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中　　国　　会　　计　　与　　财　　务　　研　　究

The Zodiac Calendar and Equity Factor Returns

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Abstract

We calculate the returns for four well-known equity return factors—market, size, value, and momentum—for each zodiac calendar year from 1927 to 2015. We find that the point estimates of average returns for each zodiac sign can be substantially different. However, when we employ statistical tests, we do not find enough evidence to reject the null hypothesis of equal excess returns across zodiac signs. For an investor with an equally weighted portfolio in these four equity factors, the Year of the Rooster may seem particularly good and the Year of the Ox particularly poor, but also in this case the null hypothesis cannot be rejected. Hence, we conclude that investment strategies based on zodiac signs are unlikely to generate superior returns.

十二生肖年和股市回报率

摘要

　　本文基于四因子模型（市场、规模、价值和动量因素）得出国际股市在 1927 至 2015 每个农历生肖年间的投资回报率。我们研究发现各生肖年平均收益率的点估计有很大的不同。然而，统计检验的结果表明，我们无法拒绝十二生肖年各年超额收益相等的零假设。对于同样用四因子模型以等权重做投资组合的投资者来说，鸡年的股市收益率似乎特别好，而牛年的收益率特别差。即使在这种情境下，十二生肖年各年超额收益相等的零假设仍然不能被拒绝。因此，我们的结论是，基于十二生肖年的投资策略是不可能产生巨额回报的。

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I. Introduction

Meisami (2013) is the first academic study to investigate the returns of equity markets for the different zodiac signs.[2] He finds empirical evidence for high returns in the Year of the Rat and low returns for the Year of the Snake for the equity market in Hong Kong over the period 1964 to 2013. For the US stock market over the period 1950 to 2013, he finds below average equity returns for the Year of the Snake and the Year of the Rooster. Other research on the Chinese calendar shows that these Zodiac signs can also have an effect on equity markets. Yuan *et al.* (2006) investigate the performance of stock markets over the lunar cycle *within* a calendar year. Their findings indicate that stock returns are 3 to 5 per cent lower on the days around a full moon than on the days around a new moon. Yen *et al.* (2001) and Yuan and Gupta (2014) investigate the performance of the equity markets around the turn of the Lunar New Year in Asian equity markets. Their results suggest that returns are higher around the Lunar New Year over the periods 1991-2000 and 1999-2012, respectively.

Beyond investing, the Asian community seems to be concerned with the Lunar New Year. For example, Wong and Yung (2005) document that the number of births increases in the Year of the Dragon as this year is associated with better prospects in life. They also analyse whether these Dragon children born in Hong Kong do indeed have more success in their lives. Senbet and Huang (2012) believe that such research suffers from endogeneity problems. If everybody in society believes that Dragon children are more successful, they might have a higher chance of receiving preferential treatment (i.e. selected for a better school, job promotion, etc.) even though their objective skills are the same as children who were not born in the Year of the Dragon. Therefore, Senbet and Huang (2012) conduct a similar study among Dragon children in the United States, where the endogeneity problem is likely to be of minor importance. They find that if success is measured by income level, Dragon children are equally as successful as all other children. Just like the study conducted by Senbet and Huang (2012), our sample of US equity return factors is likely to have few endogeneity problems.

Our paper contributes to the literature in at least two ways. First, we extend the sample period for US equity market returns back to 1927. A time-series extension of 25 years is important because the conclusions of Meisami (2013) are based on only four and five zodiac cycles for the Hong Kong and the US markets, respectively. Second, we do not investigate total stock market returns; rather, we investigate factor returns. Factor returns are the excess return series of the equity market minus the risk-free interest rate, small capitalisation minus large capitalisation stocks, value minus growth stocks, and high momentum versus low

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[2] In the popular press, *The Economist* also devoted attention to the performance of stock markets in zodiac calendar years. However, it is not clear what their data and methodology are. Moreover, they only report point estimates without significance tests. See *The Economist*, "Returns of the Dragon", published online on 23 January 2012: http://www.economist.com/blogs/graphicdetail/2012/01/daily-chart-9.

momentum stocks. Fama and French (1993) and Carhart (1997) describe these equity factors extensively. In the asset pricing literature, these four factors are considered to be important in describing the cross-section of US stock returns. These factors are associated with systematic risk (or behaviour) and therefore are compensated with an unconditional (risk) premium. This makes it particularly relevant to examine these four factor portfolios instead of other portfolios that are not associated with systematic excess returns, such as industry portfolios.

We *do not* perform statistical tests on the effect of zodiac signs on Asian equity markets. The reason is that these stock markets have only existed for a limited number of years: for example, the Shenzhen Stock Exchange in China opened in July 1991, and the Shanghai Stock Exchange in its present form opened in December 1990.[3] Historical data on the price index of the Hong Kong Stock Exchange starts in August 1964 at the monthly frequency and in November 1969 at the daily frequency, but data on total returns (price returns plus dividend returns) only starts in January 1973.[4] Since Meisami (2013) has already investigated the *price* returns of the Hong Kong Stock Exchange, we do not repeat his analysis here. For the interested reader, we include the total returns in local currency and in US dollars for each zodiac year for Hong Kong (1973), China (1995), Singapore (1973), South Korea (1988), Taiwan (1989), Malaysia (1986), and Indonesia (1991) in the Appendix of this paper in Table A1.[5] We also include the excess returns of the Asian markets (in US dollars) relative to the US market. The use of excess returns relative to the US extracts the global business cycle effects that may be present in Asian equity returns.

It is important to note that the zodiac signs all have their positive and negative characteristics. No sign is considered good or bad in an absolute sense. Nevertheless, as stated above, some years have acquired the reputation for better outcomes. In the Western world, 'Rat' and 'Pig' are more likely to be associated with bad rather than good characteristics, but this is not the case for the Chinese zodiac signs. In Table A2 in the Appendix, we list the positive and negative characteristics associated with each of the 12 zodiac signs.

The remainder of this paper is organised as follows: Section II presents the data sources and research methodology, Section III presents the empirical results, and Section IV concludes the article.

II. Data and Methodology

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[3] The Shanghai Stock Exchange formally opened in June 1866. We have no stock market data from before the present exchange.

[4] The Hong Kong Stock Exchange was formally established in 1914, but stocks have been traded in Hong Kong since 1866.

[5] Unfortunately, we do not have access to value, size, and momentum factors in each of these markets, such as constructed by Xu and Zhang (2014) for the Chinese stock market.

The data on US equity factor returns is from the data library of Kenneth French.[6] The data is available at the daily frequency, so we can design portfolios based on zodiac signs exactly when the Lunar New Year starts. The daily returns are available from 2 February 1927 to 18 February 2015.[7] This means that our data contains two more full zodiac cycles than the US sample used by Meisami (2013).

We use excess returns on the US equity market relative to the risk-free interest rate. This is different from Meisami (2013), who uses total returns on the S&P 500 index. Hence, his results show what the total return for the investor has been, while our results focus on the *additional* return that equity market investors obtained relative to risk-free nominal investments. In recent times, the difference between total and excess returns has been small. However, in the 1970s, the interest rates were above 10 per cent per annum, creating a wedge between total and excess returns. Our approach with excess returns also reduces the impact of periods with high inflation, for which high total returns are less meaningful.

In addition to the market factor, we also analyse other equity factor returns. The excess returns of stocks with small relative to large market capitalisation are called the 'size factor'. Van Dijk (2011) surveys the empirical and theoretical literature on this factor. The excess returns of stocks with low relative to high book-to-market ratios are referred to as the 'value factor' (see Fama and French (1998) and Lee (2014)). The excess returns of stocks with high relative to low past one-year returns are called the 'momentum factor'. Jegadeesh and Titman (1993) were the first to report on this factor, and their work sparked a debate in the literature on whether this factor can be explained with behavioural or rational theories. These factors have been used in, for example, Carhart (1997) to explain the returns of US equity mutual funds.

In the recent literature, several other equity factors have been put forward. Since we do not have data starting in 1927 for these factors, we do not consider these factors in this study. In the Appendix, we include Table A3 with the excess returns of the 12 US industry portfolios (also from the online data library of Kenneth French) relative to the market for each zodiac calendar year. Although these industry portfolios are not generally seen as factors that explain the cross-section of equity returns, these results might still be relevant for portfolio managers that follow industry-rotation strategies. However, the results in the Appendix contain no statistical evidence of relative under- or out-performance across zodiac calendar years for any of the 12 industries.

Our methodology is straightforward. We calculate the annual returns for each of the zodiac signs on the basis of the cumulative daily excess returns during the year. We start each year on the first day of the Zodiac New Year and end at the last day of the same zodiac year. This is slightly different from Meisami (2013), who uses the average index value of the

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last 10 trading days of the year and divides that by the average index value of the first 10 trading days of the year. Our results might be somewhat more sensitive to the start and end value in a year, but they are the true returns that an investor could have achieved during a particular zodiac calendar year.

Our null hypothesis is that zodiac signs should not matter for the historical factor returns. We test this with test statistics on the mean and on the median return as well as the equality of the variances. For the group means, we use the ANOVA test, which assumes equality of variances. We use the Kruskal and Wallis (1952) test for the group medians and Levene's (1960) test for the group variances.

III. Empirical Results

The factor returns for each individual zodiac calendar year are presented in Table A4 of the Appendix. Here, we first describe Table 1, which contains the summary statistics for each factor return. Visually, the returns per zodiac sign can been seen in Figure 1. The next step will be to analyse the statistical significance of the differences in means, medians, and variance across different zodiac calendar years.

Table 1   Summary Statistics for Each Equity Factor and an Equally Weighted Combination for Each Zodiac Calendar Year

All numbers are in percentages per annum.

Factor	Statistic	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger
Market (RMRF)	Average	12.9	8.4	-1.4	5.4	6.0	9.4	9.8	6.2	12.0	5.4	4.6	13.1
	Minimum	-5.8	-10.3	-19.6	-23.9	-68.6	6.0	-23.9	-14.4	-10.1	-37.0	-44.3	-23.2
	Median	14.1	9.0	-2.5	9.6	14.3	7.3	7.5	6.9	5.0	8.8	14.2	19.9
	Maximum	25.2	31.3	21.2	34.3	34.1	21.5	63.6	31.6	46.1	30.2	33.4	31.5
	Std deviation	10.5	13.0	13.2	20.8	33.9	5.5	30.8	16.9	19.2	20.6	27.5	19.8
Size (SMB)	Average	1.1	1.4	0.6	0.1	12.7	4.0	7.4	1.3	0.6	-2.9	-5.2	-4.9
	Minimum	-9.8	-4.0	-34.3	-12.7	-7.7	-6.7	-11.9	-6.9	-8.3	-21.3	-19.4	-23.0
	Median	-0.1	0.5	3.7	2.1	14.0	1.2	4.2	-3.1	3.3	-2.1	-4.1	-1.2
	Maximum	20.9	11.9	17.8	10.9	29.3	14.7	35.2	13.6	9.8	11.8	9.3	8.0
	Std deviation	10.7	5.0	17.1	8.9	12.0	7.5	15.0	8.5	7.0	10.5	10.8	10.2
Value (HML)	Average	-4.3	9.4	7.5	-0.2	0.9	8.2	10.8	0.0	5.1	4.2	6.2	3.8
	Minimum	-27.3	-2.7	-5.8	-13.1	-19.5	-14.1	-9.3	-39.8	-9.8	-6.7	-7.8	-12.4
	Median	-6.7	6.7	6.8	-2.1	0.0	11.6	8.7	3.5	0.8	4.1	6.8	5.3
	Maximum	13.0	31.9	25.8	14.2	21.2	19.6	40.6	19.3	23.6	23.4	26.4	24.8
	Std deviation	13.0	10.4	11.2	10.7	12.4	11.5	16.8	19.0	13.3	9.8	11.4	12.5
Momentum (WML)	Average	3.9	4.7	17.8	7.6	13.1	0.4	8.3	3.7	8.6	12.9	-1.5	5.8
	Minimum	-28.5	-7.8	6.3	-7.1	-11.0	-35.3	-5.6	-9.3	-12.9	2.4	-67.7	-16.2
	Median	5.0	1.9	15.6	6.6	16.5	4.3	11.7	0.1	11.5	11.2	7.5	9.5
	Maximum	27.0	31.3	33.2	18.7	26.3	15.5	19.0	24.3	15.6	24.0	27.0	24.8
	Std deviation	17.4	11.8	10.3	8.4	12.0	16.4	9.3	14.3	9.8	7.6	31.3	13.1
Equally Weighted Combination	Average	3.4	6.0	6.1	3.2	8.2	5.5	9.0	2.8	6.6	4.9	1.0	4.4
	Minimum	-5.6	-0.3	0.7	-9.3	-16.0	-4.4	-6.5	-4.3	-2.8	-3.7	-19.0	-3.9
	Median	4.6	4.9	4.9	1.9	12.6	6.1	8.3	2.2	4.9	4.7	4.5	2.2
	Maximum	9.9	14.2	13.2	15.2	17.8	13.0	33.4	14.5	21.8	16.9	8.7	16.5
	Std deviation	6.5	4.3	4.8	7.3	11.2	5.8	12.9	7.1	7.5	6.2	9.7	6.8

Table 1 contains the summary statistics for each of the four factors: market, size, value, and momentum. We show the average, minimum, median, maximum, and standard deviation of the annual returns of each of the zodiac calendar years. In addition to the four single factors, we also include an equally weighted portfolio of each of these four factors. Blitz (2012) suggests that a portfolio that invests a quarter in the market, value, momentum, and low volatility factors has superior risk-return characteristics compared to the market portfolio. In addition, his results indicate that optimising the weights to the factors does not yield much better risk-return characteristics than equally weighting them. One difference between his approach and ours is that we include the size factor and do not include a low volatility factor because we do not have daily data on the low volatility factor going back to 1927.

Although Meisami (2013) uses total returns instead of excess returns on the US stock market, we also see that the average return for the Year of the Snake (-1.4 per cent) is particularly low. This is not simply due to outliers as the median is also negative (-2.5 per cent). The years of the Rabbit, Pig, and Tiger seem to be particularly high, with average returns over 10 per cent. The Year of the Goat had a particularly poor return, -68.6 per cent, in one year (1931), and the Year of the Rooster had a particularly good return, 63.6 per cent, in another year (1933). The performance of each individual year can be seen in Figure 1, which is ordered by zodiac sign on the horizontal axis.
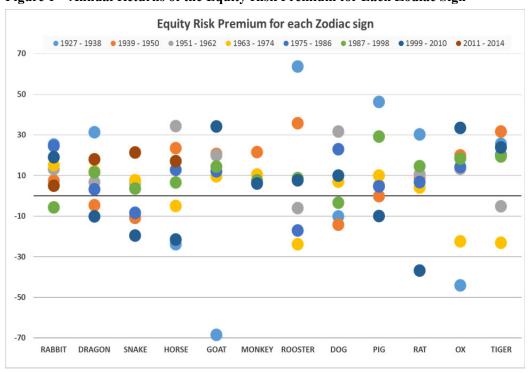
Figure 1   Annual Returns of the Equity Risk Premium for Each Zodiac Sign

We can see in Table 1 that the size returns are close to zero for many zodiac calendar years. The important exceptions are the Year of the Goat and the Year of the Rooster, with 12.7 and 7.4 per cent per annum, respectively. Particularly bad years seem to be the years of the Ox and the Tiger, with -5.2 and -4.9 per cent per annum average return, respectively. The dispersion of this factor is low compared to the market factor, with a maximum standard deviation of 17.1 per cent (Snake), while for the market premium, the standard deviation is above 20 per cent for several Zodiac signs.

The value factor performed best in the Year of the Rooster, with 10.8 per cent per annum, closely followed by the Year of the Dragon with 9.4 per cent. The years of the Rabbit and the Horse are the worst, with -4.3 and -0.2 per cent per annum, respectively.

The momentum factor has three zodiac signs that result in double-digit average returns: 17.8 (Snake), 13.1 (Goat), and 12.9 (Rat) per cent per annum. The worst individual years are Ox (2009) and Monkey (1932) years. The magnitude of dispersion as measured by the standard deviations is comparable for each of the factors except the market factor, which is higher.

We also consider the performance of an investor with a portfolio of 25 per cent in each of the four factors discussed above. This can be particularly important as the four factors may offer diversification benefits. We see that there are substantial diversification benefits as the standard deviation of annual returns drops below 10 per cent for most years, whereas the standard deviation is above 15 per cent for many individual factors. The Year of the Rooster and Year of the Goat have the highest average returns: 9.0 and 8.2 per cent, respectively. On the other hand, the Year of the Ox seems to be particularly poor for the equally weighted combination of the four factor returns, with an average of only 1.0 per cent. However, the results we have presented so far are based on point estimates only, and although we have shown the cross-sectional dispersion to indicate the uncertainty around these point estimates, statistical significance has not been established.

Table 2   Statistical Tests

We use the ANOVA test for the equality of means, the Kruskal and Wallis (1952) test for equality of medians, and Levene's (1960) test for the group variances. The test statistic is in the left column and the associated p-value in the right column.

	Equal means		Equal medians		Equal variances	
	Statistic	P-value	Statistic	P-value	Statistic	P-value
RMRF	0.31	0.98	7.04	0.80	1.52	0.14
SMB	1.51	0.15	12.69	0.31	0.99	0.46
HML	0.93	0.52	9.24	0.60	0.40	0.95
MOM	1.05	0.41	13.67	0.25	1.11	0.37
EQ COMBI	1.47	0.18	7.52	0.76	0.84	0.60

Table 2 contains the test statistics of three statistical tests. The first test is our primary test and has a null hypothesis that the average returns for each zodiac sign are the same. This is an important difference from some other studies on calendar effects. Meisami (2013), for example, performs 12 regressions. Each time the dependent variable is the annual return on the stock market, and the explanatory variables are a constant and a dummy for a particular zodiac sign. Meisami (2013) then performs 12 statistical tests, one for each regression, with the null hypothesis that the coefficient for the dummy is zero. When the null hypothesis is true and zodiac signs have no influence on stock returns, we still expect at least one rejection of the null hypothesis at the 10 per cent statistical significance level.[8] Hence, the proper statistical test is based on the null hypothesis that the mean returns are equal across zodiac signs.

We see that for each of the four factors as well as the equally weighted combination, the p-values are above 0.10, the usual significance level. This means that there is not enough statistical evidence to reject the null hypothesis that the mean returns are the same. It could be that our first test on mean returns does not provide reliable statistics due to outliers. Hence, we also test whether the medians are equal. The median is a statistic that is known to be more robust against outliers than the mean. However, by applying the Kruskall-Wallis test, we find that the null hypothesis of equal medians cannot be rejected for each of the four equity factors.

As the ANOVA test assumes equal variances for each group, we also use Levene's test to check whether this assumption is violated. Again, the p-values are above the usual significance level of 0.10, indicating that the null hypothesis of equal variances for each zodiac sign cannot be rejected. This gives support for the validity of the results from the ANOVA test on means.

IV. Conclusion

We calculate the returns for four well-known equity factor returns—the market, size, value, and momentum—for each zodiac calendar year from 1927 to 2015. We find that the point estimates of average returns for each zodiac sign can be substantially different. However, when we employ statistical tests, we do not find enough evidence to reject the null hypothesis of equal excess returns across zodiac signs. For an investor with an equally weighted portfolio in these four equity factors, the Year of the Rooster may seem particularly good and the Year of the Ox particularly poor, but also in this case the null hypothesis of equal means or medians cannot be rejected. Hence, we conclude that investment strategies based on zodiac signs are unlikely to generate superior returns.

An important drawback of this line of research is that there are only a few 12-year

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[8] Sullivan *et al.* (2001) developed a data snooping test based on the reality check bootstrap to account for the search among multiple tests for statistical significance among calendar anomalies.

cycles available, even if we go back to 1927. Hence, the power of our statistical tests to reject the null hypothesis is relatively small.

References

Blitz, D. (2012), 'Strategic Allocation to Premiums in the Equity Market', *Journal of Index Investing* 2 (4): 42-29.

Carhart, M. M. (1997), 'On Persistence in Mutual Fund Performance', *Journal of Finance* 52 (1): 57-82.

Chan, M. L., Khanthavit, A., and Thomas, H. (1996), 'Seasonality and Cultural Influences on Four Asian Stock Markets', *Asia Pacific Journal of Management* 13 (2): 1-24.

Fama, E. F. and French, K. R. (1993), 'Common Risk Factors in the Returns on Stocks and Bonds', *Journal of Financial Economics* 33 (1): 3-56.

Fama, E. F. and French, K. R. (1998), 'Value Versus Growth: The International Evidence', *Journal of Finance* 53 (6): 1975-1999.

Jegadeesh, N. and Titman, S. (1993), 'Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency', *Journal of Finance* 48 (1): 66-91.

Kruskal, W. and Wallis, W. (1952), 'Use of Ranks in One-Criterion Variance Analysis', *Journal of the American Statistical Association* 47 (260): 583-621.

Lee, C. (2014), 'Value Investing: Bridging Theory and Practice', *China Accounting and Finance Review* 16 (2): 10-38.

Levene, H. (1960), 'Robust Tests for Equality of Variances', In Olkin, I., Ghurye, S. G., Hoeffding, W., Madow, W. G., and Mann, H. B. (eds.), *Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling*, Stanford, CA: Stanford University Press, pp. 278-292.

Meisami, A. (2013), 'Zodiac Calendar and Market Returns', *Asian Journal of Finance and Accounting* 5 (1): 344-354.

Senbet, D. and Huang, W. C. (2012), 'Do Dragons have Better Fate? Revisited Using the U.S. Data', *International Journal of Economics and Research* 3 (5): 101-118.

Sullivan, R., Timmermann, A., and White, H. (2001), 'Dangers of Data Mining: The Case of Calendar Effects in Stock Returns', *Journal of Econometrics* 105 (1): 249-286.

Van Dijk, M. (2011), 'Is Size Dead? A Review of the Size Effect in Equity Returns', *Journal of Banking and Finance* 35 (12): 3263-3274.

Wong, K. F. and Yung, L. (2005), 'Do Dragons have Better Fate?', *Economic Inquiry* 43 (3):

689-697.

Xu, J. and Zhang, S. (2014), 'The Fama-French Three Factors in the Chinese Stock Market', *China Accounting and Finance Review* 16 (2): 210-227.

Yen, G., Lee, C. F., Chen, C. L., and Lin, W. C. (2001), 'On the Chinese Lunar New Year Effect in Six Asian Stock Markets: An Empirical Analysis (1991-2000)', *Review of Pacific Basin Financial Markets* 4 (4): 463-478.

Yuan, K., Zheng, L., and Zhu, Q. (2006), 'Are Investors Moonstruck? Lunar Phases and Stock Returns', *Journal of Empirical Finance* 13 (1): 1-23.

Yuan, T. and Gupta, R. (2014), 'Chinese Lunar New Year Effect in Asian Stock Markets, 1999-2012', *Quarterly Review of Economics and Finance* 54 (4): 529-537.

Appendix

Table A1A   Total Returns in Local Currency in Selected Asian Equity Markets, 1973-2015

Thomson Financial Datastream Mnemonics are below the country names. Numbers in percentages. Annual returns are calculated as the closing value of the total return index for the year divided by the value of the total return index in the previous year, minus one.

Zodiac Sign	Western Date	Hong Kong TOTMKHK(RI)	China TOTMKCA(RI)	Singapore TOTMKSG(RI)	South Korea TOTMKKO(RI)	Taiwan TOTMKTA(RI)	Malaysia TOTMKMY(RI)	Indonesia TOTMKID(RI)
Ox	03/02/1973	-54.9		-50.8				
Tiger	23/01/1974	-47.1		-25.4				
Rabbit	11/02/1975	97.1		46.6				
Dragon	31/01/1976	18.8		-10.5				
Snake	18/02/1977	3.3		-9.9				
Horse	07/02/1978	45.8		43.1				
Goat	27/01/1979	81.4		36.2				
Monkey	16/02/1980	87.8		82.8				
Rooster	05/02/1981	-12.8		1.5				
Dog	23/01/1982	-29.7		2.8				
Pig	12/02/1983	25.2		21.1				
Rat	02/02/1984	42.1		-23.7				
Ox	20/02/1985	20.6		-18.7				
Tiger	08/02/1986	47.6		67.2			46.5	
Rabbit	29/01/1987	-7.1		-6.0			6.8	
Dragon	17/02/1988	38.2		33.2	28.2		51.7	
Snake	04/02/1989	-10.0		26.6	-7.5	83.8	43.8	
Horse	27/01/1990	29.3		-7.0	-27.2	-59.4	4.5	
Goat	15/02/1991	42.7		16.2	11.9	4.6	12.5	-20.8
Monkey	04/02/1992	31.9		2.3	1.7	-34.7	20.7	-5.8
Rooster	23/01/1993	103.0		47.7	51.0	118.7	86.5	107.5
Dog	10/02/1994	-34.2		-12.5	-5.1	1.6	-19.7	-18.4
Pig	31/01/1995	62.9	9.0	20.4	8.9	-18.2	30.8	56.0
Rat	17/02/1996	23.8	134.3	-6.1	-24.7	63.0	17.7	16.7
Ox	07/02/1997	-34.3	35.0	-28.0	-7.1	14.2	-50.3	-12.8
Tiger	28/01/1998	2.3	-21.0	-2.0	20.8	-20.2	2.5	-9.8
Rabbit	16/02/1999	74.6	34.6	72.2	94.2	86.3	71.6	38.1
Dragon	05/02/2000	-1.0	16.8	-19.3	-31.5	-38.7	-27.8	-50.4
Snake	24/01/2001	-27.2	-29.9	-4.4	17.2	0.1	4.2	1.6
Horse	12/02/2002	-10.4	1.9	-23.4	-17.5	-24.6	-1.2	-12.3
Goat	01/02/2003	57.8	24.3	49.1	50.5	30.1	27.0	95.2
Monkey	22/01/2004	5.0	-20.7	15.8	9.7	1.3	12.9	39.7
Rooster	09/02/2005	19.1	-4.4	18.1	47.0	11.5	3.6	20.6
Dog	28/01/2006	39.1	115.7	40.3	6.9	18.3	43.9	46.3
Pig	17/02/2007	16.8	67.3	-3.4	17.4	0.5	14.2	48.0
Rat	07/02/2008	-47.0	-56.8	-42.1	-34.6	-42.1	-35.2	-49.5
Ox	24/01/2009	63.9	51.8	73.0	49.8	70.9	47.5	96.8
Tiger	13/02/2010	22.9	-5.9	20.4	33.3	25.0	26.4	35.9
Rabbit	03/02/2011	-13.0	-16.1	-8.2	-5.0	-15.6	4.0	16.6
Dragon	21/01/2012	22.9	7.7	22.6	2.2	12.9	7.7	15.1
Snake	09/02/2013	1.8	-15.3	-6.8	0.4	7.7	14.1	-0.1
Horse	31/01/2014	11.6	59.4	17.6	-0.6	20.8	3.0	24.9
Goat	19/02/2015	-18.6	-16.9	-17.3	-2.8	-12.3	-2.9	-1.4

Table A1B   Total Returns in US dollars in Selected Asian Equity Markets, 1973-2015

Thomson Financial Datastream Mnemonics are below the country names. Numbers in percentages. Annual returns are calculated as the closing value of the total return index for the year divided by the value of the total return index in the previous year, minus one.

Zodiac Sign	Western Date	Hong Kong TOTMKHK(RI)	China TOTMKCA(RI)	Singapore TOTMKSG(RI)	South Korea TOTMKKO(RI)	Taiwan TOTMKTA(RI)	Malaysia TOTMKMY(RI)	Indonesia TOTMKID(RI)
Ox	03/02/1973	-50.0		-44.9				
Tiger	23/01/1974	-42.3		-18.3				
Rabbit	11/02/1975	84.4		34.4				
Dragon	31/01/1976	28.0		-9.4				
Snake	18/02/1977	4.5		-4.5				
Horse	07/02/1978	40.9		53.8				
Goat	27/01/1979	76.7		36.6				
Monkey	16/02/1980	74.1		90.8				
Rooster	05/02/1981	-21.0		1.2				
Dog	23/01/1982	-38.0		2.9				
Pig	12/02/1983	6.2		17.7				
Rat	02/02/1984	42.3		-28.0				
Ox	20/02/1985	20.1		-14.1				
Tiger	08/02/1986	47.7		66.8			41.9	
Rabbit	29/01/1987	-6.7		0.0			5.2	
Dragon	17/02/1988	37.6		38.7	45.3		43.6	
Snake	04/02/1989	-10.3		30.4	-7.9	97.5	45.0	
Horse	27/01/1990	29.9		2.0	-31.3	-61.4	5.3	
Goat	15/02/1991	44.2		22.5	7.3	13.8	16.0	-23.7
Monkey	04/02/1992	32.7		1.7	-3.3	-35.4	22.6	-9.4
Rooster	23/01/1993	100.7		52.0	48.1	108.5	73.3	103.5
Dog	10/02/1994	-34.1		-4.5	-2.5	2.1	-13.3	-22.1
Pig	31/01/1995	62.9	10.6	24.8	10.3	-21.8	31.0	50.3
Rat	17/02/1996	23.5	134.9	-6.9	-32.4	62.9	20.5	13.1
Ox	07/02/1997	-34.2	35.3	-40.9	-52.0	-7.7	-72.0	-82.3
Tiger	28/01/1998	2.2	-21.0	-0.3	72.3	-15.9	-16.5	22.7
Rabbit	16/02/1999	73.9	34.6	72.2	102.1	95.5	145.3	57.8
Dragon	05/02/2000	-1.2	16.8	-21.7	-39.3	-42.1	-27.8	-60.1
Snake	24/01/2001	-27.2	-29.8	-9.0	12.6	-7.1	4.2	-7.1
Horse	12/02/2002	-10.4	1.9	-19.3	-6.1	-23.9	-1.2	1.3
Goat	01/02/2003	58.5	24.3	52.7	47.4	34.2	27.0	106.3
Monkey	22/01/2004	4.6	-20.7	19.2	27.0	7.3	12.9	26.1
Rooster	09/02/2005	19.7	-1.8	19.9	55.4	10.7	5.0	19.7
Dog	28/01/2006	38.1	124.6	48.9	10.9	14.8	54.5	51.4
Pig	17/02/2007	16.9	80.3	4.6	16.8	3.6	23.4	45.1
Rat	07/02/2008	-46.7	-54.7	-45.7	-55.7	-44.8	-42.2	-58.7
Ox	24/01/2009	63.6	52.0	84.6	81.0	78.8	56.3	138.1
Tiger	13/02/2010	22.6	-2.5	33.9	37.4	38.1	42.1	40.7
Rabbit	03/02/2011	-12.7	-12.7	-8.4	-6.5	-18.2	1.8	17.6
Dragon	21/01/2012	23.0	9.6	26.3	5.7	14.1	8.1	6.5
Snake	09/02/2013	1.7	-12.9	-9.5	2.8	5.4	5.6	-20.9
Horse	31/01/2014	11.7	54.4	10.3	-3.5	16.0	-4.8	18.7
Goat	19/02/2015	-19.0	-20.9	-20.1	-10.6	-16.9	-15.4	-7.1

Table A1C   Excess Returns of Selected Asian Equity Markets Relative to the US Equity Market, 1973-2015

Thomson Financial Datastream Mnemonics are below the country names. Numbers in percentages. Excess returns are calculated by using the USD returns from Table A1B and subtracting the corresponding US equity market return (the RM from Kenneth French's Online Data Library).

Zodiac Sign	Western Date	Hong Kong TOTMKHK(RI)	China TOTMKCA(RI)	Singapore TOTMKSG(RI)	South Korea TOTMKKO(RI)	Taiwan TOTMKTA(RI)	Malaysia TOTMKMY(RI)	Indonesia TOTMKID(RI)
Ox	03/02/1973	-34.2		-29.1				
Tiger	23/01/1974	-27.1		-3.0				
Rabbit	11/02/1975	54.6		4.6				
Dragon	31/01/1976	19.8		-17.7				
Snake	18/02/1977	8.0		-1.1				
Horse	07/02/1978	21.1		34.0				
Goat	27/01/1979	54.2		14.1				
Monkey	16/02/1980	56.2		72.9				
Rooster	05/02/1981	-17.1		5.1				
Dog	23/01/1982	-71.3		-30.4				
Pig	12/02/1983	-6.6		4.9				
Rat	02/02/1984	26.0		-44.3				
Ox	20/02/1985	-1.3		-35.5				
Tiger	08/02/1986	22.1		41.2			16.3	
Rabbit	29/01/1987	-6.4		0.3			5.5	
Dragon	17/02/1988	19.9		21.0	27.6		25.9	
Snake	04/02/1989	-21.7		19.0	-19.2	86.1	33.6	
Horse	27/01/1990	15.7		-12.2	-45.5	-75.6	-9.0	
Goat	15/02/1991	24.9		3.2	-12.0	-5.5	-3.3	-43.0
Monkey	04/02/1992	22.3		-8.7	-13.7	-45.8	12.2	-19.8
Rooster	23/01/1993	89.0		40.3	36.4	96.8	61.6	91.8
Dog	10/02/1994	-34.6		-5.0	-3.0	1.6	-13.8	-22.6
Pig	31/01/1995	28.1	-24.1	-10.0	-24.5	-56.5	-3.7	15.5
Rat	17/02/1996	4.0	115.4	-26.4	-51.8	43.4	1.1	-6.4
Ox	07/02/1997	-57.4	12.1	-64.1	-75.1	-30.9	-95.2	-105.5
Tiger	28/01/1998	-22.0	-45.2	-24.5	48.2	-40.0	-40.6	-1.4
Rabbit	16/02/1999	50.4	11.1	48.7	78.6	72.0	121.8	34.3
Dragon	05/02/2000	3.5	21.5	-16.9	-34.6	-37.3	-23.1	-55.4
Snake	24/01/2001	-11.1	-13.8	7.0	28.7	9.0	20.2	9.0
Horse	12/02/2002	9.6	21.9	0.7	14.0	-3.9	18.8	21.3
Goat	01/02/2003	23.4	-10.8	17.6	12.3	-0.9	-8.1	71.2
Monkey	22/01/2004	-2.8	-28.1	11.9	19.6	-0.1	5.5	18.7
Rooster	09/02/2005	9.2	-12.4	9.3	44.9	0.2	-5.5	9.2
Dog	28/01/2006	23.2	109.8	34.0	-4.0	-0.1	39.7	36.6
Pig	17/02/2007	22.9	86.3	10.6	22.8	9.6	29.5	51.1
Rat	07/02/2008	-11.0	-19.0	-10.0	-20.0	-9.2	-6.6	-23.0
Ox	24/01/2009	30.0	18.4	51.1	47.4	45.2	22.8	104.5
Tiger	13/02/2010	-1.4	-26.5	9.9	13.4	14.1	18.1	16.7
Rabbit	03/02/2011	-17.6	-17.6	-13.2	-11.4	-23.1	-3.0	12.7
Dragon	21/01/2012	5.1	-8.3	8.4	-12.1	-3.7	-9.8	-11.4
Snake	09/02/2013	-19.6	-34.1	-30.7	-18.4	-15.8	-15.6	-42.1
Horse	31/01/2014	-5.4	37.4	-6.7	-20.5	-1.0	-21.8	1.6
Goat	19/02/2015	-19.0	-20.9	-20.1	-10.6	-16.9	-15.4	-7.1

Table A2   Positive and Negative Traits of the Zodiac Signs

Source: http://www.rocketswag.com/fortune/chinese-zodiac/index.html

	Positive	Negative
Rat	Hardworking, sensitive, sociable, shrewd, artistic	Intolerant, over-ambitious, manipulative, selfish, ruthless
Ox	Methodical, patient, trustworthy, modest, hardworking	Conventional in thinking, demanding, stubborn, materialistic
Tiger	Powerful, sincere, courageous, vigorous, affectionate	Unstable and inconsistent, short-tempered, selfish, restless, aggressive
Rabbit	Sensitive, flexible and amiable, artistic, kind, compassionate	Detached, stubborn, moody, opportunistic
Dragon	Noble, frank, zealous, dignified, intellectual, loyal	Arrogant, intolerant, brash, demanding
Snake	Soft-spoken, creative, responsible, wise, strong, calm	Possessive, cold, distrustful, self-doubt
Horse	Popular, intelligent, open-minded, flexible, cheerful, witty	Gullible, arrogant, fickle, rude
Goat	Sincere, sympathetic, gentle, determined, creative, righteous	Passive, indecisive, weak, pessimistic
Monkey	Motivator, witty, innovative, sociable, inventive, polite	Selfish, snobbish, suspicious, jealous, manipulative
Rooster	Meticulous, self-assured, neat, alert, practical, responsible	Critical, opinionated, egoistic
Dog	Intelligent, loyal, frank, honest, amicable, sociable	Lazy, judgmental, quarrelsome, pessimistic, cynical, adamant
Pig	Sociable, honest, peace-loving, hardworking, calm, thoughtful	Materialistic, over-reliant, gullible

Table A3   Annual Industry Returns for Each Zodiac Calendar Year

Numbers in percentages. The industry classification is from Kenneth French's Online Data Library: NoDur = Consumer Nondurables – Food, Tobacco, Textiles, Apparel, Leather, Toys; Durbl = Consumer Durables – Cars, TV's, Furniture, Household Appliances; Manuf = Manufacturing – Machinery, Trucks, Planes, Off Furn, Paper, Com Printing; Enrgy = Oil, Gas, and Coal Extraction and Products; Chems = Chemicals and Allied Products; BusEq = Business Equipment – Computers, Software, and Electronic Equipment; Telcm = Telephone and Television Transmission; Utils = Utilities; Shops = Wholesale, Retail, and Some Services (Laundries, Repair Shops); Hlth = Healthcare, Medical Equipment, and Drugs; Money = Finance; Other = Other – Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment. The last column contains the p-values associated with the null hypothesis of equal means for each of the Zodiac calendar years.

	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger	Pval Means
NoDur	-3.1	0.7	2.3	3.4	-0.1	-0.7	-0.6	5.8	0.3	2.3	1.7	-6.3	0.87
Durbl	1.9	6.1	-6.7	0.2	3.3	-2.2	8.4	-0.5	3.6	-9.9	6.9	9.2	0.54
Manuf	0.0	2.8	3.0	0.5	-3.4	2.3	6.0	-0.2	2.5	-0.7	-2.1	0.0	0.73
Enrgy	-0.6	1.1	4.1	-0.7	3.1	8.2	-2.9	-1.5	3.1	6.6	-4.4	2.1	0.88
Chems	3.2	0.0	0.5	0.6	-2.9	-2.6	2.7	3.2	3.4	0.0	1.9	3.6	0.94
BusEq	7.3	-0.3	-0.3	5.5	-0.3	-3.3	6.1	1.4	5.6	2.6	0.7	-0.4	0.87
Telcm	0.8	-1.3	-1.3	-3.2	-7.7	-2.0	-1.9	4.5	-4.6	1.0	6.6	2.7	0.81
Utils	-2.5	5.9	1.0	-1.5	-5.0	3.1	-3.8	-4.2	0.1	1.3	-1.7	-1.8	0.97
Shops	0.0	2.5	-3.4	-2.5	4.8	-1.6	7.5	6.0	-5.7	2.3	0.1	0.2	0.35
Hlth	0.5	-4.5	5.1	5.0	3.4	-5.9	5.9	8.6	-2.7	3.1	3.8	-1.5	0.74
Money	-4.4	5.2	0.2	0.6	-2.8	9.3	1.9	-2.1	0.0	-0.6	6.7	-7.6	0.21
Other	-3.9	1.7	4.5	-0.2	-1.4	3.5	-1.0	-5.4	-2.6	-8.8	-3.7	-1.7	0.12

Table A4 Annual Factor Returns for Each Zodiac Calendar Year

Numbers in percentages.

RMRF	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger
1927 - 1938	25.2	31.3	-10.5	-23.9	-68.6	7.3	63.6	-10.2	46.1	30.2	-44.3	25.6
1939 - 1950	7.3	-4.7	-10.9	23.5	20.6	21.5	35.7	-14.4	-0.3	8.8	19.8	31.5
1951 - 1962	13.1	6.7	5.7	34.3	19.9	6.1	-6.1	31.6	5.0	10.5	13.3	-5.2
1963 - 1974	15.1	12.0	7.5	-5.0	9.5	10.4	-23.9	6.9	9.9	4.0	-22.4	-23.2
1975 - 1986	24.4	3.1	-8.4	12.8	12.1	7.4	-17.1	22.9	4.5	6.6	14.2	19.9
1987 - 1998	-5.8	11.4	3.5	6.5	14.3	7.2	8.7	-3.4	29.1	14.5	18.2	19.2
1999 - 2010	19.0	-10.3	-19.6	-21.6	34.1	6.0	7.5	9.8	-10.1	-37.0	33.4	23.8
2011 - 2014	4.9	17.9	21.2	17.0	-	-	-	-	-	-	-	-

SMB	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger
1927 - 1938	1.0	-3.1	-34.3	-7.3	3.2	-6.7	35.2	13.6	9.8	11.8	-18.7	-0.6
1939 - 1950	11.3	4.7	1.5	4.5	16.5	14.7	17.3	-6.2	-5.0	-9.0	5.0	-1.2
1951 - 1962	-7.0	-0.6	-5.0	0.1	-7.7	1.2	-1.7	7.4	3.3	-1.3	-3.0	-6.0
1963 - 1974	-9.6	1.3	17.1	10.0	29.3	12.3	-11.9	-6.9	5.9	-21.3	-19.4	1.3
1975 - 1986	3.3	11.9	17.8	10.9	13.3	5.5	4.4	9.1	4.4	-3.5	-4.1	-12.9
1987 - 1998	-9.8	1.1	-8.9	-12.7	14.0	0.3	4.2	-5.1	-6.3	-2.1	-5.2	-23.0
1999 - 2010	20.9	-4.0	10.7	4.1	20.7	0.4	4.1	-3.1	-8.3	5.1	9.3	8.0
2011 - 2014	-1.2	-0.1	5.9	-8.8	-	-	-	-	-	-	-	-

Table A4 (continued)

HML	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger
1927 - 1938	-7.9	-2.7	14.2	-13.1	-19.5	17.2	40.6	-39.8	19.7	23.4	-7.8	-7.5
1939 - 1950	-12.7	6.5	17.7	14.2	21.2	13.3	8.7	0.3	11.6	4.7	-5.6	24.8
1951 - 1962	-6.2	2.6	-5.8	13.0	5.7	1.6	-5.8	7.5	0.8	-4.5	6.8	5.3
1963 - 1974	13.0	7.0	7.8	-2.1	-3.1	11.6	-9.3	19.3	-9.8	4.1	26.4	12.1
1975 - 1986	8.8	15.1	5.9	-2.2	0.0	-14.1	20.6	3.5	23.6	6.2	3.8	5.8
1987 - 1998	5.3	6.5	-3.2	-13.0	-4.3	19.6	14.3	-1.9	-1.8	2.1	9.2	-12.4
1999 - 2010	-27.3	31.9	25.8	7.0	6.5	8.0	6.3	11.3	-8.3	-6.7	10.7	-1.5
2011 - 2014	-7.3	8.4	-2.6	-5.4	-	-	-	-	-	-	-	-

MOM	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger
1927 - 1938	21.2	31.3	33.2	7.1	21.1	-35.3	-5.6	24.3	11.5	2.4	-5.1	-16.2
1939 - 1950	-28.5	-7.8	6.3	-7.1	13.1	2.6	-1.0	3.1	8.3	11.2	-1.3	10.9
1951 - 1962	6.7	6.8	9.3	13.5	8.5	15.5	11.7	-6.4	11.1	18.4	7.9	9.9
1963 - 1974	11.5	0.0	20.5	4.5	16.5	4.3	19.0	-8.6	12.1	18.1	27.0	-5.6
1975 - 1986	-1.6	3.8	9.6	6.1	26.3	6.4	4.0	22.6	-12.9	9.4	20.8	7.3
1987 - 1998	-8.3	-0.4	22.5	16.2	17.2	8.3	14.6	0.1	14.5	6.9	7.5	24.8
1999 - 2010	27.0	-2.7	30.3	18.7	-11.0	0.9	15.2	-9.3	15.6	24.0	-67.7	9.5
2011 - 2014	3.3	6.2	10.7	2.0	-	-	-	-	-	-	-	-

EQ COMBI	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig	Rat	Ox	Tiger
1927 - 1938	9.9	14.2	0.7	-9.3	-16.0	-4.4	33.4	-3.0	21.8	16.9	-19.0	0.3
1939 - 1950	-5.6	-0.3	3.7	8.8	17.8	13.0	15.2	-4.3	3.7	4.0	4.5	16.5
1951 - 1962	1.6	3.9	1.1	15.2	6.6	6.1	-0.5	10.0	5.1	5.8	6.3	1.0
1963 - 1974	7.5	5.1	13.2	1.9	13.0	9.6	-6.5	2.7	4.5	1.2	2.9	-3.9
1975 - 1986	8.7	8.5	6.2	6.9	12.9	1.3	3.0	14.5	4.9	4.7	8.7	5.1
1987 - 1998	-4.7	4.7	3.5	-0.8	10.3	8.8	10.4	-2.6	8.8	5.3	7.5	2.2
1999 - 2010	9.9	3.7	11.8	2.0	12.6	3.8	8.3	2.2	-2.8	-3.7	-3.6	9.9
2011 - 2014	-0.1	8.1	8.8	1.2	-	-	-	-	-	-	-	-