ERASMUS UNIVERSITY ROTTERDAM
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BSc International Bachelor Economics and Business Economics

TESTING THE FISHER HYPOTHESIS

A comparison across different markets

ABSTRACT

This thesis examines the predictive power of the term structure of the interest rates on future inflation for eleven different countries. Significant evidence for a strong relationship is obtained for the United States, the United Kingdom, Canada, and South-Korea. A weak form of the Fisher effect is detected for Belgium, Germany, Poland, and Switzerland. Results tend to differ across the different countries and different time periods, coinciding with the research conducted by, for example, Mishkin (1984, 1990, and 1991) and Koustas and Serletis (1999). In addition, care should be taken when deriving inferences from the small-sample periods.

Keywords: *Fisher effect; Fisher hypothesis; Term structure; Inflation; Multi-country analysis*

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I. INTRODUCTION

Many economists believe, as the name suggests, that the Fisher hypothesis originates from Irvin Fisher himself. However, this is not entirely correct. In fact, the original ideas stem from, amongst others, John Stuart Mill, Alfred Marshall, and William Douglas. Fisher (1896) only highlighted existing enunciations of these economists, but did not claim any credit for novelty on the particular issue. Nevertheless, he was the first to denote the coherence of these statements and to integrate the ideas in an equation (Dimand, 1999).

Fisher (1896, 1907, and 1930) assumed that changes in the nominal interest rates were caused solely by changes in inflation rates. This idea stems from the fact that rational investors would demand compensation in case of a loss in their purchasing power, caused by inflation. In other words, this contribution is attributed to risk aversion. Consequently, adding the compensation to the real interest rate will result in the nominal interest rate.

Derived from the above, the Fisher hypothesis can be captured in the following equation:

(E.1) $$i_t = E_t(rr_{t+1}) + E_t(\pi_{t+1})$$

Where i_t represents the nominal interest rate at time t, $E_t(rr_{t+1})$ the expected real rate at time t for one-period returns, and, finally, $E_t(\pi_{t+1})$ denotes the expected inflation rate at time t, one period in the future. In order to test the Fisher hypothesis, it is quite common practice for researchers to modify the equation to simplify their research. However, assumptions made often do not hold in reality. For example, the most common empirical tests for testing the Fisher effect, are either too simple, or do not take into account taxes, or tests for the rational expectations hypothesis, while the Fisher hypothesis does not provide any information on how the expected inflation is measured, etcetera.

It has been argued that, especially in the long run, there exists a relationship between the nominal interest rates and future inflation. This is also depicted as a relationship between the term structure of the interest rates and the inflation spread. This approach examines whether there is a relationship between a pre-specified n-year inflation rate subtracted from the m-year inflation rate and, in the same manner, a pre-specified n-year interest rate subtracted from the m-year interest rate. Many studies confirm this relation to exist, amongst others Fama (1990), Mishkin (1990, 1991), Duck (1993), Berument and Jelassi (2002), Fahmy (2003), and Phylaktis and Blake (1993), for certain countries. However, contrary results are found as well, for example, by Coppock and Poitras (2000), who argued that there is no Fisher effect to be found in countries facing hyperinflation. Furthermore, mixed results are found, for example, by Mishkin (1984, 1990, and 1991) and by Koustas and Serletis (1999), who argued that there is support in favour of the hypothesis to hold. However, results vary across different countries and time periods. In conclusion, results are inconclusive.

Inconclusive or not, the information obtained from the Fisher hypothesis is of great importance to both the fields of finance and macroeconomics. One of the key qualities of this information is, argued by Harvey (1991), its ability to forecast future real economic activity. This is confirmed by the findings of Estrella and Mishkin (1997). They argued that the informational content of the term structure is useful in predicting future inflation and real activity, which might prove a useful tool in determining monetary policy. Additionally, as Jarrow (1996) puts it, the term structure might be helpful in calculating interest rate derivatives' prices and can be helpful in improving the returns on fixed income, mentioned by Deaves (1997).

Up to now, most of the studies examining the Fisher hypothesis are focused on the United States, Japan, and some western European countries, like the United Kingdom and Germany. All are in the category of highly developed countries. Therefore, much information is available in this area, however, what about other types of countries? Can the same effects be found in third world countries, Emerging Markets, or Tiger Economies? This will be the main focus of this study. Empirical testing will be based on the following research question:

"Does the Fisher hypothesis hold for different types of countries, regarding the relationship of the term structure and inflation spread?"

As already mentioned, according to Coppock and Poitras (2000), there is no evidence for the existence of the Fisher effect for countries facing hyperinflation, for example Zimbabwe. Such countries are of no interest to this study. Instead, a random selection of four types of countries are used, namely, G8 countries, highly developed countries, Tiger Economies, and Emerging Markets. The group of G8 members consists of the United States, United Kingdom, Germany, and Canada. Secondly, Belgium and Switzerland are selected as highly developed countries. The third group, the Tiger Economies, comprises of South-Korea only. Finally, the Emerging Markets group is represented by some eastern European countries, namely, Czech Republic, Hungary, and Poland. In addition, this group is completed with Thailand. The methodology utilized in this study is taken from a study by Frederic Mishkin and Philippe Jorion (1991). For the Emerging markets and the Tiger Economy there is a lack of data. Usually, one would require at least 30 independent, non-overlapping observations to test with. However, this amount of data is not available for all these countries. As a consequence, the results will probably be not completely trustworthy and should be consulted with scrutiny. Nevertheless, as the aim of this study is to compare the results between the different groups of countries, all data available for the countries is used, including the small samples in some cases.

Some research has been conducted for third world countries or Emerging Markets with respect to the Fisher effect already, like the studies of Berument and Jelassi (2002) and of Phylaktis and Blake (1993). However, results are not compared to one another. As a consequence, after the relationship is tested for each group individually, in addition to the research question, it is also hypothesized whether differences between the groups of countries exist, i.e. results across groups will be compared.

When examining the Fisher hypothesis, monetary policy is often ignored. According to the rational expectations hypothesis, investors are rational. All information regarding the economy and economic models is transparent and available to all. Therefore, rational investors do not make systematic mistakes and they can calculate the effect of shocks to the economy. However, rational expectations depend on the model. For example, if inflation is expected to increase, long-term interest rates will increase too. But, does the monetary policy allow the inflation or interest rate to increase? It depends on the goals of the monetary regime, which changes over time. For example, their goal can be price stability. Monetary policy acts on expectations of future inflation and thereby changes the actual future inflation rate. Therefore, if the monetary policy changes the interest rates and thereby changes the future inflation rate, this will differ from the expectations of the investor. However, in order to simplify the model used in this study, monetary policy is not taken into account.

The remainder of this research has the following structure. First, a small literature study is conducted, depicting the most prominent findings of other research in this field. Second, empirical results will be discussed in three subsections. The first section explains the methodology used in this study. The next section draws attention to issues regarding the data and econometric problems. The final section of this part elaborates on the results; in addition to the hypothesis tested on an individual basis, also results across groups are compared. Finally, the conclusion sums up the most important findings of this study and some suggestions for future research are discussed.

II. LITERATURE REVIEW

Much research has been devoted to studying the relationship between the term structure of the interest rates and future inflation. This section will summarize the main findings of previous studies, in particular with respect to countries included in this research.

First, it can be concluded that results obtained from former research are highly inconclusive: this might be attributed to the large array of different methodologies applied by the different studies, the treatment of taxes, different definitions of both inflation and interest rates, and the countries considered in the research may differ. For example, part of the literature pointed out a strong relation (amongst others: Yohe and Karnosky, 1969; Gibson, 1972; Fama, 1975; Lucas, 1980; Jorion and Mishkin, 1991; Woodward, 1992), some of the studies detected the Fisher hypothesis only to hold for certain countries and time periods (e.g. Fisher, 1930; Gibson, 1970; Cargill, 1976; Joines, 1977; Mishkin, 1981; Phylaktis and Blake, 1993; Payne and Ewing, 1997; Berument and Jelassi, 2002, Berument et al., 2007), and lastly, some of the researchers did not find any support of (a strong version of) the Fisher hypothesis (e.g. MacDonald and Murphy, 1989; Dutt and Ghosh, 1995).

Crowder (1997) acquired significant evidence in favour of the Fisher hypothesis to hold for Canada, especially for the longer maturities. However, he discovered that the relationship between interest rates and inflation was not stable over the past 30 years. Moreover, his study concluded that interest rates contain predictive power for future inflation, nevertheless, a reverse relationship is not found. Fama (1975) observed a similar outcome for the United States. Mishkin (1993) and Crowder and Hoffman (1996) derived the same conclusion. Finally, Crowder (1997) pointed out that the series were co-integrated, connoting that both series for inflation and interest rates are non-stationary, but in a combined linear function, they are in fact stationary. Ignoring co-integration can eventuate in spurious regressions.

Atkins and Coe (2002) acknowledged that the Fisher effect is supported with evidence for an approximately one-on-one long-run relationship between interest rates and inflation rates for the United States and Canada. They applied a special technique, developed by Pesaran et al. (2001), in which a series is supposed to be either $I(1)$ or $I(0)$, which is a slight modification of the co-integration technique, where both series are expected to be $I(1)$.

Contrary to the results obtained by Crowder (1997) and Atkins and Coe (2002), Dutt and Ghosh (1995) did not uncover significant evidence in support of the Fisher hypothesis. They employed two different tests: the Johansen-Juselius multivariate co-integration method and the Phillips-Hansen fully modified OLS method, for the weak and strong form of the hypothesis.

For Belgium, Canada, the United Kingdom, and the United States, MacDonald and Murphy (1989) did not detect significant evidence in favour of a strong relationship between interest rates and inflation, by the use of co-integration techniques. The authors suggested that the methodology could be improved by including other variables in the model, influencing the real interest rates. This stems from the fact that interest rates and inflation tend to move apart over time.

Berument and Jelassi (2002) were not able to reject the null hypothesis of a strong Fisher effect for, amongst others, Belgium, Canada, Germany, Switzerland, and the United States. These results are in line with Moazzami and Gupta (1995), who found a one-on-one relationship for Canada, Germany, United Kingdom, and the United States. Additionally, Berument and Jelassi (2002) concluded that the influence of the Fisher hypothesis could be affected by the time period and determined that results are either not significantly different from one, or not significantly different from zero, for developing countries. This is in slight contrast with the findings of Phylaktis and Blake (1993), who unearthed significant evidence of a one-on-one relationship between nominal interest rates and inflation for the developing countries Brazil and Mexico.

Berument et al. (2007) used a GARCH-model to study the validity of the Fisher effect for both G7 and developing countries. Results pointed out that the hypothesis has substantial less support for developing countries, compared to G7 countries. Furthermore, Payne and Ewing (1997) conducted a study among developing countries by the use of the Johansen-Juselius co-integration technique. A full

Fisher effect is detected for about half of the countries. No support for the hypothesis was found for Thailand. A summary of the literature study can be found in Appendix A.

III. EMPIRICAL RESULTS

III.I. METHODOLOGY

The aim of this study is to investigate whether the term structure of the interest rates has any relationship with future inflation. To examine whether the term structure of the interest rates contains any information on predicting the future path of inflation, a regression function will be estimated. The method applied in this study was adopted in a study conducted by Jorion and Mishkin in 1991. This method is chosen, because the aim of this paper is to estimate the relationship between the term structure of interest rates and future inflation for longer maturities, which was studied in the particular research by Jorion & Mishkin (1991) as well. The regression function is described in equation E.2 and results will be estimated using the Ordinary Least Squares (OLS) regression technique.

(E.2) $$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

Equation E.2 can be derived as follows: first, according to Fisher's equation (1930), investors demand a premium above the interest rate, equal to the expected inflation, taking into account their future purchasing power. Therefore, the expected inflation will be equal to the nominal interest rate minus the real interest rate.

(E.3) $$E_t \pi_t^m = i_t^m - rr_t^m$$

Where $E_t \pi_t^m$ represents the expected inflation at time *t*, from time *t* to time *t*+*m*. i_t^m equals the nominal interest rate for an *m*-period at time *t*. Finally, rr_t^m conveys an *m*-period real interest rate, at time *t*.

The true inflation for *m*-periods can be captured with a forecast error added to the expected inflation. This can be seen in equation E.4.

(E.4) $$\pi_t^m = E_t \pi_t^m + \varepsilon_t^m$$

Where ε_t^m denotes the forecast error. Next, if equation E.4 is substituted into equation E.3, equation E.5 will be derived.

(E.5) $$\pi_t^m = i_t^m - rr_t^m + \varepsilon_t^m$$

Since this study is concerned with the term structure of interest rates and tries to estimate its information content regarding future inflation, the *n*-period inflation rate is subtracted from the *m*-period inflation rate, i.e. equation E.5.

(E.6) $$\pi_t^m - \pi_t^n = i_t^m - i_t^n - rr_t^m + rr_t^n + \varepsilon_t^m - \varepsilon_t^n$$

Finally, if equation E.6 is rewritten, equation E.2 will be the result,

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

where $\pi_t^m - \pi_t^n$ is the inflation spread between the *m*-period inflation minus the *n*-period inflation rate. $\alpha_{m,n}$ is defined as $\overline{rr}^n - \overline{rr}^m$. The term spread of the interest rates is $i_t^m - i_t^n$. The error term, $\eta_t^{m,n}$, can be expressed as $\varepsilon_t^m - \varepsilon_t^n - \left(u_t^m - u_t^n\right)$, where $u_t^m = rr_t^m - \overline{rr}^m$ and $u_t^n = rr_t^n - \overline{rr}^n$. The effects of interest rate changes on inflation changes are examined, as commented earlier, by reducing the *m*-year maturity by the *n*-year maturity, where *n* corresponds to one.

In order to estimate the influence of the term structure of the interest rates, four hypotheses are tested throughout this paper on each regression function:

(H.1) $H_0 : \beta_{m,n} = 0$

(H.2) $H_1 : \beta_{m,n} \neq 0$

(H.3) $H_0 : \beta_{m,n} = 1$

(H.4) $H_1 : \beta_{m,n} \neq 1$

The first hypothesis, H.1, asserts that the slope of the term structure equals zero. If the hypothesis cannot be rejected, this means that the slope contains no significant information of future inflation rates. The second hypothesis, H.2, rejects H.1. Consequently, if this hypothesis cannot be rejected, the term structure does contain significant information on predicting future inflation (Mishkin, 1990).

The underlying theory of rational expectations suggests that, ceteris paribus, a change in interest rates will have a one-on-one relationship with a change in inflation. This is the case if H.3 cannot be rejected. On the other hand, if H.3 is rejected, one cannot directly conclude that $\beta_{m,n}$ has no impact at all. It is true that the relationship is not perfect, i.e. a one-on-one relationship, but it might well be that the impact is slightly smaller than 1 and greater than zero, or even greater than 1. Another option is that $\beta_{m,n}$ is not significantly different from zero, but this can be seen from the outcome of H.1 already.

Finally, if H.4 cannot be rejected, as just mentioned above, the coefficient can be either smaller, or larger than 1, or it can be equal to zero.

The outcome of both H.2 and H.4 point out that $\beta_{m,n}$ is significantly different from 0 and 1 respectively, in the event of no rejection. However, it does not really say anything about the true size of the coefficient.

This study will roughly replicate the study by Jorion and Mishkin (1991). However, a slightly different approach is in place. While the cited study used one sample period for all countries, this is not a very meaningful approach in this study, since not the same amount of data is available for every country. This problem is solved by estimating the regression results for three different samples, in order to make comparisons across countries. The first sample contains the results of a regression run on the full data set available for the particular country. The second sample ranges from January 1988 to May 2009.[1] Finally, because the amount of data for the emerging markets was very limited, the third sample starts at March 2005. Before the hypothesis can be tested, some important issues regarding the data need to be taken into account, which is the topic of the next section.

III.II. DATA

Since this study operates the same methodology as applied in the research by Jorion and Mishkin (1991), the interest rate data is composed of monthly observations of annualized, continuously compounded zero-coupon rates. These rates are, for example for Germany, estimates of interest rates derived from yield to maturities of outstanding bonds, published by the German Bundesbank. For Canada, the Bank of Canada provided yield curves of zero-coupon bonds. Finally, South-Korean zero-coupon rates are derived from redemption yields, estimated on Korean treasury bonds. The redemption yield is simply equal to the yield-to-maturity, which, in case of zero-coupon bonds, is the interest rate which will be used.

As the countries' interest rates are not the desired continuously compounded rates, these rates are transformed into the correct ones. Besides, Jorion and Mishkin (1991) used observations from the start of the month. In order to make comparisons between their results and results to be obtained from this study, the dataset should be slightly modified. This is done by lagging the observations of the countries with end of month data by one period. For example, in the case of Switzerland, the last observation of January 1988 is used for the beginning of the second month, the first of February 1988.

Inflation rates are derived from Consumer Price Index data, which are provided by the IMF-IFS database. The *m*-year inflation rate is simply calculated by first dividing the CPI value of *m*-years in the future by the current value of the CPI. After this first calculation, the value is divided by *m*, which results in an annual, *m*-year inflation rate. As a way of illustration, consider the CPI level of Switzerland. In order to calculate the *2*-year inflation rate, the following formula is exercised:

$$\text{(E.7)} \quad \pi_t^2 = \frac{100 * LOG\left(\dfrac{CPI + 24}{CPI + 0}\right)}{2}$$

, where π_t^2 is the *2*-year inflation rate from time *t* to time *t+2*. For Germany, CPI data is composed out of two different series, via ratio splice.

As was the case with the interest rates, inflation rates also need to be transformed into continuously compounded rates. Analogously, the inflation rates are also lagged one period, which

[1] January 1988 is chosen as from this date data is available for all highly developed countries.

means that the final observation of December is used as the first observation of January. A more elaborate explanation on the source of the data can be found in Appendix B.

Before the data can be utilized in estimating the regression functions, some econometric problems should be taken care of. First, there is the problem of autocorrelation. It is said that data from a sample is autocorrelated, when the error-terms are correlated with one another. This will result in wrongly estimated standard errors from OLS, which will make inferences about the coefficients invalid. Since the regression functions contain overlapping observations, this is a serious issue in this study and needs to be taken into account with scrutiny. One way of solving this problem is by using the Newey-West Heteroskedasticity and Autocorrelation Consistent (HAC) method, introduced by Whitney Newey and Kenneth West (1987). This method might seem well, but there is one slight disadvantage, however. The number of lags is determined automatically by the HAC method, which is not always optimal. The Newey-West HAC method is able to correct for both autocorrelation and heteroskedasticity at the same time.

It is not necessary to apply the Newey-West procedure when there is no autocorrelation present in the data. Therefore, this needs to be tested first. The Breusch-Godfrey Serial Correlation LM test is applied in this study. The only difficulty with this test might be to determine an appropriate number of lags of the residuals, which is normally decided by the frequency of the data. Correspondingly, in this study, lag lengths of 1, 12, and 60 months are chosen. Tables E-L in Appendix C provide descriptive statistics for both inflation rates and changes and for the term structure. Besides the summary statistics, also F-statistics of the Breusch-Godfrey Serial Correlation LM test are provided. As indicated in the tables, all F-values are highly significant at the 1% significance level, except for the results indicated differently.

As mentioned before, the Newey-West HAC method corrects for both heteroskedasticity and autocorrelation at the same time. Therefore, besides the Breusch-Godfrey LM test, the White heteroskedasticity test is employed. In the event that heteroskedasticity was detected, also significant autocorrelation was present in the data. Therefore, the White correction is not needed and the Newey-West HAC correction is used to correct the standard errors, if needed. There was no sign of both autocorrelation and heteroskedasticity in only nine cases.[2] Consequently, no correction is applied to these series as doing so results in extra noise added to the model, which is unfavourable.

Another problem could be that of errors-in-variables. This is the case when the assumption of accurately measured independent variables is violated. One cause can be measurement errors of one or more independent variables. Consequences for the regression output are quite severe; the coefficients will be both biased and inconsistent. This means that, on average the estimated value of the coefficient will not be equal to the true value, and, if the sample increases to ∞, the probability of correctly

[2] The corresponding series are all part of the March 2005 sample. For Belgium, Canada, Czech Republic, Germany, Hungary, Switzerland, and Thailand the four-year maturity does not need a correction. In the case of Poland and South-Korea, no correction is needed for m=3.

estimating the true value will not be zero. However, both an unbiased and consistent independent variable is required in order to obtain meaningful results from the OLS regressions. Disappointingly, there is no test in the OLS framework to point out this problem.

Finally, the data could exhibit a small-sample bias. Mishkin (1990) found that wrong inferences could be made in small samples, whilst the corrected standard errors – i.e. corrected by the Newey-West HAC method in this particular study – are in fact valid. According to his research, Monte Carlo simulation p-values would overcome part of this problem. However, this is beyond the scope of this research paper, but, it is advisable to take this issue into consideration in future research.

Preliminary evidence pointing out a relationship between the term structure of the interest rates and future inflation can be obtained in a number of ways. For example, it is possible to have a look at the descriptive statistics and discern whether the means of both series tend to move together. Furthermore, graphs depicting the relationship between the term spread and inflation changes can be consulted. Thirdly, examining a correlation matrix might give some information. These three approaches will be discussed in detail below.

Tables E-L in Appendix C provide some descriptive statistics for all countries regarding both the term structure and inflation rates and changes. The G8-countries' statistics follow about the same pattern as was found by Jorion and Mishkin (1991); countries with the highest inflation rates tend to have high interest rates as well. Another point worth mentioning is the fact that, the shorter the time period, or the more recent data is used, the lower the values for both the inflation rates and interest rates. This is a first indication of a possible predictive power of the interest rates for future inflation rates. Compared to the study in 1991, the estimated standard deviations are slightly lower. This might be due to the fact that the sample period of their study was somewhat shorter, about five years.

When having a look at the highly developed countries, Belgium and Switzerland, more or less the same results are found as the G8-countries. Again, inflation rates tend to go down with interest rates. This does not completely hold for Belgium, however. The March 2005 sample yields a higher inflation rate than the full sample. From an initial 2.2% inflation in the first sample, the rate increased to 2.5%.

The results for South-Korea also mimic the behavior of the countries just mentioned. Both the interest rate and the inflation rate decreased in the second period, compared to the initial situation.

Observing the emerging markets, the following can be concluded. The Czech Republic and Thailand are the only two countries in this particular group who reflect the same pattern in the term structure as was found for other countries. When the maturity increases, the term spread becomes larger i.e. the longer maturity, the higher the observed interest rate. Conversely, these results are not observed in the case of Poland and Hungary, where the interest rate for the longer maturities is not upward sloping, but instead, moving up and down. The summary statistics for inflation rates also show a different pattern compared to what is found before: almost all inflation rates are upward sloping, indicating that for the longer maturities, inflation will be higher. Furthermore, it can be concluded that inflation rates and interest rates of the emerging markets are much more volatile compared to the other groups of countries. For example, when looking at the standard deviations of the March 2005 period only, the average standard deviation of the inflation rates of the emerging markets is 0.24, compared to 0.16 of the G8 countries, the highest average among the other groups of countries. The difference between the highest average standard deviation of the other groups of countries and the emerging markets is even higher; about 0.10 compared to 0.06. This is respectively about 46% and 72% higher, indicating that both rates for emerging markets are much more volatile compared to other countries.

Although it is possible, however, only in a very limited form, it is quite difficult to derive correct inferences from the summary statistics in itself. Another approach is to have a look at a graph, depicting both the inflation changes and term structure over time. Figures 1 and 2 represent an overview of these time series. One of the advantages of a graph over a table is the fact that a possible relationship can be discerned more directly than looking at the summary statistics. The preliminary conclusions derived from the summary statistics are confirmed for all countries. Both the United Kingdom as well as Switzerland exhibits some relationship for the two-year maturity, which is more evident for the five-year maturity. The relationship is less clear for South-Korea and Thailand. For South-Korea, quite evidently, it seems that inflation changes and the term spread hold a negative relationship. Finally, the series are less volatile for the longer maturities.

When consulting correlations, one hopes to find, at least in this study, a one-on-one relationship. This would be the case if the correlation coefficient is nearly equal to 1. Since the study is only concerned with a relationship between the term structure and the corresponding inflation change, with the identical maturity, the only relevant numbers are found on the main diagonal of the table, indicated in bold. As can be seen from Table 1, the correlations are far from unity. Only two series seem to exhibit some relation, which are highlighted in red, with a coefficient of about |0.90|. However, this relationship is not very strong, as a consequence, on the overall it can be concluded that, from the information provided by the correlations, there is only a weak relationship between the series, if any.

Figure 1.

Graphs displaying the relationship between the inflation change and term spread of a G8 country and a highly developed country. The former is defined as $\pi_t^m - \pi_t^n$, i.e. the two-year interest rate minus the one-year inflation rate. The latter, the slope of the term-structure, is defined as $i_t^m - i_t^n$, the two-year interest rate minus the one-year interest rate. The 2-1 year and 5-1 year inflation change and term spread are represented by *m=2* and *m=5* respectively. All rates are continuously compounded, annual rates.

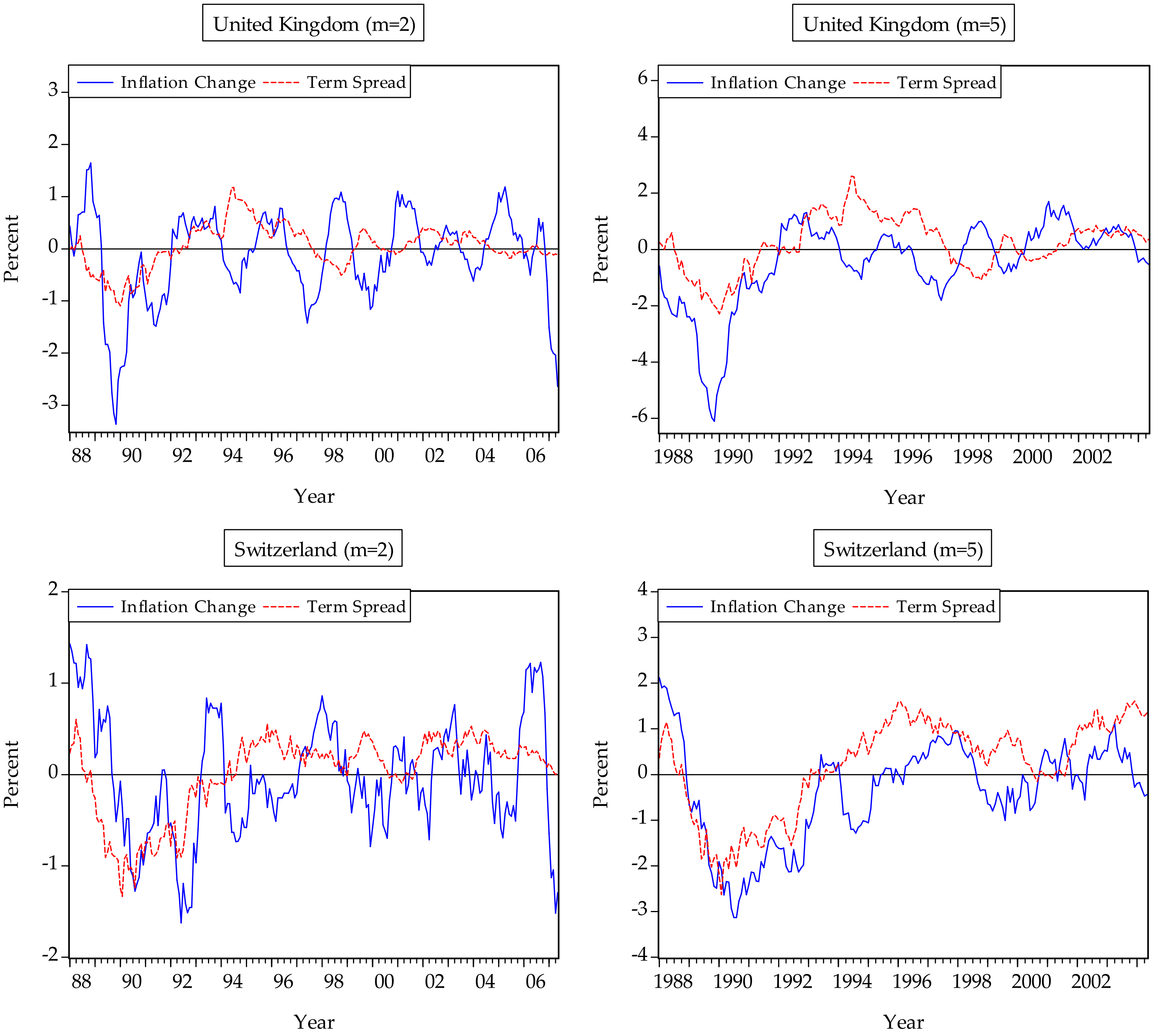

Figure 2.

Graphs displaying the relationship between the inflation change and term spread of a Tiger Economy and an Emerging Market. The former is defined as $\pi_t^m - \pi_t^n$, i.e. the two-year interest rate minus the one-year inflation rate. The latter, the slope of the term-structure, is defined as $i_t^m - i_t^n$, the two-year interest rate minus the one-year interest rate. The 2-1 year and 5-1 year inflation change and term spread are represented by *m=2* and *m=5* respectively. All rates are continuously compounded, annual rates.

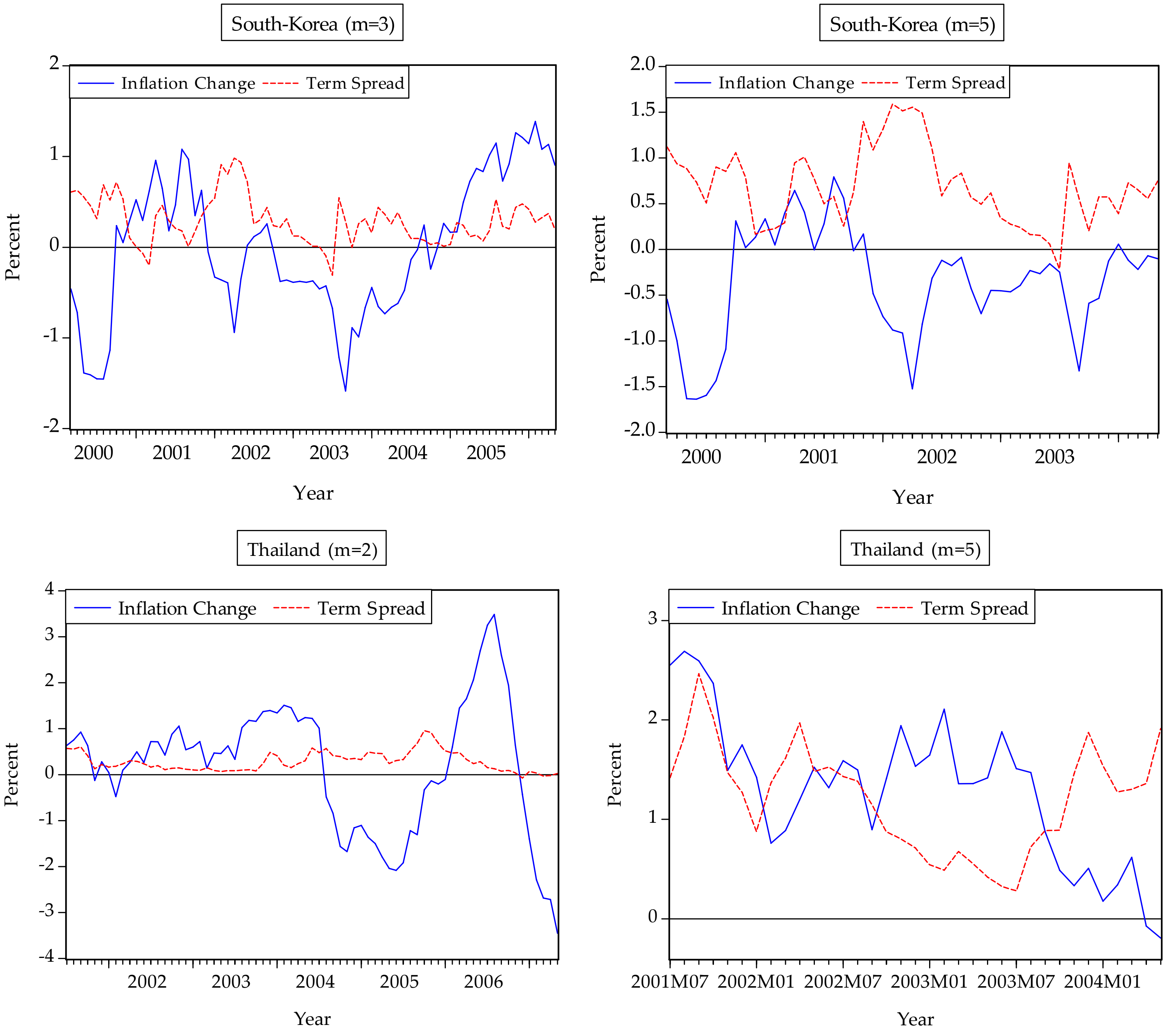

Table 1. Correlations

Correlations between inflation changes, from time *t* to *t*+*m* and the term spread, from time *t* to *t*+*m*. All correlations are obtained from annualized, continuously compounded, monthly data.

United Kingdom	Inflation Change				
Term Spread	1 year	2-1 year	3-1 year	4-1 year	5-1 year
1 year	**0.676**	-0.250	-0.312	-0.338	-0.357
2-1 year	-0.497	**0.231**	0.338	0.364	0.343
3-1 year	-0.502	0.245	**0.338**	0.369	0.350
4-1 year	-0.490	0.253	0.334	**0.365**	0.347
5-1 year	-0.473	0.260	0.332	0.361	**0.341**
Switzerland	Inflation Change				
Term Spread	1 year	2-1 year	3-1 year	4-1 year	5-1 year
1 year	**0.855**	-0.432	-0.577	-0.699	-0.787
2-1 year	-0.836	**0.348**	0.532	0.667	0.768
3-1 year	-0.854	0.338	**0.524**	0.663	0.768
4-1 year	-0.859	0.330	0.516	**0.657**	0.763
5-1 year	-0.861	0.324	0.510	0.651	**0.758**
Thailand	Inflation Change				
Term Spread	1 year	2-1 year	3-1 year	4-1 year	5-1 year
1 year	**-0.897**	-0.450	0.081	0.745	0.714
2-1 year	-0.460	**0.203**	-0.036	0.405	0.233
3-1 year	-0.458	0.153	**-0.136**	0.420	0.186
4-1 year	-0.320	0.218	-0.261	**0.340**	-0.002
5-1 year	-0.298	0.137	-0.342	0.334	**-0.059**
South-Korea	Inflation Change				
Term Spread	1 year	3-1 year	5-1 year		
1 year	**0.377**	-0.086	-0.288		
3-1 year	0.404	**-0.260**	-0.471		
5-1 year	0.236	-0.048	**-0.315**		

The next section describes a more thorough, advanced technique to estimate the Fisher effect, by the use of OLS regressions.

III.III. RESULTS

After the results of the preliminary study, it can be concluded that there is at least some evidence in favour of the Fisher hypothesis to hold. This will now be examined with a more formal test, the OLS regression method. The regression outputs are grouped according to the earlier specified groups, namely, G8 countries, Highly Developed countries, Tiger Economy, and Emerging Markets. Results are discussed accordingly. Before discussing any country in detail, it can be pointed out that R^2 increases with maturity, i.e. more of the variance is explained by the model, and α decreases with maturity, meaning that the average inflation decreases over time. These results were also obtained by Jorion and Mishkin (1991).

G8 Countries

As can be seen from Table 2, when analyzing the results for the United States' full sample, the Fisher hypothesis holds for all maturities. This means that a 1 % change in interest rates will, ceteris paribus, have a 1 % change in inflation rates, in the same direction. This was also discovered by Mishkin (1990) and Jorion and Mishkin (1991), except for a maturity of 5 years, where the null hypothesis of β=0 could not be rejected at the 10% significance level. Additionally, the results depicted in Table 2 are similar to the findings of Moazzami and Gupta (1995), Peng (1995), and Berument and Jelassi (2002).

For the period starting at January 1988, the null hypothesis of β=0 is only rejected once, for the *5*-year maturity, at the 10% significance level. This was also concluded by Mishkin (1990). Furthermore, the null hypothesis of β=1 is rejected for all maturities. These results are completely opposed to the findings when the full sample is used. One explanation for this can be the fact that after 1979, the predictive power of the interest rates on future inflation changed significantly. According to research conducted by Clarida and Friedman (1984), Roley (1986), and Huizinga and Mishkin (1986), this was due to a change in the monetary regime. A second explanation might be the fact that the R^2 is about 5.4% to 25.4% lower in this sample compared to the former. This means that less of the variance is explained by the model, caused by factors outside the model.

The final period's regression, starting in March 2005, provides inconclusive results. This problem arises probably due to a lack of data, which is almost certain the source of the high standard errors. Therefore, more evidence is needed in order to reject a hypothesis. Only with a maturity of 3 years the null hypothesis of β=1 is rejected at the 10% significance level.

Results for the United Kingdom, depicted in Table 3, show that the full sample provides somewhat weaker evidence in favor of the Fisher hypothesis, compared to the United States. However, except for m=2, it can be argued that the particular information is present. This can be concluded from the fact that the t-test of β=0 is rejected at the 10% significance level for the remaining maturities, and even one can be rejected at the 5% significance level. Besides, the t-test of β=1 is never rejected. Jorion and Mishkin (1991) and Berument et al. (2007) encountered similar results.

When having a look at the second sample, it can be concluded that there is more evidence in favour of the hypothesis to hold compared to the full sample. The null hypothesis of β=0 is rejected at the 5% significance level for all maturities and the t-test of β=1 is only rejected for m=2 at the 10% significance level. Also, the coefficients seem to be closer to 1 as well. More or less the same conclusion was derived from figure 1. Finally, R^2 almost doubled, meaning that more of the variance is explained by the model than was the case in the full sample. As with the United States, the results for the third period are highly inconclusive.

For Germany, in Table 4, results do not show any evidence for a full Fisher effect, where the coefficient of the slope of the term structure is equal to one for all maturities. On the contrary; results found for both the full sample as for the second sample tend to suggest that there is some relation, however, not equal to one. All null hypotheses of β=0 are rejected, but so are all null hypotheses of β=1. The only two exceptions showing a possible one-on-one relation between the term structure and interest rates are the five-year maturity of the full sample and the two-year maturity of the January

1988 sample. The result for the full sample is confirmed by the study of Jorion and Mishkin (1991). Evaluating the results more carefully, it can be concluded that the value of the slope coefficient lies between zero and one for the first two samples. Peng (1995) also concluded that there was a weak relation between interest rates and inflation for Germany. This is in contrast with the studies of Moazzami and Gupta (1995), Berument and Jelassi (2002), Berument et al. (2007) who discovered a strong relationship. Results found in the final sample do not provide any evidence for the Fisher hypothesis to exist. Both null hypotheses of β=0 or β=1 are rejected for m=2 and cannot be rejected for m=3 and m=4. This is mainly caused by the high standard errors as the estimated coefficients are far from one by itself.

From Table 5 it can be concluded that the results for Canada's full sample predict that for the shorter maturities, i.e. m=2, or m=3, the Fisher effect does not exist. However, for longer maturities, it can be concluded that the effect is in place, as the slope is significantly different from zero, at the 5 % significance level, and it cannot be rejected that the estimated slope coefficient is any different from one. This coincides with the results of Crowder's study in 1997. The predictive power of the term structure is even stronger for the second sample period, where only the two-year maturity does not seem to have any forecasting ability. Some of this improvement can be explained by higher values for R^2. The last period yields no direct evidence in favour of the Fisher effect to hold. In fact, the same results are found as the countries before. Additionally, the four-year maturity could not be tested, as there was only one observation in this regression. However, when analyzing standard errors of other regressions, it can be concluded that, on average, the standard errors tend to decrease with maturity. Therefore, it might be possible that some informational content could be obtained for m=4 in the final regression sample.

Table 2. United States of America

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	R^2	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
1976:6-2007:5	2-1year	-0.333	0.871	0.127	3.37	0.50
		(0.144)	(0.258)		[0.0008]*	[0.6182]
1976:6-2006:5	3-1year	-0.714	1.195	0.267	5.28	0.86
		(0.189)	(0.226)		[0.0000]*	[0.3890]
1976:6-2005:5	5-1year	-1.357	1.299	0.383	5.52	1.27
		(0.274)	(0.235)		[0.0000]*	[0.2044]
From January 1988						
1988:1-2007:5	2-1year	-0.112	0.157	0.005	0.44	2.38
		(0.185)	(0.354)		[0.6584]	[0.0181]*
1988:1-2006:5	3-1year	-0.264	0.292	0.035	1.64	3.97
		(0.170)	(0.178)		[0.1027]	[0.0001]*
1988:1-2005:5	5-1year	-0.443	0.290	0.071	1.90	4.64

		(0.219)	(0.153)		[0.0593]**	[0.0000]*
From March 2005						
2005:3-2007:5	2-1year	-0.132	0.922	0.025	0.56	0.05
		(0.372)	(1.646)		[0.5804]	[0.9624]
2005:3-2006:5	3-1year	-0.004	-0.013	0.000	0.02	1.84
		(0.275)	(0.550)		[0.9814]	[0.0886]**

Where π_t^n is the n-year inflation rate, in this study representing the 1-year inflation rate, which is subtracted from π_t^m, the m-year inflation rate, which ranges from time *t* to *t+m*. $\beta_{m,n}$ is the slope of the term structure of the interest rates, $i_t^m - i_t^n$, which can contain predictive information on future inflation.

* = Significant at the 5% significance level, ** = significant at the 10% significance level.

Table 3. United Kingdom

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	*R^2*	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
1985:2-2007:5	2-1year	-0.033	0.507	0.046	1.28	1.24
		(0.116)	(0.397)		[0.2026]	[0.2157]
1985:2-2006:5	3-1year	-0.051	0.648	0.102	1.81	0.98
		(0.172)	(0.358)		[0.0715]**	[0.3272]
1985:2-2005:5	4-1year	-0.094	0.708	0.130	1.99	0.82
		(0.221)	(0.355)		[0.0472]*	[0.4106]
1985:2-2004:5	5-1year	-0.205)	0.652	0.116	1.89	1.01
		(0.260	(0.344)		[0.0594]**	[0.3134]
From January 1988						
1988:1-2007:5	2-1year	-0.153	0.569	0.070	1.45	1.10
		(0.122)	(0.392)		[0.1479]	[0.2725]
1988:1-2006:5	3-1year	-0.324	0.785	0.208	2.44	0.67
		(0.159)	(0.322)		[0.0155]*	[0.5052]
1988:1-2005:5	4-1year	-0.492	0.889	0.302	2.93	0.36
		(0.193)	(0.303)		[0.0038]*	[0.7158]
1988:1-2004:5	5-1year	-0.660	0.839	0.277	2.85	0.55
		(0.233)	(0.295)		[0.0049]*	[0.5846]
From March 2005						
2005:3-2007:5	2-1year	-0.037	2.057	0.016	0.59	0.30
		(0.194)	(3.477)		[0.5595]	[0.7638]
2005:3-2006:5	3-1year	-0.883	-10.430	0.360	3.67	4.03
		(0.539)	(2.839)		[0.0028]*	[0.0014]*
2005:3-2005:5	4-1year	0.663	5.645	0.999	29.54	24.31
		(0.017)	(0.191)		[0.0215]*	[0.0262]*

For notes, please refer to Table 2.

Table 4. Germany

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	*R^2*	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
1972:10-2007:5	2-1year	-0.143	0.303	0.032	2.03	4.66
		(0.076)	(0.149)		[0.0433]*	[0.0000]*
1972:10-2006:5	3-1year	-0.335	0.444	0.079	2.80	3.52
		(0.123)	(0.158)		[0.0053]*	[0.0005]*
1972:10-2005:5	4-1year	-0.615	0.629	0.162	4.45	2.62
		(0.147)	(0.141)		[0.0000]*	[0.0090]*
1972:10-2004:5	5-1year	-0.893	0.785	0.262	6.05	1.66
		(0.163)	(0.130)		[0.0000]*	[0.0986]**
From January 1988						
1988:1-2007:5	2-1year	-0.111	0.546	0.056	2.24	1.87
		(0.092)	(0.243)		[0.0258]*	[0.0632]**
1988:1-2006:5	3-1year	-0.172	0.422	0.058	1.65	2.26
		(0.165)	(0.256)		[0.1004]	[0.0251]*
1988:1-2005:5	4-1year	-0.355	0.512	0.120	2.24	2.13
		(0.206)	(0.229)		[0.0264]*	[0.0340]*
1988:1-2004:5	5-1year	-0.543	0.562	0.188	2.96	2.31
		(0.218)	(0.190)		[0.0035]*	[0.0221]*
From March 2005						
2005:3-2007:5	2-1year	-0.486	4.645	0.461	3.16	2.48
		(0.245)	(1.472)		[0.0041]*	[0.0204]*
2005:3-2006:5	3-1year	0.675	-0.767	0.028	0.76	1.75
		(0.310)	(1.007)		[0.4599]	[0.1028]
2005:3-2005:5	4-1year	-1.495	2.441	0.453	0.91	0.54
		(1.736)	(2.682)		[0.5299]	[0.6861]

For notes, please refer to Table 2.

Table 5. Canada

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	*R^2*	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
1986:1-2007:5	2-1year	-0.092	0.213	0.010	0.55	2.03
		(0.141)	(0.388)		[0.5828]	[0.0436]*
1986:1-2006:5	3-1year	-0.299	0.520	0.115	1.90	1.75
		(0.162)	(0.274)		[0.0590]**	[0.0808]**
1986:1-2005:5	4-1year	-0.521	0.654	0.204	2.60	1.38
		(0.201)	(0.251)		[0.0098]*	[0.1688]
1986:1-2004:5	5-1year	-0.658	0.676	0.251	2.99	1.43
		(0.209)	(0.226)		[0.0031]*	[0.1546]
From January 1988						
1988:1-2007:5	2-1year	-0.110	0.207	0.010	0.52	2.00
		(0.152)	(0.396)		[0.6026]	[0.0466]*
1988:1-2006:5	3-1year	-0.364	0.548	0.129	2.00	1.65

		(0.173)	(0.274)		[0.0470]*	[0.1011]
1988:1-2005:5	4-1year	-0.652	0.714	0.250	2.90	1.16
		(0.208)	(0.246)		[0.0042]*	[0.2463]
1988:1-2004:5	5-1year	-0.793	0.741	0.300	3.39	1.18
		(0.213)	(0.219)		[0.0008]*	[0.2380]
From March 2005						
2005:3-2007:5	2-1year	0.082	0.010	0.000	0.01	1.43
		(0.138)	(0.691)		[0.9885]	[0.1648]
2005:3-2006:5	3-1year	0.348	-0.736	0.054	0.84	1.99
		(0.394)	(0.874)		[0.4162]	[0.0703]**
2005:3-2005:5	4-1year	-1.282	1.216	1.000	NA	NA
		(NA)	(NA)		[NA]	[NA]

For notes, please refer to Table 2.

Highly developed countries

Results for Belgium do not show any sign of the Fisher effect to hold, for both the full sample as well as the sample starting in March 2005. This confirms the expectations derived from the preliminary study of the descriptive statistics. However, as was the case with Germany, there is some support of a relationship between interest rates and future inflation. Former research by MacDonald and Murphy (1989) has discovered a similar relationship, contradicting the strong relation detected by Berument and Jelassi (2002). Despite the fact that β is not equal to one, the full sample's test results suggest that the β-coefficient does contain some information on future inflation rates, as the slope of the term structure is between zero and one. According to the test results, it is concluded that for m=3, the influence of the term structure is negligible, i.e. zero. Again, no sign of a one-on-one relationship between the term structure and inflation changes is discovered for the sample starting in March 2005. Table 6 gives an overview of these results.

On first sight, it can be pointed out that the beta coefficients in Table 7 are quite higher compared to the values obtained for Belgium, Germany, United Kingdom and the United States, for the same time period. This might be favourable evidence for a relationship between the interest rates and future inflation to exist. Additionally, this would be in line with the conclusions derived from figure 1 and tables G and H. However, when testing the hypothesis of β=0 and β=1 respectively, one can conclude that, due to the low standard errors, the coefficients' values are quite accurate. Therefore, both null hypotheses are rejected, yielding a slope coefficient of somewhere between zero and one. For the longer term maturity, the existence of the full Fisher effect is rejected, however, a 1% increase in interest rates will probably yield a 0.8% increase in future inflation rates, which is quite substantial. The results for the smaller sample are not very helpful on estimating the predictive power of the term structure, as both null hypotheses are not rejected which is caused by the high standard errors.

Table 6. Belgium

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	R^2	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
1988:1-2007:5	2-1year	-0.028	0.261	0.021	2.10	5.96
		(0.075)	(0.124)		[0.0366]*	[0.0000]*
1988:1-2006:5	3-1year	-0.068	0.158	0.016	1.22	6.51
		(0.087)	(0.129)		[0.2226]	[0.0000]*
1988:1-2005:5	4-1year	-0.200	0.242	0.075	2.50	7.85
		(0.072)	(0.097)		[0.0131]*	[0.0000]*
1988:1-2004:5	5-1year	-0.302	0.354	0.200	4.40	8.02
		(0.073)	(0.081)		[0.0000]*	[0.0000]*
From March 2005						
2005:3-2007:5	2-1year	-0.113	4.457	0.130	1.22	0.95
		(0.609)	(3.646)		[0.2330]	[0.3521]
2005:3 -2006:5	3-1year	1.387	-1.764	0.170	2.49	3.90
		(0.254)	(0.708)		[0.0271]*	[0.0018]*
2005:3-2005:5	4-1year	0.873	-1.119	0.243	0.57	1.07
		(1.119)	(1.978)		[0.6722]	[0.4781]

For notes, please refer to Table 2.

Table 7. Switzerland

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	R^2	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
1988:1-2007:5	2-1year	-0.037	0.485	0.110	2.92	3.10
		(0.080)	(0.166)		[0.0039]*	[0.0022]*
1988:1-2006:5	3-1year	-0.160	0.609	0.279	5.17	3.32
		(0.096)	(0.118)		[0.0000]*	[0.0011]*
1988:1-2005:5	4-1year	-0.368	0.718	0.436	6.75	2.65
		(0.107)	(0.106)		[0.0000]*	[0.0087]*
1988:1-2004:5	5-1year	-0.557	0.812	0.575	9.92	2.29
		(0.104)	(0.082)		[0.0000]*	[0.0231]*
From March 2005						
2005:3-2007:5	2-1year	-1.158	6.957	0.450	4.98	4.27
		(0.298)	(1.396)		[0.0000]*	[0.0002]*
2005:3-2006:5	3-1year	-0.440	2.170	0.155	1.55	0.83
		(0.579)	(1.404)		[0.1463]	[0.4199]
2005:3-2005:5	4-1year	0.365	-1.032	0.268	0.60	1.19
		(1.029)	(1.706)		[0.6536]	[0.4446]

For notes, please refer to Table 2.

Tiger Economy

It is not expected that the Fisher hypothesis holds for South-Korea, when looking at the graphs from figure 2 solely. Not surprisingly, this is also confirmed by the regression output found in Table 8, for the full sample only. Actually, the results suggest a negative relationship to hold, also pointed out in the discussion of figure 2. Furthermore, correlations in table 1 suggest a similar pattern to exist. But, when evaluating the test results for the March 2005 sample, there is significant evidence for a full Fisher effect; the null hypothesis of β=0 is highly rejected and the null hypothesis of β=1 cannot be rejected. This means that, for the three-year maturity in the second sample, the term structure does contain significant information on predicting future inflation rates.

Table 8. South-Korea

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	*R^2*	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
2000:3 -2006:5	3-1year	0.179 (0.184)	-0.613 (0.348)	0.043	1.76 [0.0822]**	4.64 [0.0000]*
2000:3-2004:5	5-1year	-0.050 (0.169)	-0.452 (0.161)	0.099	2.81 [0.0070]*	9.04 [0.0000]*
From March 2005						
2005:3 -2006:5	3-1year	0.685 (0.112)	1.089 (0.360)	0.413	3.02 [0.0098]*	0.25 [0.8093]

For notes, please refer to Table 2.

Emerging Markets

It is not likely that significant evidence in support of the Fisher hypothesis is found for the emerging markets, except for Thailand, as was already concluded from the descriptive statistics. Inflation rates and interest rates tend to move up and down for these countries, contrasting a steady increasing and decreasing pattern found for the term structure and inflation changes, respectively, for countries where the hypothesis does hold. Additionally, former research obtained very little evidence for a relationship to hold for developing countries (Payne and Ewing, 1997; Berument et al. 2007). But, Phylaktis and Blake (1993) did obtain evidence supporting the Fisher hypothesis.

Results for Czech Republic, Hungary, and Poland confirm the above; there is no indication of a Fisher effect being in place. Either the estimates of the coefficients are simply too remote from 1, or both null hypotheses cannot be rejected caused by the high volatility of the series, or the null hypothesis of β=0 cannot be rejected and the null hypothesis of β=1 is significantly rejected at the 5% significance level. The three-year maturity of Poland is the only exception in this case. Both null hypotheses are rejected, meaning that the term structure contains some predictive power on forecasting future inflation rates. When evaluating the estimated coefficient, it can be seen that the slope coefficients' value lies between zero and one. However, its impact on future inflation rates is expected to be extremely modest.

Thailand does not display any sign of the Fisher hypothesis to hold in the full sample. More precisely, mixed results are found for almost all maturities. Payne and Ewing (1997) discovered similar results. For example, for *m*=2, both null hypotheses are not rejected, meaning that it is not clear to tell what the effect is, caused by a high standard error. Contrarily, in the case of *m*=3, both null hypotheses are rejected and, after a closer examination of the coefficient, there might even exist a negative relationship between the independent variable, the term structure, and the dependent variable, the inflation change. The slope of the four- and five-year maturities are both expected to have a negligible influence on the inflation changes, as the null hypothesis of β=0 cannot be rejected while the null hypothesis of β=1 is rejected at the 5% significance level. This could already be seen from figure 2, where both series move in the opposite direction for almost the whole time period. Finally, for the March 2005 sample period, the test statistics do point out a very strong relationship for *m*=4, rejecting and not rejecting the null hypothesis of β=0 and β=1, respectively. Results for the Emerging Markets are displayed in Tables 9-10.

Table 9. Eastern Europe

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	R^2	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Czech Republic						
2005:3-2007:5	2-1year	-2.097 (0.876)	9.155 (2.134)	0.342	4.29 [0.0002]*	3.82 [0.0008]*
2005:3 -2006:5	3-1year	1.792 (0.640)	-0.577 (1.193)	0.018	0.48 [0.6367]	1.32 [0.2089]
2005:3-2005:5	4-1year	0.533 (0.278)	0.159 (0.359)	0.164	0.44 [0.7374]	2.34 [0.2567]
Hungary						
2005:3-2007:5	2-1year	0.290 (0.561)	1.622 (2.032)	0.035	0.80 [0.4322]	0.31 [0.7619]
2005:3 -2006:5	3-1year	0.454 (0.376)	-11.751 (2.083)	0.778	5.64 [0.0001]*	6.12 [0.0000]*
2005:3-2005:5	4-1year	2.927 (0.033)	0.441 (0.091)	0.959	4.85 [0.1294]	6.15 [0.1026]
Poland						
2005:3-2007:5	2-1year	0.633 (0.231)	-0.092 (0.198)	0.018	0.46 [0.6476]	5.50 [0.0000]*
2005:3 -2006:5	3-1year	1.570 (0.069)	0.185 (0.069)	0.374	2.68 [0.0201]*	11.81 [0.0000]*
2005:3-2005:5	4-1year	-12.669 (NA)	-23.894 (NA)	1.000	NA [NA]	NA [NA]

For notes, please refer to Table 2.

Table 10. Thailand

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n}\left(i_t^m - i_t^n\right) + \eta_t^{m,n}$$

ESTIMATION PERIOD	*SERIES*	*α* (s.e.)	*β* (s.e.)	*R^2*	*T-TEST OF β=0* [p-value]	*T-TEST OF β=1* [p-value]
Full Sample						
2001:7-2007:5	2-1year	0.293 (0.540)	-0.387 (1.191)	0.003	0.32 [0.7464]	1.16 [0.2483]
2001:7-2006:5	3-1year	1.210 (0.382)	-1.385 (0.722)	0.164	1.92 [0.0600]**	3.30 [0.0016]*
2001:7-2005:5	4-1year	1.095 (0.490)	-0.530 (0.657)	0.026	0.81 [0.4234]	2.33 [0.0243]*
2001:7-2004:5	5-1year	1.389 (0.361)	-0.080 (0.409)	0.003	0.20 [0.8457]	2.64 [0.0125]*
From March 2005						
2005:3-2007:5	2-1year	-0.225 (1.062)	0.102 (1.658)	0.000	0.06 [0.9512]	0.54 [0.5929]
2005:3-2006:5	3-1year	-0.708 (0.606)	0.544 (0.627)	0.063	0.87 [0.4014]	0.73 [0.4795]
2005:3-2005:5	4-1year	-3.303 (0.079)	0.952 (0.083)	0.993	11.53 [0.0551]**	0.59 [0.6628]

For notes, please refer to Table 2.

Section *III.III* discussed the regression results of the influence of the term structure of the interest rates on future inflation on an individual basis. For each country, both null hypotheses of β=0 and β=1 were tested respectively. Consequently, one naturally might hypothesize whether the same results are found across the different countries. For example, Jorion and Mishkin (1991) tested this hypothesis by comparing the slope coefficients of the term structure. No significant evidence was obtained to reject the null hypothesis of an equal slope. Of course, this test can be applied in this study as well. However, there is one major drawback to this method; comparing the beta coefficients on itself is of little use, if any. This can be seen in light of the following: when testing the informational content of the term structure, the null hypotheses of β=0 and β=1 are tested respectively. The test statistic is calculated as

(E.8) $$t = \frac{\hat{\beta} - \beta^*}{SE(\hat{\beta})}$$

where $\hat{\beta}$ corresponds to the estimated beta coefficient by the regression function, and β^* denotes the beta coefficients' value under the null hypothesis. Now, as can be derived from (E.8), in order to estimate the predictive power of the term structure, the standard error is taken into account. Applying this procedure is necessary, as, in the event of a high standard error, one cannot be certain about the correct influence of the slope. Consequently, comparing the beta coefficients across countries does not result in meaningful answers. Therefore, another technique is required to appropriately compare the results for the different countries. One option is to determine how well the estimated regression function matches the observed data. By consulting the goodness of fit statistics, this can be discovered. In particular, the R^2 provides this information and, accordingly, this statistic will be compared across the different countries. In general, R^2 accommodates information on how much of the variance about the mean of y is explained by the model. Therefore, if the statistic increases, factors outside the model have less of an impact on the dependent variable, resulting in more accurate estimations obtained from the regression.

It has already been concluded that, in general, R^2 rises with maturity. For the full sample and the sample starting in January 1988, Thailand and the United Kingdom are the only exceptions, respectively. When comparing the full sample, it can be concluded that the estimated model for the United States is the best in fitting the data, with an R^2 varying from 0.127 to 0.383. The estimated model for Thailand fits the data in the worst way, as its R^2 lies between 0.003 and 0.164. Results for Canada and Germany are found to be quite similar. The second sample reveals slightly different results. The models for Germany and Canada are no longer alike; the former model deteriorated, while the latter model improved. Furthermore, the best predicted outcomes are derived from the Swiss' model, contrasting heavily with the United States' model: an R^2 between 0.110 to 0.575 and 0.005 to 0.071, respectively. The results for Belgium are little better compared to the United States; 0.021-0.200. Finally, the third sample provides mixed results. Some countries still behave according to the earlier found pattern of a rising goodness of fit when maturity increases. However, some countries' R^2 moves up and down over time. It can be concluded that the estimated models perform quite well in fitting the actual data, which can be seen from, for example, the models of the United Kingdom, Hungary, and Thailand, where the explained variance is almost equal to 1 for the longer maturity. However, it should be noted that the final sample only includes very few observations compared to the former two samples. Resultantly, the improved results might be just caused by the lack of data. For example, an estimated regression can quite accurately match the true data when there are only 3-27 observations.

Another option is to test whether the average beta coefficient of each group differs across the different groups, per maturity. First, the average value of the beta coefficient is calculated for the full time period and an across-group comparison is made. Second, same method is applied as before, but this time with the March 2005 sample period. Although this is not a true statistical test, it can be seen whether the same predictive power of the term structure of the interest rates is found for the different groups of countries. When comparing first the full samples' average coefficients and afterwards the March 2005 samples' average coefficients, one can determine whether a possible difference stems from a lack of data or the effects are genuinely different. Consulting Table 11, it can be concluded that, for the full sample, the average beta coefficient differs highly across the different groups. Only the G8 countries and highly developed countries seem to have more or less the same slope of the term spread. The March 2005 sample shows a little more coherence between the averages of the G8 countries and Emerging Markets. Initially, for the full sample, the difference for the two-year maturity for the two groups was about 443%. Now, the difference decreased to 41%, still very high. Furthermore, initially the difference was 581% for *m*=3, which decreased to only 2% in the second sample. Additionally, the difference between the G8 countries and the Tiger Economy decreased, which is contrary to the increased difference between the former group and highly developed countries. So, it is quite likely that the lack of data in the March 2005 sample is an important factor explaining the different results for the beta coefficients. However, it can also be hypothesized that the Fisher effect is in fact genuinely different between the groups of countries. Future research based on longer time horizons should point this out.

Table 11. Group-average beta coefficients

Displayed in the table are group averages of the beta coefficient, calculated for two sample periods, per group, with differing maturity.

		Full Sample		
Maturity	*G8 countries*	*Highly developed countries*	*Tiger Economy*	*Emerging Markets*
M=2	0.474	0.373	-	2.575
M=3	0.702	0.384	-0.613	-3.382
M=4	0.663	0.480	-	0.023
M=5	0.853	0.583	-0.452	-0.080
		March 2005 Sample		
M=2	1.908	5.707	-	2.697
M=3	-2.986	0.203	1.089	-2.900
M=4	8.492	-1.076	-	0.517

IV. CONCLUSIONS

This thesis extended the research from existing literature in examining the predictive power of the term structure of the interest rates on future inflation for four different groups of countries and three different time periods. It can be concluded that, for the full sample, data of the United States and the United Kingdom provide significant evidence for a full Fisher effect. For Canada, a one-on-one relation is found, except for *m*=2 and *m*=3. The hypothesis is rejected for South-Korea, Thailand, and Germany, however, the results for Germany are indicative of some informational content in the term structure. The second sample period's results cannot reject a strong relationship for the United Kingdom and Canada, except for both *2*-year maturities. A weak relationship was detected for Belgium, Germany, and Switzerland. Finally, in the March 2005 sample, the Fisher hypothesis is soundly rejected for all countries. Only exceptions are Poland, South-Korea, and Thailand. Poland provides some evidence of a weak relation, *m*=3 discloses a strong relationship for South-Korea, as well as the *4*-year maturity of Thailand. However, one should be very careful in deriving conclusions from the third period as the number of observations is very small. The comparisons based on the R^2

across countries show that the predictive power of the models changes for the different time periods. This is most evident for the United States, where the best model changes into the worst from the first time period to the second.

Future research might focus on the influence of the monetary policy on nominal interest rates, as this might have a very important impact on the term structure, and, resultantly, influencing its predictive information on future inflation. Hitherto, this information is often ignored when examining the Fisher hypothesis. Additionally, co-integration techniques should be used, as unit roots are detected in both inflation and interest rates' levels (amongst others; MacDonald and Murphy, 1989; Payne and Ewing, 1997; Crowder, 1997) which will invalidate the results obtained from Ordinary Least Squares regressions. Finally, as mentioned before, it is advisable to make use of Monte Carlo simulation p-values. This is especially useful to deal with a small-sample bias.

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VI. APPENDIX

APPENDIX A: LITERATURE STUDY

Table A.
Summary of the main findings of the literature study adopted in part *II*.

Author (+year)	Research Topic	Country	Methodology	Results/ conclusions	Comments
Mishkin & Jorion (1991)	Predictive power of the nominal interest rates on future inflation	USA, UK, Germany, Switzerland	Ordinary Least Squares regression	Fisher hypothesis is not rejected and holds especially for the longer maturities	Monte Carlo simulation p-values are used to deal with small-sample bias
Crowder (1997)	Theory underlying the Fisher hypothesis is tested on nominal Canadian interest rate and inflation	Canada	Co-integration techniques, such as univariate, multivariate, multivariate dynamic, and innovations analysis	Significant evidence is found in favour of the Fisher hypothesis to hold in Canada, unit routs in, and co-integration between the series was found	Same results are found by Mishkin(1992), Crowder and Hoffman(1996), and Fama(1975)
MacDonald and Murphy (1989)	Investigating whether there is a long-run relationship between interest rates and inflation, by the use of co-integration	Belgium, Canada, UK, USA	Co-integration technique	No significant evidence was found in favour of a strong relationship between interest rates and inflation	The authors suggest including other variables in the model, influencing real interest rates. This, to improve the co-integration model
Berument and Jelassi (2002)	Relationship between interest rates and inflation is tested on 26 countries	Amongst others: Belgium, Canada, Germany, Switzerland, UK, USA	Ordinary Least Squares Regression	More than half of the countries in their study showed evidence is favour of a strong Fisher effect	Attention is also paid to short-run dynamics of the interest rates. Ignoring this would yield auto-correlation in the residuals
Berument et al. (2007)	Both G7 and developing countries are tested on the validity of the Fisher effect, using interest rates, expected inflation, and risk	Amongst others: Canada, Germany, Hungary, Switzerland, UK, US, a Tiger economy, eastern European countries	Generalized autoregressive conditional heteroskedasticity models (GARCH)	The hypothesis has substantial less support in developing countries compared to G7 countries	-
Payne and Ewing	Fisher hypothesis is	Amongst others:	Johansen-Juselius co-integration	Full Fisher effect is found	Authors concluded that monetary

(1997)	examined for developing countries	Thailand	technique	for half of the countries	policy was of no influence on real interest rates for Malaysia, Pakistan, and Sri Lanka

APPENDIX B: DATA

Ratio splice function for Germany:

For Germany, CPI data is composed out of two different series, namely, one old series for the period up to 1991, and another, new series, starting at 1991. After 1991, data for CPI is taken from the observations of the new series. Before 1991, the data needs to be modified in order to have one base level throughout the composed series. Equation E.9 describes how the composed series is derived.

(E.9) $$CPI = CPI_t * \frac{CPI_{new}}{CPI_{old}}$$

CPI corresponds to the new series and CPI_t denotes an observation of the old series, which is multiplied by the value of the CPI level of the new series in 1991 divided by the value of the CPI level of the old series in 1991.

Table B. Interest Rate Sources

COUNTRY	*MATURITY*	*SAMPLE*	*SOURCE*
Belgium	1-5 year	1986:12-2009:5*	National Bank of Belgium
Canada	1-5 year	1986:2-2009:2	Bank of Canada
Czech Republic	1-4 year	2005:3-2009:7	Datastream; Intercapital
Germany	1-5 year	1972:9-2009:5	German Bundesbank
Hungary	1-4 year	2005:3-2009:7	Datastream; Intercapital
Poland	1-4 year	2005:3-2009:7	Datastream; Intercapital
South-Korea	1 year	2000:3-2009:7	Datastream; Korean Securities
	3 and 5 year	1995:6-2009:7*	Dealers Association (KSDA)
Switzerland	1 year	1988:1-2007:10	Swiss National Bank
	2-5 year	1988:1-2009:5*	
Thailand	1-5 year	2001:7-2009:5	The Thai Bond Market Association
United Kingdom	1-5 year	1985:1-2008:1	Bank of England/Econstats
United States of America	1, 3, and 5 year	1962:1-2009:6*	Federal Reserve
	2 year	1976:6-2009:6	

For Germany, estimates of the interest rates are derived from the yield-to-maturity of zero-coupon bonds. In the case of South-Korea, redemption yields are used. This yield is exactly the same as the yield-to-maturity. The YTM can be confidently used in case of zero-coupon bonds, as there is no interest to be reinvested. At the end of the period, the face-value will be paid out, leaving a return of the face-value minus the purchase price, equal to the YTM.
For Canada and Thailand, interest rates are derived from yield curves for zero-coupon bonds. Rates are obtained via bootstrapping. In short, first, all coupons of a bond are decomposed into zero-coupon bonds. Second, via interpolation, equations are generated to estimate the yields at different points in time. Finally, the yields are connected using a cubic spline. For a more elaborate explanation, see for example the website of ThaiBMA, or the research by R. Deaves and M. Parlar (2000).
Interest rates for Czech Republic, Hungary, and Poland, are derived from zero yield curves.
Interest rates for United Kingdom are estimates of the yield of zero-coupon British government securities, calculated by the Bank of England. Belgian interest rates are yields of Belgian government bonds.

Spot interest rates on Swiss Confederation bonds are used in the case of Switzerland and, finally, for the United States of America, the market yield on treasury securities is used to resemble the interest rates of zero-coupon bonds.
* Indicates that not the full sample size is being used. In the case of South-Korea, the data of the *1*-year interest rate is available from March 2000. Therefore, since the *1*-year rate is subtracted from the longer maturity, data for the *3*- and *5*-year interest rates are only taken into account from March 2000 and onwards as well. The same logic applies for Switzerland. Data for the *1*-year interest rate ends in October 2007, which will be the end for other maturities as well. Finally, in the case of the USA, as for the other countries, also the shortest time span of the different samples will be applied to all samples. However, it is not necessary for the USA to change the starting period of the sample since it concerns the *2*-year interest rate, but, it is very helpful in making meaningful comparisons of the results, which is quite hard with different time spans. For the ease in comparing results, the sample of Belgium starts at January 1988, instead of December 1986.

Table C. Interest Rate Data's Source Codes

The data for some countries have some specific source codes, for example from Datastream or from the German Bundesbank.

COUNTRY	*MATURITY*	*SOURCE CODE*	*COUNTRY*	*MATURITY*	*SOURCE CODE*
Czech	1 year	CZ01Y00		4 year	HN04Y00
Republic	2 year	CZ02Y00	Poland	1 year	PO01Y00
	3 year	CZ03Y00		2 year	PO02Y00
	4 year	CZ04Y00		3 year	PO03Y00
Germany	1 year	WZ9808		4 year	PO04Y00
	2 year	WZ9810	South-Korea	1 year	KOBDY1Y
	3 year	WZ9812		3 year	KOBDY3Y
	4 year	WZ9814		5 year	KOBDY5Y
	5 year	WZ9816	United States	1 year	RIFLGFCY01_N.B
Hungary	1 year	HN01Y00	of America	2 year	RIFLGFCY02_N.B
	2 year	HN02Y00		3 year	RIFLGFCY03_N.B
	3 year	HN03Y00		5 year	RIFLGFCY05_N.B

Table D. Data CPI

CPI data is obtained from the IMF-IFS database. Sample periods and base periods are listed for each country.

COUNTRY	*BASE PERIOD*	*SAMPLE*
Belgium	2005	1957:1-2009:4
Canada	2005	1957:1-2009:4
Czech Republic	2005	1993:1-2009:4
Germany	1990/2005	1957:1-2009:4
Hungary	2005	1976:1-2009:4
Poland	2005	1988:1-2009:3
South-Korea	2005	1970:1-2009:4
Switzerland	2005	1957:1-2009:4
Thailand	2005	1965:1-2009:4
United Kingdom	2005	1957:1-2009:4
United States of America	2005	1957:1-2009:4

APPENDIX C: SUMMARY STATISTICS

Table E. Summary Statistics for the term structure; G8 Countries

Table output is based on continuously compounded, monthly data. The mean, standard deviation, and autocorrelation for each country and time series are displayed respectively. Autocorrelation is calculated using the Breusch-Godfrey Serial Correlation LM test, with the number of lags between parentheses. With respect to autocorrelation; all results are highly significant at the 1% significance level, except the results indicated differently.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation*		
					(1)	(12)	(60)
		UNITED STATES					
Full sample	1976:6-2008:5	1 year	6.523	0.168	12165	1143.8	242.73
	1976:6-2007:5	2-1 year	0.307	0.019	2261.4	194.07	40.659
	1976:6-2006:5	3-1 year	0.484	0.030	2573.7	227.98	47.986
	1976:6-2004:5	5-1 year	0.741	0.046	3248.7	290.36	62.923

From January 1988	1988:1-2008:5	1 year	4.835	0.127	9328.7	842.64	156.35
	1988:1-2007:5	2-1 year	0.331	0.019	1435.5	117.12	25.745
	1988:1-2006:5	3-1 year	0.563	0.029	1940.2	162.99	33.985
	1988:1-2004:5	5-1 year	0.911	0.052	3406.9	294.23	65.310
From March 2005	2005:3-2008:5	1 year	4.137	0.163	358.63	31.427	-
	2005:3-2007:5	2-1 year	-0.02	0.041	80.339	4.484	-
	2005:3-2006:5	3-1 year	0.165	0.053	23.966	0.976[a]	-
UNITED KINGDOM							
Full sample	1985:2-2008:5	1 year	7.069	0.165	8496.2	720.96	144.31
	1985:2-2007:5	2-1 year	0.025	0.023	3412.0	286.92	54.504
	1985:2-2006:5	3-1 year	0.071	0.039	3900.2	332.60	62.613
	1985:2-2005:5	4-1 year	0.114	0.050	3926.4	337.29	64.735
	1985:2-2004:5	5-1 year	0.147	0.059	3712.8	318.86	61.522
From January 1988	1988:1-2008:5	1 year	6.632	0.169	11709	1029.9	197.63
	1988:1-2007:5	2-1 year	0.045	0.026	3643.8	307.20	57.793
	1988:1-2006:5	3-1 year	0.107	0.044	3924.5	336.81	64.197
	1988:1-2005:5	4-1 year	0.162	0.057	3803.5	329.39	64.909
	1988:1-2004:5	5-1 year	0.201	0.068	3520.5	304.76	60.888
From March 2005	2005:3-2008:5	1 year	4.816	0.081	296.84	37.808	-
	2005:3-2007:5	2-1 year	-0.07	0.012	30.917	2.77**	-
	2005:3-2006:5	3-1 year	-0.08	0.019	5.01**	2.30[a]	-
	2005:3-2005:5	4-1 year	-0.09	0.021	0.077[a]	-	-
GERMANY							
Full sample	1972:10-2008:5	1 year	5.564	0.117	15555	1344.0	258.25
	1972:10-2007:5	2-1 year	0.238	0.018	619.20	84.713	17.697
	1972:10-2006:5	3-1 year	0.473	0.029	1475.7	162.79	33.148
	1972:10-2005:5	4-1 year	0.666	0.038	2313.1	230.51	46.754
	1972:10-2004:5	5-1 year	0.811	0.045	3023.2	284.75	57.475
From January 1988	1988:1-2008:5	1 year	4.687	0.135	18526	1701.7	320.54
	1988:1-2007:5	2-1 year	0.171	0.015	1931.2	162.46	29.803
	1988:1-2006:5	3-1 year	0.368	0.028	2694.9	223.19	43.633
	1988:1-2005:5	4-1 year	0.549	0.041	3336.5	227.84	56.875
	1988:1-2004:5	5-1 year	0.686	0.053	3638.9	304.82	61.804
From March 2005	2005:3-2008:5	1 year	3.369	0.123	353.10	25.210	-
	2005:3-2007:5	2-1 year	0.123	0.018	43.166	3.19**	-
	2005:3-2006:5	3-1 year	0.325	0.023	4.69**	0.761[a]	-
	2005:3-2005:5	4-1 year	0.644	0.050	0.021[a]	-	-
CANADA							
Full sample	1986:1-2008:5	1 year	5.956	0.166	8604.7	729.64	149.38
	1986:1-2007:5	2-1 year	0.204	0.022	2487.9	226.13	45.376

	1986:1-2006:5	3-1 year	0.382	0.036	2669.8	239.16	46.444
	1986:1-2005:5	4-1 year	0.530	0.047	2747.7	244.71	45.863
	1986:1-2004:5	5-1 year	0.619	0.057	2690.3	239.91	44.139
From January 1988	1988:1-2008:5	1 year	5.675	0.171	7748.9	670.09	130.21
	1988:1-2007:5	2-1 year	0.211	0.024	2488.0	225.33	46.035
	1988:1-2006:5	3-1 year	0.403	0.040	2592.0	231.99	46.328
	1988:1-2005:5	4-1 year	0.566	0.052	2600.9	233.54	44.651
	1988:1-2004:5	5-1 year	0.664	0.062	2536.4	229.19	42.451
From March 2005	2005:3-2008:5	1 year	3.663	0.102	186.22	16.182	-
	2005:3-2007:5	2-1 year	0.047	0.028	95.968	5.010	-
	2005:3-2006:5	3-1 year	0.261	0.046	26.932	3.791[a]	-
	2005:3-2005:5	4-1 year	0.747	0.028	0.005[a]	-	-

* = F-statistics are displayed in the table. All results are highly significant at the 1% significance level, unless indicated differently. F-statistics are calculated by the use of the Breusch-Godfrey Serial Correlation LM test.
** = significant at 5% significance level.
[a] = not significant at 5 % significance level. No adjustment regarding autocorrelation is needed.

Table F. Summary Statistics for Inflation Rates and Changes; G8 Countries

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation*		
					(1)	(12)	(60)
		UNITED STATES					
Full sample	1976:6-2008:5	1 year	4.094	0.138	17913	1882.6	473.46
	1976:6-2007:5	2-1 year	-0.07	0.046	2961.2	341.07	224.72
	1976:6-2006:5	3-1 year	-0.14	0.069	6100.9	672.16	225.72
	1976:6-2004:5	5-1 year	-0.39	0.097	9189.2	883.30	192.11
From January 1988	1988:1-2008:5	1 year	2.949	0.074	1957.6	217.76	77.063
	1988:1-2007:5	2-1 year	-0.06	0.043	847.65	123.06	71.734
	1988:1-2006:5	3-1 year	-0.10	0.045	972.84	125.04	41.923
	1988:1-2004:5	5-1 year	-0.18	0.056	1888.0	201.35	65.001
From March 2005	2005:3-2008:5	1 year	2.878	0.251	153.97	25.571	-
	2005:3-2007:5	2-1 year	-0.15	0.240	112.97	16.580	-
	2005:3-2006:5	3-1 year	-0.01	0.157	7.18**	3.882[a]	-
		UNITED KINGDOM					
Full sample	1985:2-2008:5	1 year	3.511	0.116	7000.5	698.99	150.46
	1985:2-2007:5	2-1 year	-0.02	0.055	2325.4	260.23	83.256
	1985:2-2006:5	3-1 year	-0.01	0.078	4341.6	441.22	102.94
	1985:2-2005:5	4-1 year	-0.01	0.097	5940.7	619.74	151.75
	1985:2-2004:5	5-1 year	-0.11	0.112	6238.4	685.25	176.24
From January 1988	1988:1-2008:5	1 year	3.441	0.130	5688.0	572.50	112.52
	1988:1-2007:5	2-1 year	-0.13	0.057	1889.1	216.00	66.475
	1988:1-2006:5	3-1 year	-0.24	0.076	3007.9	298.70	60.417

	1988:1-2005:5	4-1 year	-0.35	0.092	4086.1	407.13	86.262
	1988:1-2004:5	5-1 year	-0.49	0.108	4577.0	485.36	108.58
From March 2005	2005:3-2008:5	1 year	3.362	0.241	295.77	24.491	-
	2005:3-2007:5	2-1 year	-0.18	0.193	129.03	7.293	-
	2005:3-2006:5	3-1 year	-0.06	0.319	71.852	7.724[a]	-
	2005:3-2005:5	4-1 year	0.175	0.116	0.049[a]	-	-
			GERMANY				
Full sample	1972:10-2008:5	1 year	2.765	0.088	11615	989.54	210.76
	1972:10-2007:5	2-1 year	-0.07	0.030	2090.7	187.01	79.476
	1972:10-2006:5	3-1 year	-0.13	0.046	4549.6	392.33	121.16
	1972:10-2005:5	4-1 year	-0.20	0.059	6671.3	574.75	166.47
	1972:10-2004:5	5-1 year	-0.26	0.069	8666.6	754.51	190.53
From January 1988	1988:1-2008:5	1 year	2.145	0.078	3495.4	290.88	67.573
	1988:1-2007:5	2-1 year	-0.02	0.035	795.65	73.252	27.882
	1988:1-2006:5	3-1 year	-0.02	0.050	1373.4	117.50	31.986
	1988:1-2005:5	4-1 year	-0.07	0.060	1650.3	136.15	29.654
	1988:1-2004:5	5-1 year	-0.16	0.068	1788.6	145.78	29.438
From March 2005	2005:3-2008:5	1 year	2.010	0.124	145.28	21.209	-
	2005:3-2007:5	2-1 year	0.086	0.124	111.42	11.844	-
	2005:3-2006:5	3-1 year	0.426	0.105	9.540	1.804[a]	-
	2005:3-2005:5	4-1 year	0.076	0.180	2.909[a]	-	-
			CANADA				
Full sample	1986:1-2008:5	1 year	2.507	0.087	2679.9	231.00	62.982
	1986:1-2007:5	2-1 year	-0.05	0.047	892.49	95.908	49.818
	1986:1-2006:5	3-1 year	-0.10	0.056	1167.9	104.16	37.324
	1986:1-2005:5	4-1 year	-0.18	0.069	1601.8	146.26	42.850
	1986:1-2004:5	5-1 year	-0.24	0.076	1851.1	162.37	46.629
From January 1988	1988:1-2008:5	1 year	2.349	0.089	2135.7	186.51	50.218
	1988:1-2007:5	2-1 year	-0.07	0.051	782.86	84.154	37.695
	1988:1-2006:5	3-1 year	-0.14	0.061	1006.6	89.746	28.956
	1988:1-2005:5	4-1 year	-0.25	0.074	1368.1	123.55	32.381
	1988:1-2004:5	5-1 year	-0.31	0.085	1661.1	145.16	38.296
From March 2005	2005:3-2008:5	1 year	2.059	0.107	45.347	5.755	-
	2005:3-2007:5	2-1 year	0.082	0.082	18.199	2.90**	-
	2005:3-2006:5	3-1 year	0.148	0.151	7.50**	12.98[a]	-
	2005:3-2005:5	4-1 year	-0.35	0.043	0.000[a]	-	-

Table G. Summary Statistics for the term structure; Highly Developed Countries

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation* (1)	(12)	(60)
					BELGIUM		
Full sample	1988:1-2008:5	1 year	5.165	0.164	18604	1651.2	302.00
	1988:1-2007:5	2-1 year	0.171	0.021	953.7	87.855	16.603
	1988:1-2006:5	3-1 year	0.355	0.033	1301.1	120.58	23.282
	1988:1-2005:5	4-1 year	0.513	0.045	2006.8	188.31	36.846
	1988:1-2004:5	5-1 year	0.614	0.054	2350.4	206.96	37.144
From March 2005	2005:3-2008:5	1 year	3.388	0.124	391.53	27.152	-
	2005:3-2007:5	2-1 year	0.118	0.017	31.379	2.154[a]	-
	2005:3-2006:5	3-1 year	0.299	0.023	3.842[a]	0.291[a]	-
	2005:3-2005:5	4-1 year	0.598	0.049	0.003[a]	-	-
					SWITZERLAND		
Full sample	1988:1-2008:5	1 year	3.349	0.157	16574	1518.1	273.08
	1988:1-2007:5	2-1 year	0.008	0.029	3444.0	290.03	55.999
	1988:1-2006:5	3-1 year	0.071	0.048	4160.1	350.90	66.21
	1988:1-2005:5	4-1 year	0.151	0.062	4535.1	387.42	71.809
	1988:1-2004:5	5-1 year	0.212	0.073	4642.1	402.17	73.467
From March 2005	2005:3-2008:5	1 year	1.790	0.127	364.31	23.179	-
	2005:3-2007:5	2-1 year	0.186	0.017	68.826	6.304	-
	2005:3-2006:5	3-1 year	0.408	0.016	0.476[a]	1.534[a]	-
	2005:3-2005:5	4-1 year	0.601	0.034	0.157[a]	-	-

Table H. Summary Statistics for Inflation Rates and Changes; Highly Developed Countries

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation* (1)	(12)	(60)
					BELGIUM		
Full sample	1988:1-2008:5	1 year	2.244	0.060	1571.6	147.14	41.642
	1988:1-2007:5	2-1 year	0.017	0.037	721.30	86.874	28.611
	1988:1-2006:5	3-1 year	-0.01	0.041	822.72	89.054	22.727
	1988:1-2005:5	4-1 year	-0.08	0.039	714.94	70.256	16.166
	1988:1-2004:5	5-1 year	-0.08	0.043	671.52	66.181	16.603
From March 2005	2005:3-2008:5	1 year	2.525	0.234	273.81	54.053	-
	2005:3-2007:5	2-1 year	0.414	0.212	135.84	25.131	-
	2005:3-2006:5	3-1 year	0.858	0.098	5.13**	0.370[a]	-
	2005:3-2005:5	4-1 year	0.204	0.111	0.675[a]	-	-
					SWITZERLAND		

Full sample	1988:1-2008:5	1 year	1.770	0.105	6367.1	548.63	133.28
	1988:1-2007:5	2-1 year	-0.03	0.042	1082.6	97.633	29.804
	1988:1-2006:5	3-1 year	-0.12	0.055	1428.5	123.08	26.059
	1988:1-2005:5	4-1 year	-0.26	0.067	1745.8	144.73	27.289
	1988:1-2004:5	5-1 year	-0.39	0.078	2001.2	165.65	30.790
From March 2005	2005:3-2008:5	1 year	1.243	0.162	219.98	36.349	-
	2005:3-2007:5	2-1 year	0.136	0.173	134.82	12.491	-
	2005:3-2006:5	3-1 year	0.445	0.088	5.49**	24.1**	-
	2005:3-2005:5	4-1 year	-0.26	0.067	0.051[a]	-	-

Table I. Summary Statistics for the term structure; Tiger Economy

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation*		
					(1)	(12)	(60)
		SOUTH-KOREA					
Full sample	2000:3-2008:5	1 year	5.018	0.113	636.41	50.843	5.550
	2000:3-2006:5	3-1 year	0.294	0.030	60.573	6.041	1.099[a]
	2000:3-2004:5	5-1 year	0.690	0.059	46.944	4.690	-
From March 2005	2005:3-2008:5	1 year	4.706	0.086	178.33	12.066	-
	2005:3-2006:5	3-1 year	0.281	0.036	1.673[a]	0.951[a]	-

Table J. Summary Statistics for Inflation Rates and Changes; Tiger Economy

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation*		
					(1)	(12)	(60)
		SOUTH-KOREA					
Full sample	2000:3-2008:5	1 year	3.235	0.093	450.97	41.059	7.135
	2000:3-2006:5	3-1 year	-0.00	0.088	309.48	27.696	4.459
	2000:3-2004:5	5-1 year	-0.36	0.084	81.768	9.531	-
From March 2005	2005:3-2008:5	1 year	3.177	0.185	304.28	32.626	-
	2005:3-2006:5	3-1 year	0.990	0.061	2.74[a]	0.754[a]	-

Table K. Summary Statistics for the term structure; Emerging Markets

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation*		
					(1)	(12)	(60)
		CZECH REPUBLIC					
Full sample	2005:3-2008:5	1 year	2.964	0.132	423.69	32.584	-
	2005:3-2007:5	2-1 year	0.281	0.021	18.659	2.097[a]	-
	2005:3-2006:5	3-1 year	0.523	0.032	3.601[a]	1.870[a]	-
	2005:3-2005:5	4-1 year	0.773	0.042	0.000[a]	-	-

			HUNGARY				
Full sample	2005:3-2008:5	1 year	7.555	0.136	88.694	7.341	-
	2005:3-2007:5	2-1 year	-0.11	0.039	30.036	3.53**	-
	2005:3-2006:5	3-1 year	-0.03	0.047	6.99**	0.617[a]	-
	2005:3-2005:5	4-1 year	-0.34	0.085	0.025[a]	-	-
			POLAND				
Full sample	2005:3-2008:5	1 year	5.383	0.113	33.777	3.483	-
	2005:3-2007:5	2-1 year	-0.42	0.155	16.740	2.192[a]	-
	2005:3-2006:5	3-1 year	-0.79	0.176	1.025[a]	6.512[a]	-
	2005:3-2005:5	4-1 year	-0.37	0.242	0.381[a]	-	-
			THAILAND				
Full sample	2001:7-2008:5	1 year	2.882	0.134	2503.7	235.08	23.803
	2001:7-2007:5	2-1 year	0.281	0.026	193.88	17.502	2.277[a]
	2001:7-2006:5	3-1 year	0.610	0.044	117.35	10.762	-
	2001:7-2005:5	4-1 year	0.933	0.066	99.188	9.673	-
	2001:7-2004:5	5-1 year	1.205	0.091	69.082	6.183	-
From March 2005	2005:3-2008:5	1 year	3.905	0.139	212.32	16.832	-
	2005:3-2007:5	2-1 year	0.308	0.054	112.14	8.753	-
	2005:3-2006:5	3-1 year	0.734	0.089	18.712	3.332	-
	2005:3-2005:5	4-1 year	0.927	0.176	0.001[a]	-	-

Table L. Summary Statistics for Inflation Rates and Changes; Emerging Markets

For notes, please refer to Table E.

Sample	Period	Series	Mean	St.Dev.	Autocorrelation*		
					(1)	(12)	(60)
			CZECH REPUBLIC				
Full sample	2005:3-2008:5	1 year	3.687	0.313	311.21	40.827	-
	2005:3-2007:5	2-1 year	0.479	0.328	165.70	17.962	-
	2005:3-2006:5	3-1 year	1.490	0.138	11.243	4.107[a]	-
	2005:3-2005:5	4-1 year	0.655	0.017	0.340[a]	-	-
			HUNGARY				
Full sample	2005:3-2008:5	1 year	5.579	0.329	209.22	19.364	-
	2005:3-2007:5	2-1 year	0.118	0.336	111.00	7.584	-
	2005:3-2006:5	3-1 year	0.795	0.626	62.902	5.115[a]	-
	2005:3-2005:5	4-1 year	2.776	0.038	0.004[a]	-	-
			POLAND				
Full sample	2005:3-2008:5	1 year	2.701	0.219	268.17	20.730	-
	2005:3-2007:5	2-1 year	0.674	0.110	56.947	9.954	-
	2005:3-2006:5	3-1 year	1.431	0.056	1.363[a]	1.11[a]	-
	2005:3-2005:5	4-1 year	2.015	0.148	-[b]	-	-

THAILAND							
Full sample	2001:7-2008:5	1 year	3.087	0.223	515.73	51.438	6.121
	2001:7-2007:5	2-1 year	0.185	0.168	491.66	60.624	12.573
	2001:7-2006:5	3-1 year	0.364	0.151	263.57	22.110	-
	2001:7-2005:5	4-1 year	0.600	0.220	390.12	29.636	-
	2001:7-2004:5	5-1 year	1.293	0.124	59.665	4.058	-
From March 2005	2005:3-2008:5	1 year	3.526	0.3823	204.38	25.973	-
	2005:3-2007:5	2-1 year	-0.19	0.385	198.68	31.100	-
	2005:3-2006:5	3-1 year	-0.31	0.193	8.36**	1.991[a]	-
	2005:3-2005:5	4-1 year	-2.42	0.168	0.000[a]	-	-

[b] = no result is obtained from the Breusch-Godfrey Serial Correlation LM test for *m*=4 in the case of Poland.

APPENDIX D: EVIEWS PROGRAM

```
wfcreate EViews_Program m 1957:1 2009:6

read(b3, s=sheet1) CPI_rates.xls CPIBE CPICA CPISW CPITH CPIUK CPIUS CPIGE CPICZ CPIHU CPIPO CPISK
smpl 1962:1 2009:6
read(b4, s=sheet1) Interest_rates.xls CA1 CA2 CA3 CA4 CA5 GE1 GE2 GE3 GE4 GE5 UK1 UK2 UK3 UK4 UK5 SW1 SW2 SW3 SW4
SW5 US1 US2 US3 US5 BE1 BE2 BE3 BE4 BE5 TH1 TH2 TH3 TH4 TH5 CZ1 CZ2 CZ3 CZ4 HU1 HU2 HU3 HU4 PO1 PO2 PO3 PO4
SK1 SK3 SK5

genr BE_inflchange2=100*log(CPIBE(+23)/CPIBE(-1))/2-100*log(CPIBE(+11)/CPIBE(-1))
genr BE_inflchange3=100*log(CPIBE(+35)/CPIBE(-1))/3-100*log(CPIBE(+11)/CPIBE(-1))
genr BE_inflchange4=100*log(CPIBE(+47)/CPIBE(-1))/4-100*log(CPIBE(+11)/CPIBE(-1))
genr BE_inflchange5=100*log(CPIBE(+59)/CPIBE(-1))/5-100*log(CPIBE(+11)/CPIBE(-1))

genr CA_inflchange2=100*log(CPICA(+23)/CPICA(-1))/2-100*log(CPICA(+11)/CPICA(-1))
genr CA_inflchange3=100*log(CPICA(+35)/CPICA(-1))/3-100*log(CPICA(+11)/CPICA(-1))
genr CA_inflchange4=100*log(CPICA(+47)/CPICA(-1))/4-100*log(CPICA(+11)/CPICA(-1))
genr CA_inflchange5=100*log(CPICA(+59)/CPICA(-1))/5-100*log(CPICA(+11)/CPICA(-1))

genr CZ_inflchange2=100*log(CPICZ(+23)/CPICZ(-1))/2-100*log(CPICZ(+11)/CPICZ(-1))
genr CZ_inflchange3=100*log(CPICZ(+35)/CPICZ(-1))/3-100*log(CPICZ(+11)/CPICZ(-1))
genr CZ_inflchange4=100*log(CPICZ(+47)/CPICZ(-1))/4-100*log(CPICZ(+11)/CPICZ(-1))

genr GE_inflchange2=100*log(CPIGE(+23)/CPIGE(-1))/2-100*log(CPIGE(+11)/CPIGE(-1))
genr GE_inflchange3=100*log(CPIGE(+35)/CPIGE(-1))/3-100*log(CPIGE(+11)/CPIGE(-1))
genr GE_inflchange4=100*log(CPIGE(+47)/CPIGE(-1))/4-100*log(CPIGE(+11)/CPIGE(-1))
genr GE_inflchange5=100*log(CPIGE(+59)/CPIGE(-1))/5-100*log(CPIGE(+11)/CPIGE(-1))

genr HU_inflchange2=100*log(CPIHU(+23)/CPIHU(-1))/2-100*log(CPIHU(+11)/CPIHU(-1))
genr HU_inflchange3=100*log(CPIHU(+35)/CPIHU(-1))/3-100*log(CPIHU(+11)/CPIHU(-1))
genr HU_inflchange4=100*log(CPIHU(+47)/CPIHU(-1))/4-100*log(CPIHU(+11)/CPIHU(-1))

genr PO_inflchange2=100*log(CPIPO(+23)/CPIPO(-1))/2-100*log(CPIPO(+11)/CPIPO(-1))
genr PO_inflchange3=100*log(CPIPO(+35)/CPIPO(-1))/3-100*log(CPIPO(+11)/CPIPO(-1))
genr PO_inflchange4=100*log(CPIPO(+47)/CPIPO(-1))/4-100*log(CPIPO(+11)/CPIPO(-1))

genr SK_inflchange3=100*log(CPISK(+35)/CPISK(-1))/3-100*log(CPISK(+11)/CPISK(-1))
genr SK_inflchange5=100*log(CPISK(+59)/CPISK(-1))/5-100*log(CPISK(+11)/CPISK(-1))

genr SW_inflchange2=100*log(CPISW(+23)/CPISW(-1))/2-100*log(CPISW(+11)/CPISW(-1))
genr SW_inflchange3=100*log(CPISW(+35)/CPISW(-1))/3-100*log(CPISW(+11)/CPISW(-1))
genr SW_inflchange4=100*log(CPISW(+47)/CPISW(-1))/4-100*log(CPISW(+11)/CPISW(-1))
genr SW_inflchange5=100*log(CPISW(+59)/CPISW(-1))/5-100*log(CPISW(+11)/CPISW(-1))

genr TH_inflchange2=100*log(CPITH(+23)/CPITH(-1))/2-100*log(CPITH(+11)/CPITH(-1))
genr TH_inflchange3=100*log(CPITH(+35)/CPITH(-1))/3-100*log(CPITH(+11)/CPITH(-1))
genr TH_inflchange4=100*log(CPITH(+47)/CPITH(-1))/4-100*log(CPITH(+11)/CPITH(-1))
genr TH_inflchange5=100*log(CPITH(+59)/CPITH(-1))/5-100*log(CPITH(+11)/CPITH(-1))

genr UK_inflchange2=100*log(CPIUK(+23)/CPIUK(-1))/2-100*log(CPIUK(+11)/CPIUK(-1))
genr UK_inflchange3=100*log(CPIUK(+35)/CPIUK(-1))/3-100*log(CPIUK(+11)/CPIUK(-1))
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genr UK_inflchange4=100*log(CPIUK(+47)/CPIUK(-1))/4-100*log(CPIUK(+11)/CPIUK(-1))
genr UK_inflchange5=100*log(CPIUK(+59)/CPIUK(-1))/5-100*log(CPIUK(+11)/CPIUK(-1))

genr US_inflchange2=100*log(CPIUS(+23)/CPIUS(-1))/2-100*log(CPIUS(+11)/CPIUS(-1))
genr US_inflchange3=100*log(CPIUS(+35)/CPIUS(-1))/3-100*log(CPIUS(+11)/CPIUS(-1))
genr US_inflchange4=100*log(CPIUS(+47)/CPIUS(-1))/4-100*log(CPIUS(+11)/CPIUS(-1))
genr US_inflchange5=100*log(CPIUS(+59)/CPIUS(-1))/5-100*log(CPIUS(+11)/CPIUS(-1))

genr tsbe2=100*log(1+be2(-1)/100)-100*log(1+be1(-1)/100)
genr tsbe3=100*log(1+be3(-1)/100)-100*log(1+be1(-1)/100)
genr tsbe4=100*log(1+be4(-1)/100)-100*log(1+be1(-1)/100)
genr tsbe5=100*log(1+be5(-1)/100)-100*log(1+be1(-1)/100)

genr tsca2=100*log(1+ca2/100)-100*log(1+ca1/100)
genr tsca3=100*log(1+ca3/100)-100*log(1+ca1/100)
genr tsca4=100*log(1+ca4/100)-100*log(1+ca1/100)
genr tsca5=100*log(1+ca5/100)-100*log(1+ca1/100)

genr tscz2=100*log(1+cz2/100)-100*log(1+cz1/100)
genr tscz3=100*log(1+cz3/100)-100*log(1+cz1/100)
genr tscz4=100*log(1+cz4/100)-100*log(1+cz1/100)

genr tsge2=100*log(1+GE2(-1)/100)-100*log(1+GE1(-1)/100)
genr tsge3=100*log(1+GE3(-1)/100)-100*log(1+GE1(-1)/100)
genr tsge4=100*log(1+GE4(-1)/100)-100*log(1+GE1(-1)/100)
genr tsge5=100*log(1+GE5(-1)/100)-100*log(1+GE1(-1)/100)

genr tshu2=100*log(1+hu2/100)-100*log(1+hu1/100)
genr tshu3=100*log(1+hu3/100)-100*log(1+hu1/100)
genr tshu4=100*log(1+hu4/100)-100*log(1+hu1/100)

genr tspo2=100*log(1+po2/100)-100*log(1+po1/100)
genr tspo3=100*log(1+po3/100)-100*log(1+po1/100)
genr tspo4=100*log(1+po4/100)-100*log(1+po1/100)

genr tssk3=100*log(1+sk3/100)-100*log(1+sk1/100)
genr tssk5=100*log(1+sk5/100)-100*log(1+sk1/100)

genr tssw2=100*log(1+sw2(-1)/100)-100*log(1+sw1(-1)/100)
genr tssw3=100*log(1+sw3(-1)/100)-100*log(1+sw1(-1)/100)
genr tssw4=100*log(1+sw4(-1)/100)-100*log(1+sw1(-1)/100)
genr tssw5=100*log(1+sw5(-1)/100)-100*log(1+sw1(-1)/100)

genr tsth2=100*log(1+th2/100)-100*log(1+th1/100)
genr tsth3=100*log(1+th3/100)-100*log(1+th1/100)
genr tsth4=100*log(1+th4/100)-100*log(1+th1/100)
genr tsth5=100*log(1+th5/100)-100*log(1+th1/100)

genr tsuk2=100*log(1+uk2(-1)/100)-100*log(1+uk1(-1)/100)
genr tsuk3=100*log(1+uk3(-1)/100)-100*log(1+uk1(-1)/100)
genr tsuk4=100*log(1+uk4(-1)/100)-100*log(1+uk1(-1)/100)
genr tsuk5=100*log(1+uk5(-1)/100)-100*log(1+uk1(-1)/100)

genr tsus2=100*log(1+us2/100)-100*log(1+us1/100)
genr tsus3=100*log(1+us3/100)-100*log(1+us1/100)
genr tsus5=100*log(1+us5/100)-100*log(1+us1/100)

smpl 1988:1 2007:5
equation BE88_M2.ls(n) be_inflchange2 c tsbe2
smpl 1988:1 2006:5
equation BE88_M3.ls(n) be_inflchange3 c tsbe3
smpl 1988:1 2005:5
equation BE88_M4.ls(n) be_inflchange4 c tsbe4
smpl 1988:1 2004:5
equation BE88_M5.ls(n) be_inflchange5 c tsbe5

smpl 2005:3 2007:5
equation BE05_M2.ls(n) be_inflchange2 c tsbe2
smpl 2005:3 2006:5
equation BE05_M3.ls(n) be_inflchange3 c tsbe3
smpl 2005:3 2005:5
equation BE05_M4.ls be_inflchange4 c tsbe4

smpl 1986:1 2007:5
equation CAFS_M2.ls(n) ca_inflchange2 c tsca2
smpl 1986:1 2006:5
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equation CAFS_M3.ls(n) ca_inflchange3 c tsca3
smpl 1986:1 2005:5
equation CAFS_M4.ls(n) ca_inflchange4 c tsca4
smpl 1986:1 2004:5
equation CAFS_M5.ls(n) ca_inflchange5 c tsca5

smpl 1988:1 2007:5
equation CA88_M2.ls(n) ca_inflchange2 c tsca2
smpl 1988:1 2006:5
equation CA88_M3.ls(n) ca_inflchange3 c tsca3
smpl 1988:1 2005:5
equation CA88_M4.ls(n) ca_inflchange4 c tsca4
smpl 1988:1 2004:5
equation CA88_M5.ls(n) ca_inflchange5 c tsca5

smpl 2005:3 2007:5
equation CA05_M2.ls(n) ca_inflchange2 c tsca2
smpl 2005:3 2006:5
equation CA05_M3.ls(n) ca_inflchange3 c tsca3
smpl 2005:3 2005:5
equation CA05_M4.ls ca_inflchange4 c tsca4

smpl 2005:3 2007:5
equation CZ_M2.ls(n) cz_inflchange2 c tscz2
smpl 2005:3 2006:5
equation CZ_M3.ls(n) cz_inflchange3 c tscz3
smpl 2005:3 2005:5
equation CZ_M4.ls cz_inflchange4 c tscz4

smpl 1972:9 2007:5
equation GEFS_M2.ls(n) ge_inflchange2 c tsge2
smpl 1972:9 2006:5
equation GEFS_M3.ls(n) ge_inflchange3 c tsge3
smpl 1972:9 2005:5
equation GEFS_M4.ls(n) ge_inflchange4 c tsge4
smpl 1972:9 2004:5
equation GEFS_M5.ls(n) ge_inflchange5 c tsge5

smpl 1988:1 2007:5
equation GE88_M2.ls(n) ge_inflchange2 c tsge2
smpl 1988:1 2006:5
equation GE88_M3.ls(n) ge_inflchange3 c tsge3
smpl 1988:1 2005:5
equation GE88_M4.ls(n) ge_inflchange4 c tsge4
smpl 1988:1 2004:5
equation GE88_M5.ls(n) ge_inflchange5 c tsge5

smpl 2005:3 2007:5
equation GE05_M2.ls(n) ge_inflchange2 c tsge2
smpl 2005:3 2006:5
equation GE05_M3.ls(n) ge_inflchange3 c tsge3
smpl 2005:3 2005:5
equation GE05_M4.ls ge_inflchange4 c tsge4

smpl 2005:3 2007:5
equation HU_M2.ls(n) hu_inflchange2 c tshu2
smpl 2005:3 2006:5
equation HU_M3.ls(n) hu_inflchange3 c tshu3
smpl 2005:3 2005:5
equation HU_M4.ls hu_inflchange4 c tshu4

smpl 2005:3 2007:5
equation PO_M2.ls(n) po_inflchange2 c tspo2
smpl 2005:3 2006:5
equation PO_M3.ls po_inflchange3 c tspo3
smpl 2005:3 2005:5
equation PO_M4.ls(n) po_inflchange4 c tspo4

smpl 2000:3 2006:5
equation SKFS_M3.ls(n) sk_inflchange3 c tssk3
smpl 2000:3 2004:5
equation SKFS_M5.ls(n) sk_inflchange5 c tssk5

smpl 2005:3 2006:5
equation SK05_M3.ls sk_inflchange3 c tssk3
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smpl 1987:12 2007:5
equation SWFS_M2.ls(n) sw_inflchange2 c tssw2
smpl 1987:12 2006:5
equation SWFS_M3.ls(n) sw_inflchange3 c tssw3
smpl 1987:12 2005:5
equation SWFS_M4.ls(n) sw_inflchange4 c tssw4
smpl 1987:12 2004:5
equation SWFS_M5.ls(n) sw_inflchange5 c tssw5

smpl 2005:3 2007:5
equation SW05_M2.ls(n) sw_inflchange2 c tssw2
smpl 2005:3 2006:5
equation SW05_M3.ls(n) sw_inflchange3 c tssw3
smpl 2005:3 2005:5
equation SW05_M4.ls sw_inflchange4 c tssw4

smpl 2001:7 2007:5
equation THFS_M2.ls(n) th_inflchange2 c tsth2
smpl 2001:7 2006:5
equation THFS_M3.ls(n) th_inflchange3 c tsth3
smpl 2001:7 2005:5
equation THFS_M4.ls(n) th_inflchange4 c tsth4
smpl 2001:7 2004:5
equation THFS_M5.ls(n) th_inflchange5 c tsth5

smpl 2005:3 2007:5
equation TH05_M2.ls(n) th_inflchange2 c tsth2
smpl 2005:3 2006:5
equation TH05_M3.ls(n) th_inflchange3 c tsth3
smpl 2005:3 2005:5
equation TH05_M4.ls th_inflchange4 c tsth4

smpl 1985:1 2007:5
equation UKFS_M2.ls(n) uk_inflchange2 c tsuk2
smpl 1985:1 2006:5
equation UKFS_M3.ls(n) uk_inflchange3 c tsuk3
smpl 1985:1 2005:5
equation UKFS_M4.ls(n) uk_inflchange4 c tsuk4
smpl 1985:1 2004:5
equation UKFS_M5.ls(n) uk_inflchange5 c tsuk5

smpl 1988:1 2007:5
equation UK88_M2.ls(n) uk_inflchange2 c tsuk2
smpl 1988:1 2006:5
equation UK88_M3.ls(n) uk_inflchange3 c tsuk3
smpl 1988:1 2005:5
equation UK88_M4.ls(n) uk_inflchange4 c tsuk4
smpl 1988:1 2004:5
equation UK88_M5.ls(n) uk_inflchange5 c tsuk5

smpl 2005:3 2007:5
equation UK05_M2.ls(n) uk_inflchange2 c tsuk2
smpl 2005:3 2006:5
equation UK05_M3.ls(n) uk_inflchange3 c tsuk3
smpl 2005:3 2005:5
equation UK05_M4.ls(n) uk_inflchange4 c tsuk4

smpl 1976:6 2007:5
equation USFS_M2.ls(n) us_inflchange2 c tsus2
smpl 1976:6 2006:5
equation USFS_M3.ls(n) us_inflchange3 c tsus3
smpl 1976:6 2005:5
equation USFS_M5.ls(n) us_inflchange5 c tsus5

smpl 1988:1 2007:5
equation US88_M2.ls(n) us_inflchange2 c tsus2
smpl 1988:1 2006:5
equation US88_M3.ls(n) us_inflchange3 c tsus3
smpl 1988:1 2005:5
equation US88_M5.ls(n) us_inflchange5 c tsus5

smpl 2005:3 2007:5
equation US05_M2.ls(n) us_inflchange2 c tsus2
smpl 2005:3 2006:5
equation US05_M3.ls(n) us_inflchange3 c tsus3
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freeze(WaldBE88_M2_B0) BE88_M2.wald c(2)=0
freeze(WaldBE88_M2_B1) BE88_M2.wald c(2)=1
freeze(WaldBE88_M3_B0) BE88_M3.wald c(2)=0
freeze(WaldBE88_M3_B1) BE88_M3.wald c(2)=1
freeze(WaldBE88_M4_B0) BE88_M4.wald c(2)=0
freeze(WaldBE88_M4_B1) BE88_M4.wald c(2)=1
freeze(WaldBE88_M5_B0) BE88_M5.wald c(2)=0
freeze(WaldBE88_M5_B1) BE88_M5.wald c(2)=1

freeze(WaldBE05_M2_B0) BE05_M2.wald c(2)=0
freeze(WaldBE05_M2_B1) BE05_M2.wald c(2)=1
freeze(WaldBE05_M3_B0) BE05_M3.wald c(2)=0
freeze(WaldBE05_M3_B1) BE05_M3.wald c(2)=1
freeze(WaldBE05_M4_B0) BE05_M4.wald c(2)=0
freeze(WaldBE05_M4_B1) BE05_M4.wald c(2)=1

freeze(WaldCAFS_M2_B0) CAFS_M2.wald c(2)=0
freeze(WaldCAFS_M2_B1) CAFS_M2.wald c(2)=1
freeze(WaldCAFS_M3_B0) CAFS_M3.wald c(2)=0
freeze(WaldCAFS_M3_B1) CAFS_M3.wald c(2)=1
freeze(WaldCAFS_M4_B0) CAFS_M4.wald c(2)=0
freeze(WaldCAFS_M4_B1) CAFS_M4.wald c(2)=1
freeze(WaldCAFS_M5_B0) CAFS_M5.wald c(2)=0
freeze(WaldCAFS_M5_B1) CAFS_M5.wald c(2)=1

freeze(WaldCA88_M2_B0) CA88_M2.wald c(2)=0
freeze(WaldCA88_M2_B1) CA88_M2.wald c(2)=1
freeze(WaldCA88_M3_B0) CA88_M3.wald c(2)=0
freeze(WaldCA88_M3_B1) CA88_M3.wald c(2)=1
freeze(WaldCA88_M4_B0) CA88_M4.wald c(2)=0
freeze(WaldCA88_M4_B1) CA88_M4.wald c(2)=1
freeze(WaldCA88_M5_B0) CA88_M5.wald c(2)=0
freeze(WaldCA88_M5_B1) CA88_M5.wald c(2)=1

freeze(WaldCA05_M2_B0) CA05_M2.wald c(2)=0
freeze(WaldCA05_M2_B1) CA05_M2.wald c(2)=1
freeze(WaldCA05_M3_B0) CA05_M3.wald c(2)=0
freeze(WaldCA05_M3_B1) CA05_M3.wald c(2)=1
freeze(WaldCA05_M4_B0) CA05_M4.wald c(2)=0
freeze(WaldCA05_M4_B1) CA05_M4.wald c(2)=1

freeze(WaldCZ_M2_B0) CZ_M2.wald c(2)=0
freeze(WaldCZ_M2_B1) CZ_M2.wald c(2)=1
freeze(WaldCZ_M3_B0) CZ_M3.wald c(2)=0
freeze(WaldCZ_M3_B1) CZ_M3.wald c(2)=1
freeze(WaldCZ_M4_B0) CZ_M4.wald c(2)=0
freeze(WaldCZ_M4_B1) CZ_M4.wald c(2)=1

freeze(WaldGEFS_M2_B0) GEFS_M2.wald c(2)=0
freeze(WaldGEFS_M2_B1) GEFS_M2.wald c(2)=1
freeze(WaldGEFS_M3_B0) GEFS_M3.wald c(2)=0
freeze(WaldGEFS_M3_B1) GEFS_M3.wald c(2)=1
freeze(WaldGEFS_M4_B0) GEFS_M4.wald c(2)=0
freeze(WaldGEFS_M4_B1) GEFS_M4.wald c(2)=1
freeze(WaldGEFS_M5_B0) GEFS_M5.wald c(2)=0
freeze(WaldGEFS_M5_B1) GEFS_M5.wald c(2)=1

freeze(WaldGE88_M2_B0) GE88_M2.wald c(2)=0
freeze(WaldGE88_M2_B1) GE88_M2.wald c(2)=1
freeze(WaldGE88_M3_B0) GE88_M3.wald c(2)=0
freeze(WaldGE88_M3_B1) GE88_M3.wald c(2)=1
freeze(WaldGE88_M4_B0) GE88_M4.wald c(2)=0
freeze(WaldGE88_M4_B1) GE88_M4.wald c(2)=1
freeze(WaldGE88_M5_B0) GE88_M5.wald c(2)=0
freeze(WaldGE88_M5_B1) GE88_M5.wald c(2)=1

freeze(WaldGE05_M2_B0) GE05_M2.wald c(2)=0
freeze(WaldGE05_M2_B1) GE05_M2.wald c(2)=1
freeze(WaldGE05_M3_B0) GE05_M3.wald c(2)=0
freeze(WaldGE05_M3_B1) GE05_M3.wald c(2)=1
freeze(WaldGE05_M4_B0) GE05_M4.wald c(2)=0
freeze(WaldGE05_M4_B1) GE05_M4.wald c(2)=1

freeze(WaldHU_M2_B0) HU_M2.wald c(2)=0
freeze(WaldHU_M2_B1) HU_M2.wald c(2)=1
freeze(WaldHU_M3_B0) HU_M3.wald c(2)=0
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freeze(WaldHU_M3_B1) HU_M3.wald c(2)=1
freeze(WaldHU_M4_B0) HU_M4.wald c(2)=0
freeze(WaldHU_M4_B1) HU_M4.wald c(2)=1

freeze(WaldPO_M2_B0) PO_M2.wald c(2)=0
freeze(WaldPO_M2_B1) PO_M2.wald c(2)=1
freeze(WaldPO_M3_B0) PO_M3.wald c(2)=0
freeze(WaldPO_M3_B1) PO_M3.wald c(2)=1
freeze(WaldPO_M4_B0) PO_M4.wald c(2)=0
freeze(WaldPO_M4_B1) PO_M4.wald c(2)=1

freeze(WaldSKFS_M3_B0) SKFS_M3.wald c(2)=0
freeze(WaldSKFS_M3_B1) SKFS_M3.wald c(2)=1
freeze(WaldSKFS_M5_B0) SKFS_M5.wald c(2)=0
freeze(WaldSKFS_M5_B1) SKFS_M5.wald c(2)=1

freeze(WaldSK05_M3_B0) SK05_M3.wald c(2)=0
freeze(WaldSK05_M3_B1) SK05_M3.wald c(2)=1

freeze(WaldSWFS_M2_B0) SWFS_M2.wald c(2)=0
freeze(WaldSWFS_M2_B1) SWFS_M2.wald c(2)=1
freeze(WaldSWFS_M3_B0) SWFS_M3.wald c(2)=0
freeze(WaldSWFS_M3_B1) SWFS_M3.wald c(2)=1
freeze(WaldSWFS_M4_B0) SWFS_M4.wald c(2)=0
freeze(WaldSWFS_M4_B1) SWFS_M4.wald c(2)=1
freeze(WaldSWFS_M5_B0) SWFS_M5.wald c(2)=0
freeze(WaldSWFS_M5_B1) SWFS_M5.wald c(2)=1

freeze(WaldSW05_M2_B0) SW05_M2.wald c(2)=0
freeze(WaldSW05_M2_B1) SW05_M2.wald c(2)=1
freeze(WaldSW05_M3_B0) SW05_M3.wald c(2)=0
freeze(WaldSW05_M3_B1) SW05_M3.wald c(2)=1
freeze(WaldSW05_M4_B0) SW05_M4.wald c(2)=0
freeze(WaldSW05_M4_B1) SW05_M4.wald c(2)=1

freeze(WaldTHFS_M2_B0) THFS_M2.wald c(2)=0
freeze(WaldTHFS_M2_B1) THFS_M2.wald c(2)=1
freeze(WaldTHFS_M3_B0) THFS_M3.wald c(2)=0
freeze(WaldTHFS_M3_B1) THFS_M3.wald c(2)=1
freeze(WaldTHFS_M4_B0) THFS_M4.wald c(2)=0
freeze(WaldTHFS_M4_B1) THFS_M4.wald c(2)=1
freeze(WaldTHFS_M5_B0) THFS_M5.wald c(2)=0
freeze(WaldTHFS_M5_B1) THFS_M5.wald c(2)=1

freeze(WaldTH05_M2_B0) TH05_M2.wald c(2)=0
freeze(WaldTH05_M2_B1) TH05_M2.wald c(2)=1
freeze(WaldTH05_M3_B0) TH05_M3.wald c(2)=0
freeze(WaldTH05_M3_B1) TH05_M3.wald c(2)=1
freeze(WaldTH05_M4_B0) TH05_M4.wald c(2)=0
freeze(WaldTH05_M4_B1) TH05_M4.wald c(2)=1

freeze(WaldUKFS_M2_B0) UKFS_M2.wald c(2)=0
freeze(WaldUKFS_M2_B1) UKFS_M2.wald c(2)=1
freeze(WaldUKFS_M3_B0) UKFS_M3.wald c(2)=0
freeze(WaldUKFS_M3_B1) UKFS_M3.wald c(2)=1
freeze(WaldUKFS_M4_B0) UKFS_M4.wald c(2)=0
freeze(WaldUKFS_M4_B1) UKFS_M4.wald c(2)=1
freeze(WaldUKFS_M5_B0) UKFS_M5.wald c(2)=0
freeze(WaldUKFS_M5_B1) UKFS_M5.wald c(2)=1

freeze(WaldUK88_M2_B0) UK88_M2.wald c(2)=0
freeze(WaldUK88_M2_B1) UK88_M2.wald c(2)=1
freeze(WaldUK88_M3_B0) UK88_M3.wald c(2)=0
freeze(WaldUK88_M3_B1) UK88_M3.wald c(2)=1
freeze(WaldUK88_M4_B0) UK88_M4.wald c(2)=0
freeze(WaldUK88_M4_B1) UK88_M4.wald c(2)=1
freeze(WaldUK88_M5_B0) UK88_M5.wald c(2)=0
freeze(WaldUK88_M5_B1) UK88_M5.wald c(2)=1

freeze(WaldUK05_M2_B0) UK05_M2.wald c(2)=0
freeze(WaldUK05_M2_B1) UK05_M2.wald c(2)=1
freeze(WaldUK05_M3_B0) UK05_M3.wald c(2)=0
freeze(WaldUK05_M3_B1) UK05_M3.wald c(2)=1
freeze(WaldUK05_M4_B0) UK05_M4.wald c(2)=0
freeze(WaldUK05_M4_B1) UK05_M4.wald c(2)=1
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freeze(WaldUSFS_M2_B0) USFS_M2.wald c(2)=0
freeze(WaldUSFS_M2_B1) USFS_M2.wald c(2)=1
freeze(WaldUSFS_M3_B0) USFS_M3.wald c(2)=0
freeze(WaldUSFS_M3_B1) USFS_M3.wald c(2)=1
freeze(WaldUSFS_M5_B0) USFS_M5.wald c(2)=0
freeze(WaldUSFS_M5_B1) USFS_M5.wald c(2)=1

freeze(WaldUS88_M2_B0) US88_M2.wald c(2)=0
freeze(WaldUS88_M2_B1) US88_M2.wald c(2)=1
freeze(WaldUS88_M3_B0) US88_M3.wald c(2)=0
freeze(WaldUS88_M3_B1) US88_M3.wald c(2)=1
freeze(WaldUS88_M5_B0) US88_M5.wald c(2)=0
freeze(WaldUS88_M5_B1) US88_M5.wald c(2)=1

freeze(WaldUS05_M2_B0) US05_M2.wald c(2)=0
freeze(WaldUS05_M2_B1) US05_M2.wald c(2)=1
freeze(WaldUS05_M3_B0) US05_M3.wald c(2)=0
freeze(WaldUS05_M3_B1) US05_M3.wald c(2)=1
```