Mutual Funds

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Mutual Funds

- In this lecture I am going to look at various methods which try to measure the performance of mutual funds.

Mutual Funds

BVI:Members,Assets and Investors

Source: **Stefan Seip** Director General BVI Bundesverband Deutscher Investment- und Vermögensverwaltungs-Gesellschaften e.V.

74 members: „Kapitalanlagegesellschaften“ (German mutual fund management companies)

No of funds & assets under management (31/03/02)*:

– 5,491 "Spezialfonds" (institutional) assets: 502.7 billion Euro

– 2,354 "Publikumsfonds" (retail) assets: 436.4 billion Euro

15 million investors

- including Luxembourgean and other foreign funds of German origin

Mutual Fund Investments

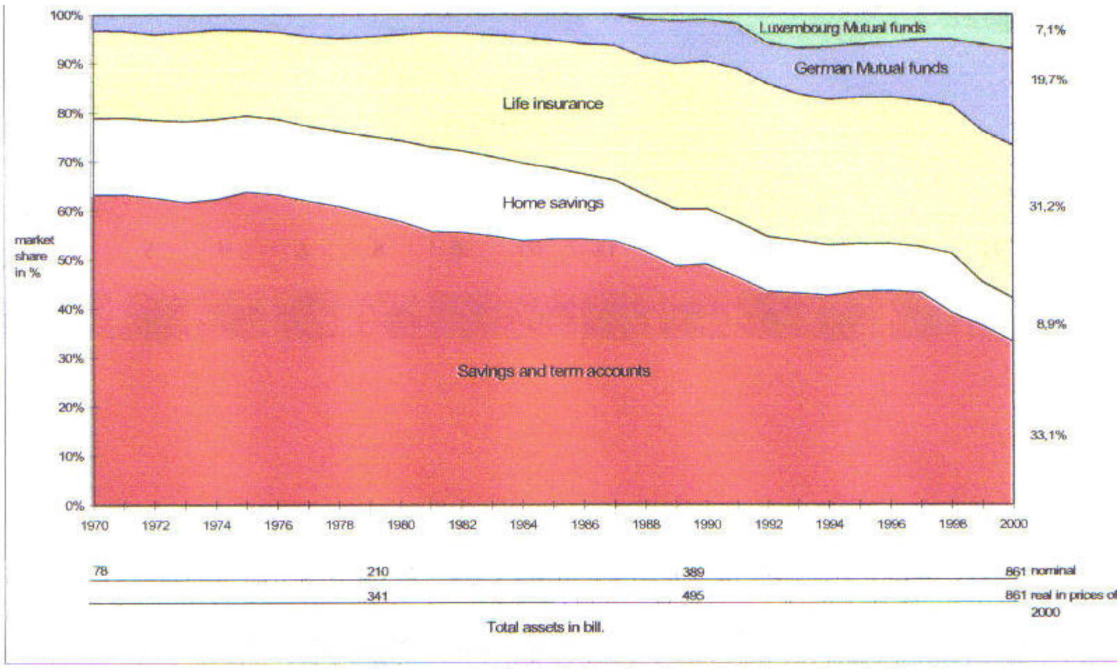


Fig 1: Total assets under management by German mutual funds (bottom lines), market shares of mutual fund types

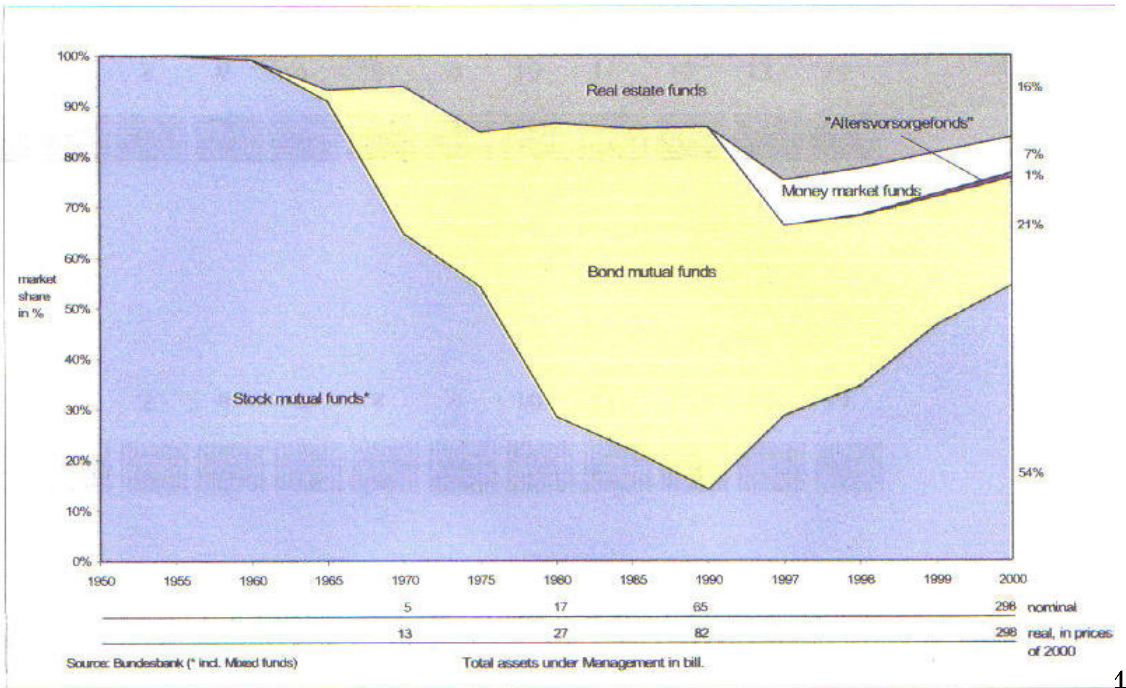


Fig 2: Total amount of indirect investments (bottom line), market shares of different types of indirect investments

Assessing Managed Fund investment performance

- What do we have to consider when trying to measure the performance of these managed funds?
- How do we go about assessing their relative performance?
- We will consider some of these issues.

DWS Akkumula

- How well has DWS done over the past ten years? Has it provided good returns to investors?
- We will explore some of these issues using data on the above taken from Datastream.
- But first we need some measurement concepts.

Managed Funds

- Managed funds are collective investments involving schemes run by professional managers with the objective of producing returns for investors. There are two general forms of managed fund structures, *close-ended* and *open-ended* funds. In addition, managed funds can be categorized into various types according to their investment products. This includes unit trusts, superannuation funds, approved deposit funds (roll-over funds), etc.

Managed Funds

- Much of the literature in the area has concentrated on mutual funds (i.e. open-ended funds). This is because, unlike other types of managed funds, such as insurance companies and pension funds, which invest in securities as a means to meet assumed liabilities or risks, mutual funds, are based on return generation. In addition, mutual fund performance can be examined from their unit prices because, unlike closed-end funds, prices of mutual funds perfectly reflect the market values of their assets.

Managed Funds

- Treynor (1965), Sharpe (1966), and Jensen (1968) successfully combined the risk and return dimensions of investment performance into one composite index.
- They took advantage of advances in Modern Portfolio Theory and the Capital Asset Pricing Model. Their three papers are so influential that their performance models are sometimes called “the traditional measures”.

Managed Funds

- attempts have been made to improve the ability and to reduce possible biases of the traditional measures of detecting superior performance. In relation to this there have been three important developments:
  - *timing performance models*,
  - *multifactor benchmarks* and
  - *conditional analysis*.
- In terms of the empirical work, earlier studies focused on finding whether active managers had skills to outperform the market.

Managed Funds

Traditional measures of performance

- Rate of return
  – a starting point for evaluating the performance of a managed portfolio is to measure its realised returns. We should focus our attention on a *percentage* (*relative*) return because it is scale-free, meaning that the effect of different investment outlays is held constant.

Managed Funds

Traditional measures of performance

- For a given time interval, the percentage return can be computed either as *discrete* or *continuous* rate of return
  - a portfolio's return is calculated as a rate of change in its values between the beginning and the end of an evaluation period. In practice, changes in portfolio value may occur from the movements in values of assets held in the portfolio, and from intra-period new contributions and withdrawals by the fund's clients. The last items are cash flows that are out of the control of a manager.

Managed Funds

Traditional measures of performance

– Specifically, at the onset the market value of a portfolio is subdivided into shares. Subsequently, whenever there are contributions of new money into the portfolio or withdrawals of money out of the portfolio, the number of shares outstanding is adjusted to reflect effects of these cash flows. Then, at the beginning of each evaluation interval, the fund unit price can be calculated by dividing the portfolio’s value by the number of shares outstanding. The portfolio’s return can be measured from the rate of change in its unit prices.

Managed Funds

Traditional measures of performance

- **Discrete Rate of Return**
  - The discrete rate of return (*R*) from holding fund *p* between time *0* and *t* can be expressed as;

$$R_{p,t} = [P_t - P_0 + D] / P_0 \qquad (1)$$

Where: P_t is price per share of a mutual fund at time *t*

D is cash distribution from the fund during the interval.

Managed Funds

Traditional measures of performance

– The discrete return assumes that the distribution (*D*) is made only at the end of the evaluation interval, *t*. Obviously, the longer the interval, the more likely this assumption will be violated.
– To reduce the error, the evaluation interval can be divided into subintervals. The return in each subinterval, as defined by *(1)*, can then be compounded to obtain returns over the original evaluation interval.
– The *time-weighted (*or *geometric)* approach can be used for compounding. The time-weighted return (*TR*) of a portfolio *p* is defined as:

Managed Funds

Traditional measures of performance

$$TR_{p,t} = [(1+R_{p,1})(1+R_{p,2}) \ldots (1+R_{p,N})] - 1 \quad (2)$$

where $R_{p,k}$'s are subinterval returns as measured by Equation *(1)*

$k = 1, \ldots, N$

N = numbers of sub-intervals from the initial evaluation interval.

The time-weighted return can be interpreted as the compounded rate of growth of the initial portfolio value (P_0) during the evaluation period, t. Although the *arithmetic*, and the *dollar-weighted* returns can also be used for compounding, these two methods may not measure a manager's performance accurately.

Managed Funds

Traditional measures of performance

– **Continuously Compounded Rate of Return**

The difficulty of manipulating geometric compounding of discrete returns, as in *(2)*, motivates *continuously compounded returns* (R') concept. It is defined as:

$$R'_{p,t} = ln(1+ R_{p,t})$$

$$= ln((P_t+D) / P_0) \quad (3)$$

where *ln(.)* is a natural logarithm symbol.

$'$ indicates continuous returns.

Managed Funds

Traditional measures of performance

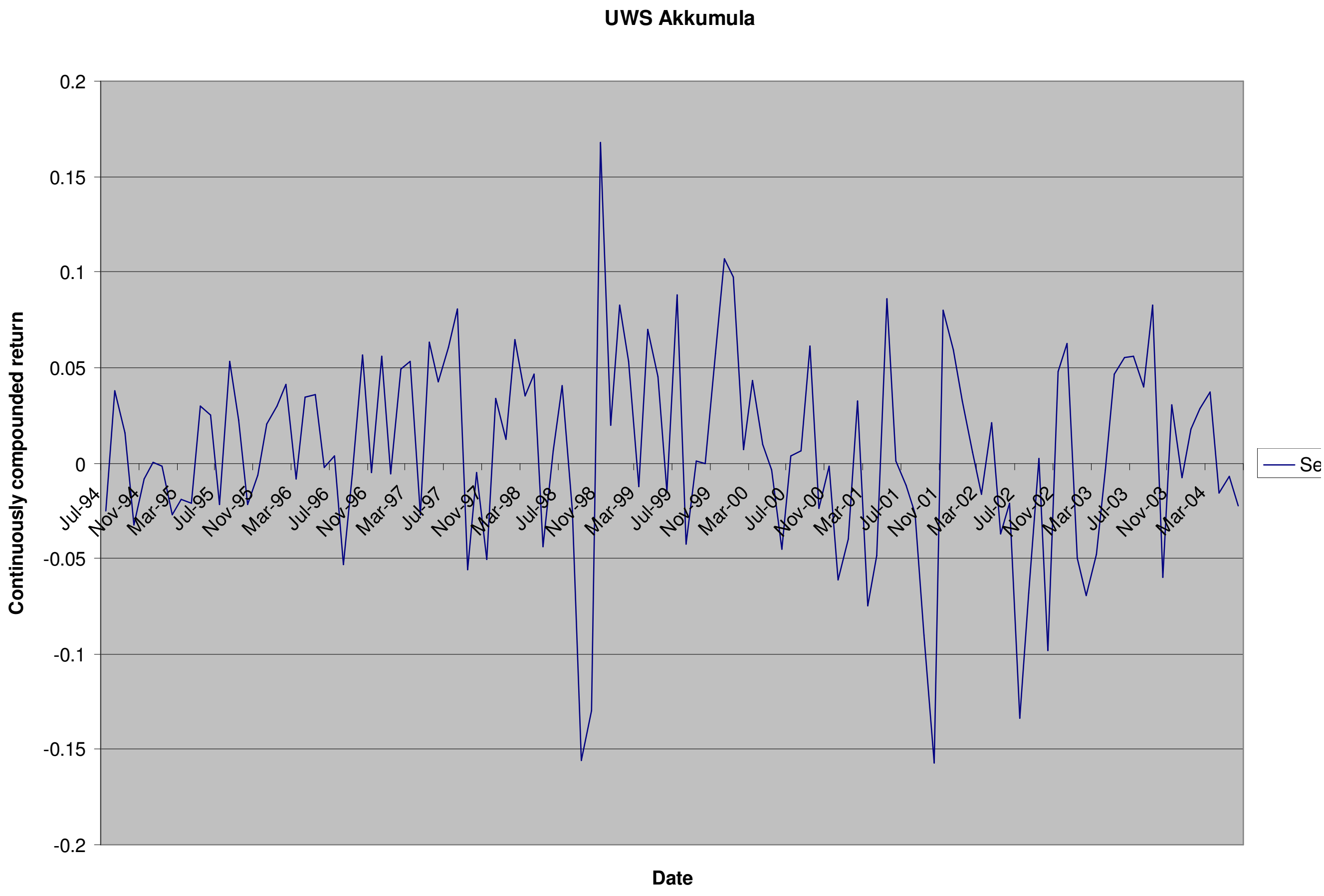
- The computational advantage of the continuously compounded return becomes clear when we consider geometric compounding;

$$TR'_{p,t} = ln(1+ TR_{p,t})$$
$$= ln((1+R_{p,1})(1+ R_{p,2}) \ldots (1+ R_{p,N}))$$
$$= R'_{p,1} + R'_{p,2} + \ldots + R'_{p,N}$$

where R'_{pk}'s are subinterval continuous returns as measured by *(3)*.

DWS Akkumula monthly continously compounded returns June 1994 to June 2004

Is this a good performance?



DWS Akkumula monthly continously compounded returns June 1994 to June 2004

- What are the characteristics of this series?
- Average return 0.6% per month or 7.49% per year.
- Was it risky?
  - Its standard deviation was 5.285% per month
  - If it was a normal distribution 95 times out of a 100 the monthly outcome would have been between 0.006% +/- 5.285*2 %
  - Between –10.564% and plus 10.576%
  - Is this good or bad? We need a benchmark! So we can tell.

DWS Akkumula monthly continously compounded returns June 1994 to June 2004

Mean	0.006039846
Standard Error	0.004824881
Median	0.003763131
Mode	#N/A
Standard Deviation	0.052853926
Sample Variance	0.002793538
Kurtosis	1.219453925
Skewness	-0.462342853
Range	0.324846186
Minimum	-0.1570573
Maximum	0.167788886
Sum	0.72478149
Count	120
Largest(1)	0.167788886
Smallest(1)	-0.1570573
Confidence Level(95.	0.009553734

DWS Akkumula monthly continously compounded returns June 1994 to June 2004

- There is a lot of volatility in the series.
- It is negatively skewed.
- There is an enormous range of monthly returns from nearly plus 17% to minus 16%!
- We have ten years of monthly data. Suppose we split the data into five year intervals?

UWS Akkumula June 94-June99

	Column1
Mean	0.011702
Standard Error	0.0064
Median	0.01385
Mode	#N/A
Standard Deviation	0.049573
Sample Variance	0.002457
Kurtosis	2.97431
Skewness	-0.47457
Range	0.323795
Minimum	-0.15601
Maximum	0.167789
Sum	0.702107
Count	60
Largest(1)	0.167789
Smallest(1)	-0.15601
Confidence Level(95.0%)	0.012806

UWS Akkumula June 99-June 2004

	Column1
Mean	-0.00111
Standard Error	0.007168
Median	0.00083
Mode	#N/A
Standard Deviation	0.055055
Sample Variance	0.003031
Kurtosis	0.284012
Skewness	-0.41955
Range	0.263932
Minimum	-0.15706
Maximum	0.106874
Sum	-0.06523
Count	59
Largest(1)	0.106874
Smallest(1)	-0.15706
Confidence Level(95.0%)	0.014347

Managed Funds

COMPLICATIONS OF

PERFORMANCE MEASUREMENTS

- Measuring a fund's performance is more complicated than merely computing its realised or expected, returns. Two sources of the complications are discussed below

Investment Risk

Since returns and risks are positively correlated, a manager can improve a portfolio's return simply by aggressively investing in more risky assets. Given that investors are risk averters, investment performance measures should incorporate both, portfolio's risks and returns. However, unlike returns, an appropriate quantitative measure of risk is controversial.

Managed Funds
Risk benchmarking

Benchmarking

Essentially, investing in a managed fund is worthwhile only if the manager can add more value than what the investors could achieve by themselves. To this end, the fund's performance must be compared with an appropriate *benchmark*. The benchmark should be an *efficient naïve* portfolio replicable by average investors at low costs.

Managed Funds Risk benchmarking

In summary, we would like to construct a composite number that combines return and risk into one index.

This composite index must hold the risks of an evaluated portfolio constant, so that performance can be judged on the basis of risk-adjusted returns.

Ideally, the index should be able to evaluate portfolio's performance on two aspects; *relative* performance (i.e., relative to other active portfolios), and *absolute* performance (i.e., relative to a naïve benchmark).

Managed Funds Risk benchmarking

The Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM) provide theoretical frameworks that overcome the complications of performance measurement outlined previously.

Treynor (1965), Sharpe(1966), and Jensen (1968) were the first to realise the potential applications of MPT and CAPM for investment performance evaluation.

Managed Funds Risk benchmarking

Sharpe Index (SI)

According to MPT, a portfolio's risk is measured by the standard deviation of its returns. Using this concept, the Sharpe Index (*SI*) adjusts for a portfolio's risk by dividing its excess return by its standard deviation. For any portfolio *p*:

$$SI_p = E(\tilde{r}_p) / \sigma(\tilde{r}_p)$$

Where: $E(.)$ is the expected value symbol

$\sigma(.)$ is the standard deviation symbol

r_p is the excess return of portfolio *p*, defined as $r_p = R_p - R_f$

R_f is the risk-free rate.

$\tilde{}$ superscript indicating randomness of the above two variables

Managed Funds
Risk benchmarking

The *SI* is an excess return per unit of risk. For ranking purposes, the higher the *SI*, the better the performance.

To check whether a fund adds value (i.e., beats the market), one has to compare the *SI* with the slope of the Capital Market Line (CML). Any fund *p* is said to beat the market, if SI_p > slope CML, and vice versa.

Managed Funds Risk benchmarking

Treynor (1965)'s Index (*TI*)

CAPM suggests a portfolio's risk is divided into systematic and unsystematic parts. Since unsystematic risk can be eliminated cheaply by diversification, investors are compensated only for bearing systematic risk.

Therefore, an appropriate measure of a portfolio's risk is its systematic risk, or beta (β_p). Accordingly, the Treynor Index (*TI*) adjusts portfolio's excess return by its beta in a similar manner as the *SI*.

Managed Funds
Risk benchmarking

$$TI_p = \quad E(\tilde{r}_p) / \beta_p$$

where β_p is the portfolio p's beta, defined as;

$$\beta_p \quad = \quad \sigma_{(\tilde{r}p,\ \tilde{r}m)} / \sigma^2(\tilde{r}m)$$

where $\sigma_{(x,y)}$ is the covariance between x and y

$\sigma^2\ (x)$ is the variance of x

$\tilde{r}_m$ is excess return on the market portfolio.

Managed Funds Risk benchmarking

The TI_p measures a portfolio *p*'s excess return per unit of its systematic risk. For ranking purposes, the higher the *TI*, the better the performance. To see whether a fund adds value, one has to compare the *TI* with the slope of the Security Market Line (SML). Fund *p* beats the market, if TI_p > slope SML, and vice versa.

Managed Funds
Risk benchmarking

- **Jensen's Alpha (*JA*)**

  Like the *TI*, the Jensen's Alpha (*JA*) takes into account only systematic risk for adjusting portfolio's return. However, the *JA* measures the deviation of a portfolio's return from its equilibrium level, defined as the deviation of return from the risk-adjusted expectation fo that return. The *JA* of any portfolio *p* is defined as;

$$JA_p = E(\tilde{r}p) - \beta p\, E(\tilde{r}m) \quad (4)$$

Managed Funds
Risk benchmarking

The term "$\beta_p E(r_m)$" is portfolio *p*'s equilibrium return implied by the SML. For ranking purpose, the higher the JA_p, the better the performance. To see whether fund *p* adds value, one has to merely check a numerical sign of the *JA*. The fund beats the market, if "$JA_p > 0$", and vice versa.

Managed Funds Risk benchmarking

Defining αp as portfolio *p*'s *abnormal return* hence results in Equation *(5)*, below. Note that *(4)* is expressed on an *ex ante* basis. Equation *(5)* thus allows us to evaluate manager performance on an *ex post* basis. Jensen (1969) has shown that, provided βp is constant over time, the αp is an unbiased estimator of *JAp*.

$$\tilde{r}_{p,t} = \alpha_p + \beta p \, \tilde{r}m,t + \tilde{\varepsilon}p,t \qquad (5)$$

Where: $t = 1, \ldots, T$

T is the number of observations for fund p

αp is an estimator of JAp

$\tilde{\varepsilon}p,t \sim iid\,(0, \sigma^2(\varepsilon p)),\ E(\tilde{\varepsilon}p,t\ \tilde{r}m,t) = 0$

Managed Funds
Risk benchmarking

- How do these returns compare with a low-risk return?

- I have pulled down the monthly interbank rate artificially converted into Euros from Datastream.
- The summary statistics are on the next page. Ideally I should have used a Government borrowing rate but these were at a higher frequency on Datastream.

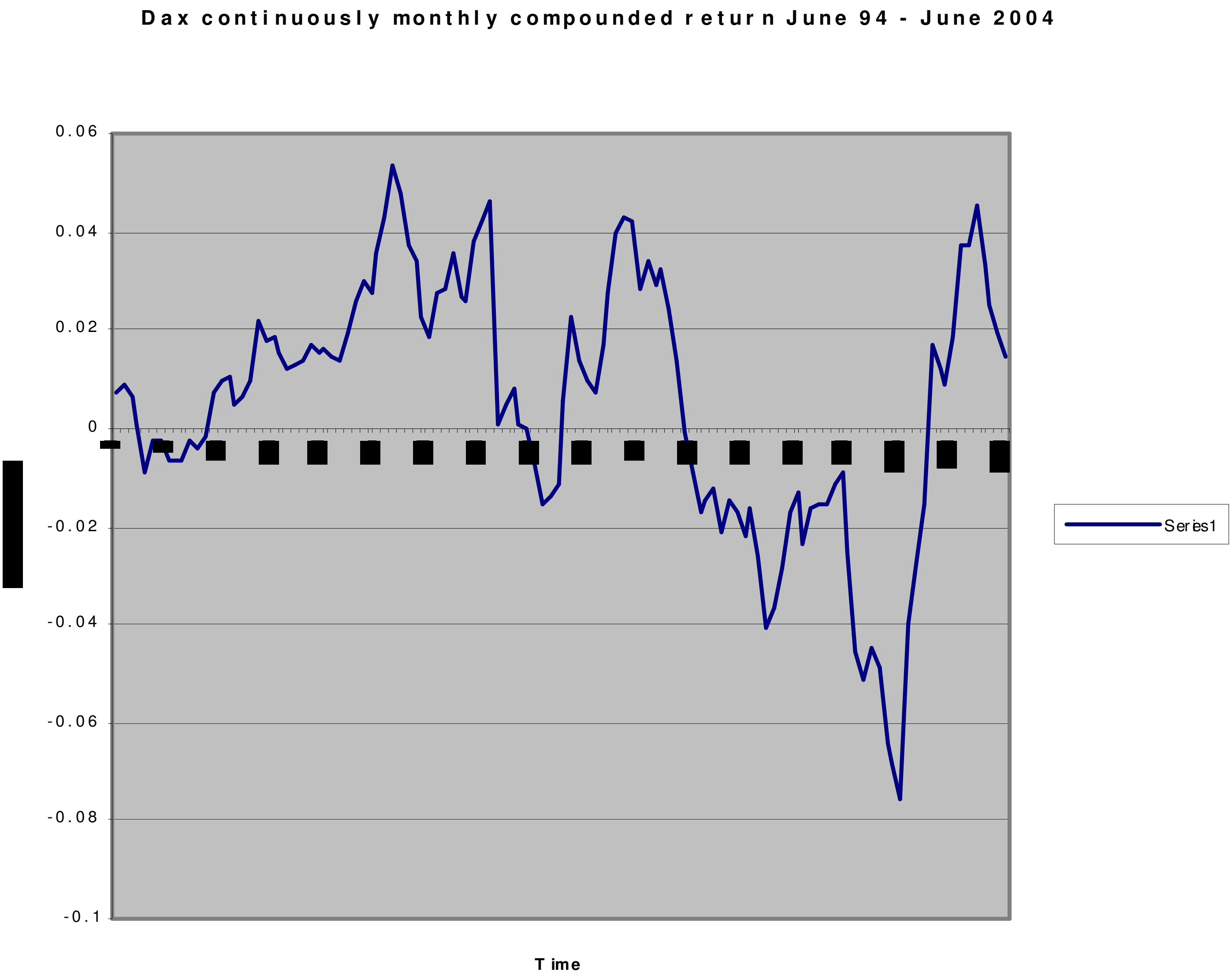
GERMANY INTERBANK 1 MONTH - OFFERED RATE in Euros in monthly terms

	Column1
Mean	0.001502
Standard Error	3.41E-05
Median	0.001451
Mode	#N/A
Standard Deviation	0.000375
Sample Variance	1.41E-07
Kurtosis	-0.68926
Skewness	0.269249
Range	0.001416
Minimum	0.000861
Maximum	0.002277
Sum	0.181778
Count	121
Largest(1)	0.002277
Smallest(1)	0.000861
Confidence Level(95.0%)	6.76E-05

Managed Funds Risk benchmarking

- The mean monthly interest rate on inter bank borrowing is only 15 basis points per month on average but its always positive.
- The minimum is roughly 8.5 basis points at the maximum is about 23 basis points.
- The standard deviation is about 3 and ¾ basis points.

Dax 200 Continuously compounded monthly return Jun 94-Jun 2004



DAX monthly continuously compounded returns 94-2004

Column1	
Mean	0.005006156
Standard Error	0.002383973
Median	0.008813522
Mode	#N/A
Standard Deviation	0.026115115
Sample Variance	0.000681999
Kurtosis	0.370506286
Skewness	-0.663027631
Range	0.129080344
Minimum	-0.075676052
Maximum	0.053404292
Sum	0.600738767
Count	120
Largest(1)	0.053404292
Smallest(1)	-0.075676052
Confidence Level(95.	0.004720498

How does UWS compare with the DAX?

- UWS offers 0.006% mean monthly returns with a standard deviation of 5.29%.
- The Dax 200 offers a mean monthly return of 0.005% with a standard deviation of 2.61%.
- We would expect the DAX to have lower risk as the DAX 200 is basically the return on a 200 stock diversified portfolio.

A Sharpe ratio for UWS

$$SI_p = E(\tilde{r}_p) / \sigma(\tilde{r}_p)$$

$$= (0.006\text{-}0.0015)/0.0529$$

$$UWS\ SI = 0.0851$$

$$DAX\ SI = (0.005\text{-}0.0015)/0.0261$$

$$= 0.1341.$$

UWS Vs DAX 200

- Clearly UWS did not do as well as the DAX 200 over this period.

This measure takes into account total risk.

Calculating the Treynor measure.

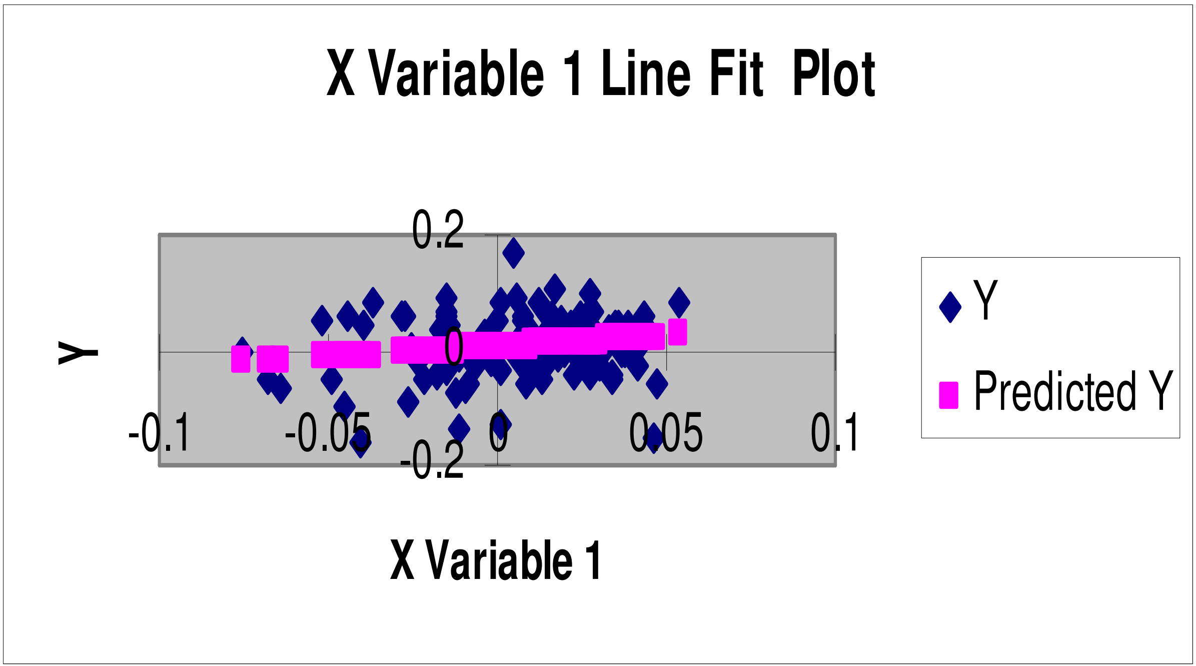
$$TI_p = E(\tilde{r}_p) / \beta_p$$

SUMMARY OUTPUT							
Regression Statistics							
Multiple R	0.17871						
R Square	0.031937						
Adjusted F	0.023734						
Standard E	0.052223						
Observatio	120						
ANOVA							
	df	*SS*	*MS*	*F*	*ignificance F*		
Regressior	1	0.010617	0.010617	3.892947	0.050827		
Residual	118	0.321814	0.002727				
Total	119	0.332431					
	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*lpper 95.0%*
Intercept	0.004229	0.004855	0.871131	0.385451	-0.00538	0.013843	-0.00538	0.013843
X Variable	0.361689	0.183314	1.973055	0.050827	-0.00132	0.724701	-0.00132	0.724701

Interpreting the regression

- UWSreturn = α + βDaxreturn
- UWSreturn = 0.0042 + 0.362Daxreturn
- The Coefficient is just about significant but a very low R^2
- This might be expected given we have used a 10 year estimation period.

Calculating UWS Treynor Index



Calculating UWS Treynor index.

- Suppose we use 5 years data – less averaging? A bit better with a beta of 0.472.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.232827							
R Square	0.054208							
Adjusted F	0.039878							
Standard E	0.056957							
Observatio	68							
ANOVA								
	df	*SS*	*MS*	*F*	*ignificance F*			
Regressior	1	0.012272	0.012272	3.782802	0.056044			
Residual	66	0.214109	0.003244					
Total	67	0.226381						
	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0%*	*Jpper 95.0%*
Intercept	0.008353	0.006981	1.196435	0.235807	-0.00559	0.022291	-0.00559	0.022291
X Variable	0.47177	0.242562	1.944943	0.056044	-0.01252	0.956061	-0.01252	0.956061

Calculating Treynor index for UWS

- However to be consistent with the Sharpe measure we should use the same time interval. If we use the full ten years.
- UWS Treynor = *(0.006-0.0015)/*
  Index *0.362*

  = *0.0124*

Treynor Index Dax = *(0.005-*
0.0015)/ 1

= *0.0035*

Conflict between the two measures

- Dax 200 looks far better on the Sharpe Measure
- UWS looks better on the Treynor measure.
  - They use different measures of risk:
    - Sharpe total risk
    - Treynor market related risk

- Lets have a look at Jensen’s alpha.

Calculating Jensen alpha for UWS

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.181096							
R Square	0.032796							
Adjusted F	0.024599							
Standard E	0.052255							
Observatio	120							
ANOVA								
	df	*SS*	*MS*	*F*	*ignificance F*			
Regressior	1	0.010925	0.010925	4.001123	0.047766			
Residual	118	0.322204	0.002731					
Total	119	0.33313						
	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*lpper 95.0%*
Intercept	0.003258	0.004813	0.67694	0.499769	-0.00627	0.01279	-0.00627	0.01279
X Variable	0.366377	0.183163	2.000281	0.047766	0.003665	0.729089	0.003665	0.729089

Calculating Jensen alpha for UWS

- We have calculated the regression in excess return form.
- $Ret_{tUWS} - Rf_t = \alpha + ßRet_{tDAx} – Rf_t$
- The α is the measure of performance:
    - Superior if positive
    - Inferior if negative
- In this case UWS has an alpha of 0.003 apparently superior.

Calculating Jensen alpha for UWS

- This is a very weak regression.
- The statistic on alpha is not significant.
- The adjusted R-Square is 0.0025 – so the regression is not explaining a great deal.
- The F statistic for the regression as a whole is significant.
- We have run it over a ten year period. I tried it over the last five years too but it looks worse.

Exercise for you

- Go to the following website in the finance department at the University of Ulm.
  - Click on ulmcourse
  - You will find an xl file with data on German managed funds
  - Run Sharpe, Treynor and Jensen measures on one of these funds using xl.

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