50	0.70	0.68	0.91	0.59	0.81	16,533.99	8,899.46	0.35	0.32	558	558
0.39	0.72	0.56	0.92	0.48	0.83	75,347.70	157,724.59	0.35	0.32	667	667
0.95	0.12	1.22	0.16	1.07	0.14	49,657.50	483,454.81	0.40	0.09	390	390
1.10	0.10	1.40	0.15	1.25	0.13	29,319.16	94,723,733.49	0.20	0.20	255	255
0.95	0.16	1.22	0.21	1.07	0.20	49,657.50	332,863.59	0.40	0.40	390	390
0.95	0.13	1.22	0.17	1.07	0.15	49,657.50	59,331,992.05	0.40	0.10	390	390
1.00	**0.45**	**1.38**	**0.60**	**1.22**	**0.53**	**32,195.96**	**19,203,142.29**	**0.47**	**0.41**	**391.40**	**391.40**
2.79		**2.62**		**3.02**		**-1.88**		**0.86**			

[1] *We use common daily data of real trading days in our estimations of return and risk for both Swiss and US ETFs. Real data regards the days which record non-zero trading volume.*

[2] *We use t-tests in order to examine if the deviations between the statistical characteristics of Swiss and US ETFs are economically significant.*

** Statistically significant at the 1% level. **Statistically significant at the 5% level. ***Statistically significant at the 10% level.*

We note that the records in Table 8 concerning Swiss ETFs are not similar to those the results of Tables 1 and 2 due to the modification we implemented so that the Swiss and US trading data can be comparable to each other avoiding any possible bias.

Regarding the percentage return, we see that the Swiss ETFs display negative average return, while the US ETFs have positive performance. Furthermore, the performance

of Swiss ETFs is associated to superior standard deviation as compared to the US competitors. The return and risk deviations between Swiss and US ETFs are statistically significant at the 10% level. Therefore, we infer that Swiss ETFs are less efficient, more risky and finally less preferable for a global asset allocation strategy.

The beta's coefficients indicate that Swiss ETFs are less fully-invested in the components of the underlying indexes in relation to the US peers. The average beta for the ETF Swiss sample is equal to 0.67, since the mean beta for US ETFs approximates the unity, implying a a full replication strategy. The deviation between Swiss and US ETFs betas is significant at the 5% level. The lagged replication of Swiss ETFs partially explains the deviation in performance between Swiss and US ETFs.

Considering tracking efficiency, the tracking errors of Swiss ETFs are higher than the respective computations for US ETFs. The average Swiss tracking error is equal to 1.22 while the average tracking error in US ETF market is substantially lower being equal to 0.53. Likewise, the average tracking error for Swiss ETFs derived from each individual method is greater than the corresponding estimations for the US ETFs. The large divergence between the tracking errors of Swiss and US ETFs is partially attributed to the different replication strategy adopted by these investment products.

Going further, the average volume of Swiss ETFs is found to be significantly lower than the volume of US ETFs. An average number of 32,195.96 ETF shares daily trade on Swiss exchange. The respective figure for US ETFs equals the 19,203,142.29 shares. The difference in volumes between the two markets is statistically significant at the 10% level.

The last trading factor considered concerns the management fees. In accordance to the records in Table 8, the average expense ratio of Swiss ETFs is equal to 0.47% while the mean management fee ratio of US ETFs is equal to 0.41%. The difference of 6 b.p. in expense ratios of Swiss and US ETFs is not significant at any acceptable level.

5. Conclusion

Most of the literature on Exchange Traded Funds focuses on US ETFs while some also cover the Asian and Australian ETFs. This paper focuses on a European ETF market, the Swiss ETFs. We first investigate the percentage risk and return of Swiss ETFs in relation to the return and risk of their tracking indexes. We find that ETFs underperform their benchmarks, while they burden their investors with greater risk than the risk of the underlying indexes. These disparities suggest that Swiss ETFs do

not adopt full replication strategies with respect to the composition of their benchmarks. In fact, lower than unity beta estimates suggest that while ETFs are protected during bear markets, they do not fully replicate the benchmark's components, a fact that contributes to their underperformance.

Regarding the magnitude of tracking error of Swiss ETFs we find that it is substantial to an approximate average of 1.02%. The value of tracking error is statistically significant to any acceptable level and reflects the effect of incomplete replication on indexes' composition. Further, we find that the tracking error is positively related to the management fees and the risk of ETFs.

Regarding the impact of expenses on ETFs performance, we find that expenses influence negatively ETF investor returns. Applying regression analysis, we estimate that a one unit increase in expenses produces a deduction of ETFs return by 0.35 units. Besides, we find that the level of ETFs management fee depend on the level of ETF risk. As an example of this relationship, ETFs that track non-European indexes which face the greatest risk also experience the higher risk and tracking error.

In other regression results we found that the volume of Swiss ETFs is positively affected by the intraday price volatility, the number of trades, and the trading frequency, meaning that an increase in these factors generates a greater volume of shares. Interestingly enough, we also denote that the lagged return of Swiss ETFs is not a crucial determinant of volume, in line to the ETF nature of continuous trading within the day.

Finally, we compare 10 couples of Swiss and US ETFs that track exactly the same indexes. The main inference of this comparison is that Swiss ETF market is inferior to the US one. More specifically, we find out that the average return of Swiss ETFs is negative, while the performance of the respective US ETFs is positive. Moreover, Swiss ETFs report superior risk and tracking error records than the US counterparts. They also display less trading activity as reflected in average volumes.

Overall, the empirical findings on Swiss ETFs are in line with those reported in the literature for other ETF markets. Like Elton *et al.* (2002) we find that ETFs underperform their benchmark counterparts and that management expenses count for a large portion of ETFs tracking error. Like Kostovetsky (2003) and Frino and Gallagher (2001), our estimates for tracking error are large and significant and ETFs do not fully replicate their corresponding indexes.

Furthermore, our results provide new evidence on the interactions between performance, expenses and risk. As expected, expenses have a negative impact on performance but they themselves are positively affected by the risk of ETFs. This

further suggests that the conventional ex ante positive relationship between performance and risk emerges from the subtle influence that risk exerts on administrative expenses. New evidence is also the finding that in the case of ETFs the negative relationship between return and expenses is not one-for-one, as in studies on mutual funds, but one third-for-one.

A last contribution of this paper is in identifying the factors that determine the trading volume of ETFs. We find that a significant part of volume is due to factors unrelated to the trading activity of each ETF or its price change on the previous day. We think that this part of trading volume arises from the unique characteristics that make ETFs attractive to investors.

In conclusion, we should note that this is just a first attempt of studying one emerging ETF market such as the Swiss one. Further investigation can be devoted either on the Swiss ETFs or, more importantly, on the German ETF market, which is the most significant market ETF in Europe in terms of products availability, assets invested and daily turnover. Furthermore, additional researching issues can be addressed such as the validation of "the law of one price" in the case of ETFs written on the same indexes but traded in different markets with different institutional frameworks, currencies and trading hours. Finally, in this respect, limitations in international arbitrage execution could be accentuated.

References

- Ammann, M. and Zimmermann, H. (2001). Tracking Error and Tactical Asset Allocation, *Financial Analysts Journal* **57**(2), pp. 32-43.
- Ackert, F.L. and Tian, Y.S. (2000). Arbitrage and Valuation in the Market for Standard and Poor's Depository Receipts, *Financial Management*, **29**(3), pp. 71-88.
- Blume, E.M. and Edelen, R.M. (2004). S&P 500 Indexers, Tracking Error and Liquidity, *Journal of Portfolio Management*, **30**(3), pp. 37-46.
- Carty, C.M. (2001). ETFs From A to Z, *Financial Planning*, May 1, pp. 102-106.
- Elton, J.E., Gruber, M.J., Comer, G. and Li, K. (2002), Spiders: Where are the Bugs?, *Journal of Business*, **75**(3), pp. 453-473.
- Frino, A. and Gallagher**,** D.R. **(**2001). Tracking S&P 500 Index Funds, *Journal of Portfolio Management*, **28**(1), pp. 44-55.
- Gastineau, L. Gary, 2001, "Exchange-Traded Funds: An Introduction", *Journal of Portfolio Management*, Vol. **27**(3), pp. 88-96.

- Gastineau, L. Gary, 2004, "The Benchmark Index ETF Performance Problem", *Journal of Portfolio Management*, Vol. **30**(2), pp. 96-104.
- Gallagher, R. David and Reuben Segara, 2005, "The Performance and Trading Characteristics of Exchange-Traded Funds", *working paper*, *The University of New South Wales*.
- Gruber, Martin J., 1996, "Another Puzzle: The Growth in Actively Managed Mutual Funds," *Journal of Finance*, Vol. **51**, pp. 783-810.
- Kostovetsky, Leonard, 2003, "Index Mutual Funds and Exchange Traded Funds", *Journal of Portfolio Management*, Vol.29 (4), pp.80-92.
- Larsen Jr, Glen A. and Bruce G. Resnick, 1998, "Empirical Insights on Indexing", *Journal of Portfolio Management*, Vol. **25**(1), pp. 51-60.
- Malkiel, Burton G., 1995, "Returns from Investing in Equity Mutual Funds 1971-1991," *Journal of Finance*, Vol. **50**, pp. 549-572.
- Pope, F. Peter and Pradeep K. Yadav, 1994, "Discovering Errors in Tracking Error", *Journal of Portfolio Management*, Vol. **20**(2), pp. 27-32.
- Poterba, M. James and John B. Shoven, 2002, "Exchange Traded Funds: A New Investment Option for Taxable Investors", *American Economic Review*, Vol. **92**, pp. 422-427.
- Roll, Richard, 1992, "A Mean/Variance Analysis of Tracking Error", *Journal of Portfolio Management*, Vol. **18**(4), pp.13-22.