NBER WORKING PAPER SERIES

MOMENTUM IN IMPERIAL RUSSIA

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Working Paper 21700
http://www.nber.org/papers/w21700

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2015

William Goetzmann is with the Yale School of Management and NBER. Simon Huang is with the Cox School of Business, Southern Methodist University. We would like to thank Narasimhan Jegadeesh, Adam Kolasinski, Geert Rouwenhorst, Jim Smith, Rex Thompson, Kumar Venkataraman, as well as seminar participants at Southern Methodist University and Yale University.

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NBER Working Paper No. 21700
November 2015
JEL No. G10,G12,G14,G23,N2

ABSTRACT

Some of the leading theories of momentum have different empirical predictions about its profitability conditional on market composition and structure. The overconfidence explanation provided by Daniel, Hirshleifer, and Subrahmanyam (1998), for example, predicts lower momentum profits in markets with more sophisticated investors. The information-based theory of Hong and Stein (1999) predicts lower momentum profits in markets with lower informational frictions. The institutional theory of Vayanos and Woolley (2013) predicts lower momentum profits in markets with less agency. In this paper, we use a dataset from a major 19th century equity market to test these predictions. Over this period, there was no evidence of delegated management in Imperial Russia. A regulatory change in 1893 made speculating on the St. Petersburg stock market more accessible to small investors. We find a momentum effect that is similar in magnitude to those in modern markets and stronger during the post-1893 period than during the pre-1893 period, consistent with the overconfidence theory of momentum.

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1 Introduction

Momentum strategies, also known as relative strength strategies, are a class of long-short trading strategies that buy past winners and sell past losers. Jegadeesh and Titman (1993) first document the profitability of momentum strategies in a sample of U.S. stocks during the period of 1965 to 1989. Many other studies extend this initial finding by documenting momentum profitability in the post-1989 period, in equity markets outside of the U.S., and in other asset classes.[1] While there is an abundance of empirical evidence for momentum, the debate on its underlying mechanism remains unsettled. For instance, Daniel, Hirshleifer, and Subrahmanyam (1998) propose a model in which investor overconfidence about the precision of private information generates the momentum effect. In contrast, in Hong and Stein's (1999) model, the interaction of boundedly rational agents and the slow diffusion of information generate initial underreaction and subsequent overreaction. More recently, Lou (2012) and Vayanos and Woolley (2013) propose explanations of momentum driven by flows into and between institutional money managers.

Although these theories all generate the momentum effect, they have different predictions about momentum profitability conditional on market composition and structure. Tests of these predictions require significant variation for identification. In this paper, we use a comprehensive dataset of monthly stock returns from the St. Petersburg Stock Exchange in the 19th and early 20th centuries to test these predictions. The St. Petersburg Stock Exchange provides an ideal setting for investigating momentum because: 1) it is, as yet, an untouched sample for finance researchers;[2] 2) there was no evidence of a delegated manage-

[1]See, e.g., Rouwenhorst (1998), Jegadeesh and Titman (2001), and Asness, Moskowitz, and Pedersen (2013).

[2]The majority of academic studies of the momentum effect use the database of U.S. stocks maintained by the Center for Research in Security Prices (CRSP). The CRSP dataset starts in 1926. Even with the many

ment structure in the Russian Empire over this period;[3] and 3) a regulatory change in 1893 substantially reduced the costs of speculative trading for less sophisticated investors. The institutional theory predicts a muted momentum effect in such a market, as the institutions that the theory relies on to generate momentum were absent. The overconfidence theory predicts lower momentum profits during the pre-1893 period than during the post-1893 period because, in the later period, there was more market participation by those who were more susceptible to being overconfident. In contrast, the information diffusion theory predicts higher momentum profits during the pre-1893 period because market participation was narrower and information flow was slower.

Our results are most consistent with the investor overconfidence theory. Despite the absence of a delegated management structure in our setting, we find that past medium-term winners outperform past medium-term losers by as much as 74 basis points per month, which is similar in magnitude to momentum profits in modern markets. Exposure to the market factor cannot explain this outperformance. In addition, we find that the momentum effect is small and insignificant during the pre-1893 period but large and highly significant during the post-1893 period. A structural break test with unknown break date confirms this result and the estimated break date is just two months after the regulatory change. Furthermore, a placebo test that uses momentum returns from the London Stock Exchange shows that the same empirical regularity is not observed in a market that did not undergo a similar regulatory change.

Daniel and Moskowitz (2013) document that the momentum trade occasionally experi-

papers that use different samples, the issue of whether these samples are truly independent remains. For instance, Asness, Moskowitz, and Pedersen (2013) finds a strong common factor structure among momentum returns from a set of diverse markets and asset classes.

[3]The fund industry existed in the U.K. during this period but invested almost exclusively in bonds.

ences large crashes. This suggests that, whatever the mechanism, momentum profits could compensate for an infrequently occurring risk factor. Based on this idea, they propose a method to manage this extreme left-tail risk.[4] Interestingly, in our Russian sample, which extends more than 40 years, we find that, while momentum returns are somewhat negatively skewed, extraordinary crashes like those that occurred in the U.S. are absent. Our evidence, therefore, is less consistent with theories that attribute high average momentum profits to compensation for bearing crash risk and with the idea that momentum trading is a destabilizing force. From a practical perspective, the evidence also suggests that momentum strategies do not necessarily require protection against left-tail risk.

The remainder of the paper is organized as follows. Section 2 provides the historical background. Section 3 reviews related literature and develops the hypotheses. Section 4 presents the data and methodology. Section 5 establishes the results. Section 6 concludes the paper.

2 Historical Background

The St. Petersburg Exchange was established in the early 1800s, approximately one hundred years after the founding of the City of St. Petersburg. From 1732 to 1918, St. Petersburg was the capital of the Russian Empire. The first stocks traded on the St. Petersburg Stock Exchange in the early 1830s.[5] As the Russian economy developed, the numbers of corporations with shares traded on the St. Petersburg Stock Exchange grew rapidly. By 1914,

[4]See also Barroso and Santa-Clara (2013), Chuang and Ho (2013), Huang (2013), and Lou and Polk (2013).

[5]See Lizunov (2004).

more than two hundred Russian corporations had their shares listed.[6] Market participants consisted mainly of ruling elites, company insiders, and wealthy merchants. Compared to a modern stock market, delegated managers such as mutual funds were notably absent.[7]

During most of our sample period from January 1865 to July 1914, the Russian stock market was regulated by the corporate law of 1836. The goal of the law was to encourage corporate capitalism in the style of Western Europe while maintaining bureaucratic control in the traditional Russian style. Its primary weapon against speculation on the stock market was the strict ban on futures agreement. Article 29 (2167) categorically stated as follows:

> Any agreement among private persons, whether on the exchange or outside it, regarding the purchase and sale of stocks or notes not for cash, and with delivery at a future date and at a certain price, is absolutely forbidden. Furthermore, if such agreements are made known in court, they shall be considered null and void, and those individuals convicted of having made such agreements shall be punished under the law against games of chance. Brokers or notaries who dare to conclude such agreements shall be dismissed from their posts.

In the decades that followed, shortcomings of the law of 1836 became apparent and caused the tsarist policy markers to consider numerous reforms. However, due to the bureaucrats' more basic impulses of inertia and fear of change, most of these plans failed. One notable exception was the Russian law *PSZ* 3-9741, enacted on June 8, 1893. It removed the afore-

[6]See Owen (1991). The St. Petersburg Stock Exchange closed down due to World War I in July 1914. It reopened for two months in 1917 before it closed down again for 74 years after the Revolution of 1917.

[7]According to Abramov and Akshentceva (2014), the first mutual funds did not appear in Russia until 1997. Over some of the period of our study, investment funds in London traded in Russian securities, which raised the possibility of institutional influence via international channels. Virtually all British funds, however, held fixed-income securities. See, e.g., Goetzmann and Ukhov (2006) for details.

mentioned restrictions that prohibited futures dealings in stocks.[8] As a result of this new law, a speculative fever swept across Imperial Russia in the fall of 1893. According to Owen (1991), "instead of being confined [...] to the Hotel Demuth in Petersburg and, in Moscow, the Chizhov Court and the apartment of a Georgian princess, [trading activities] enveloped all the big hotels, as crowds of people who owned interest-bearing securities sold them to buy dividend-paying stocks whose values were soaring." (p. 138)

In the following sections, we examine this unique setting in detail using hand-collected share price and dividend data to test hypotheses about the specific grounds for the momentum effect. The results shed light on how unfettered speculation by broad spectrum of the public can rapidly and radically affect market efficiency.

3 Related Literature and Hypothesis Development

Momentum strategies buy past medium-term winners and sell past medium-term losers. Motivated by the observation that mutual funds tend to buy stocks that have recently performed well, Jegadeesh and Titman (1993) systematically investigate the profitability of such strategies for U.S. common stocks. For each portfolio formation month t, they form portfolios based on cumulative stock returns from month $t-J$ to $t-1$ and hold them for K months. They examine strategies with values of J that range from 3 to 12 months and values of K that also range from 3 to 12 months. Using data during the period of 1965 to 1989, they find that past winners significantly outperform past losers for all horizons considered by as much as 1.49% a month.

Unlike the findings for a number of other anomalies examined, Fama and French (1996)

[8] *PSZ* 3-9741 implicitly legalized time deals on stocks and bonds by forbidding such deals on gold currency and securities reckoned in gold, solely for the purpose of realizing a speculative profit.

find that their three-factor model cannot explain momentum profits. After controlling for the Fama and French (1993) factors, to which it is negatively correlated, momentum yields monthly alphas of 1.74%. This deepens the momentum puzzle. The inability of pre-existing asset pricing models to explain momentum has led researchers to add it as an additional risk factor (Carhart (1997)).

Momentum does not seem to be a spurious result of data mining, as its effects are also present when other basis assets are used. Rouwenhorst (1998) documents momentum in developed markets stocks, while Rouwenhorst (1999) finds evidence of momentum in emerging markets. Using a U.S. sample, Moskowitz and Grinblatt (1999) demonstrate that industry momentum strategies are just as profitable as individual stock momentum strategies. Asness, Moskowitz, and Pedersen (2013) show that momentum is also present in cross-country equity index, currency, and bond futures, as well as in commodity futures.

There is an ongoing theoretical debate as to what causes momentum. Using a risk-based framework, Berk, Green, and Naik (1999), Johnson (2002), and Sagi and Seasholes (2007) contend that past winners are riskier and, thus, that momentum is due to time-varying expected returns. In contrast, a number of behavioral models based on well-documented psychological evidence also yield momentum as an implication. Barberis, Shleifer, and Vishny (1998), Hong and Stein (1999), and Grinblatt and Han (2005) propose investor underreaction to news as an explanation of momentum, while De Long et al. (1990), Daniel, Hirshleifer, and Subrahmanyam (1998), and Barberis and Shleifer (2003) argue that momentum could be the result of overreaction to information by market participants.

This paper focuses on the investor overconfidence theory of Daniel, Hirshleifer, and Subrahmanyam (1998), the information-based theory of Hong and Stein (1999), and the institutional theory of Vayanos and Woolley (2013). The Vayanos-Woolley theory is based on flows between institutional money managers. Flows are triggered by changes in fund managers' efficiency, which investors can infer from past performance. Momentum arises if flows exhibit inertia and because rational prices underreact to expected future flows. According to this theory, because a delegated management structure is notably absent in our setting, the momentum effect should be relatively weak.[9]

The Daniel-Hirshleifer-Subrahmanyam model assumes a representative investor who is overconfident about the precision of his private signal. New public signals, on average, are viewed as confirming the validity of the investor's private signal. Thus, public information triggers further overreaction to a preceding private signal. This continuing overreaction causes momentum in security prices. According to this theory and the basic intuition that small, less sophisticated investors are more likely to exhibit the overconfidence bias, the momentum effect should be stronger during times when there is more market participation by these investors. In our sample, the post-1893 period is such a time. The Russian law *PSZ* 3-9741, enacted on June 8, 1893, removed all restrictions that prohibited futures dealings in stocks.[10] A speculative fever swept across Imperial Russia in the fall of 1893 as a result of this law. Taken together, the overconfidence theory predicts that the momentum effect should be stronger during the post-1893 period than during the pre-1893 period.

The prediction of the Daniel-Hirshleifer-Subrahmanyam model stands in contrast to that of the Hong-Stein model. In the Hong-Stein model, two groups of boundedly rational agents interact when information diffuses gradually across the population. Prices underreact in the short run so momentum trading is profitable. Because this theory argues that the momentum

[9]This prediction is not unique to the institutional theory. The data snooping critique of the momentum effect also predicts that there will be no momentum in this out-of-sample setting.

[10]These dealings are defined as any purchase of stock in the absence of cash and with delivery at a certain time in the future.

effect is caused by the slow diffusion of information, it predicts that momentum should be weaker during the post-1893 period than during the pre-1893 period. This is because the increased public interest in the stock market caused by *PSZ* 3-9741 and general technological progress in communication should have allowed information to flow faster in the post-1893 period.

The paper closest to ours is Chui, Titman, and Wei (2003). They focus on intra-industry momentum and on the real estate investment trust (REIT) industry in the U.S. They argue that the REIT industry experienced a structural change in 1990 and use this identification to test opposite predictions from the overconfidence theory and the information-based theory. For chronological reasons, they do not comment on Vayanos and Woolley (2013). Our dataset is independent of the CRSP dataset that is used by Chui, Titman, and Wei (2003) as well as by most other papers in this literature. Finally, their identification of the year 1990 is based on two different factors: 1) the financial difficulties of banks and savings and loans in the late 1980s and early 1990s that substantially reduced the amount of debt that was available to finance commercial real estate; and 2) the 1993 legislation that made it easier for pension funds to hold REITs in their portfolios.

Our paper is also part of an emerging literature on documenting momentum in historical equity markets. Chabot, Ghysels, and Jagannathan (2009) document momentum in the U.K. market over the period of 1866 to 1907. Geczy and Samonov (2013) compile a database of U.S. stock returns over the period of 1801 to 2012. They find that momentum is consistently profitable over this expansive period of time. Our current analysis not only supports these authors' findings that momentum is ubiquitous in pre-World War I markets but also allows a comparative analysis with respect to international correlation of momentum returns and documentation of the strategy's frequency of crashes over long periods.

4 Data and Methodology

Our dataset of end-of-month stock prices for all companies listed on the St. Petersburg Stock Exchange over the period from January 1865 to July 1914 was hand-collected from five different sources. From the periods of January 1865 to December 1890, January 1893 to December 1893, and January 1897 to December 1904, end-of-month prices are from the Yearbook of the Finance Ministry. From January 1891 to November 1892, end-of-month prices are from the Bulletin of the Finance, the Industries and Trade. For the month of December 1892, end-of-month stock prices are from the Stock Exchange Newsletter. For the periods of January 1894 to December 1896, January 1905 to December 1911, and January 1914 to July 1914, end-of-month stock prices are from the Commercial and Industrial Newspaper. Finally, from January 1912 to December 1913, end-of-month stock prices are directly from the St. Petersburg Stock Exchange. The data are available for download on the website of the International Center for Finance at the Yale School of Management.

The methodology that we used to process the raw data closely follows Goetzmann, Ibbotson, and Peng (2001). The month-end prices were obtained by searching the end-of-month issues for the last transaction price for each stock that month. When no transaction took place in the last week, the latest bid and ask prices were averaged. In total, we collected 43,736 end-of-month stock prices for 598 companies. From these, we calculated 38,090 monthly returns for 543 firms. There were three instances of 50% price drops, and we assume that they represent stock splits.[11] We computed only the returns when two adjacent prices were available, in a manner similar to that of CRSP. The number of firms in the universe averaged 64. It reached a high point in April 1912, with 206 listed firms.[12] The fact that

[11] Assuming otherwise does not change our results.

[12] In Goetzmann, Ibbotson, and Peng's (2001) old NYSE dataset, the number of firms peaked at 114 in

the number of firms concurrently listed peaked at under 210, while the total number of firms in the database exceeded 540 indicates that, not only did firms appear during the sample period, but that they also disappeared.

We were able to obtain dividend data for the period of 1885 to 1915 from the same sources. In total, we have 4,951 annual dividend payment observations for 478 companies. Because we do not know whether these publications always reported dividends for all stocks listed on the St. Petersburg Stock Exchange, we do not know whether exclusions of dividends meant that they were not paid or whether we failed to find them. The number of stocks for which we have an unbroken series of annual dividend payment observations is small. In analysis that follows, we assume that the dividends were paid at year-end, but changing this assumption does not change our results.

We control for market risk exposure in our asset pricing tests. Because we are limited by the fact that we lack data on shares outstanding, we use a simple procedure to construct a price-weighted market index. For each month in our sample, we calculate monthly returns for all stocks that trade in two consecutive months. We weight these returns by the price at the beginning of the two months. The return of the price-weighted index over period t, $r_{M,t}$, is defined as

$$r_{M,t} \equiv \sum_{i=1}^{N_t}(r_{i,t}w_{i,t}) = \sum_{i=1}^{N_t}(\frac{P_{i,t}+D_{i,t}}{P_{i,t-1}}\frac{P_{i,t-1}}{\sum_{j=1}^{N_t}P_{j,t-1}}) = \frac{\sum_{i=1}^{N_t}(P_{i,t}+D_{i,t})}{\sum_{j=1}^{N_t}P_{j,t-1}}. \quad (1)$$

Here, $r_{i,t}$ represents the return of security i over the period t, and $w_{i,t}$ represents the weight of security i over period t, which is equal to $P_{i,t-1}/\sum_{j=1}^{N_t}P_{j,t-1}$, as the index is price-weighted. Using a price-weighted index offers the benefit that its return closely approximates return to

May 1883.

a “buy and hold” portfolio over the period and, as such, is not sensitive to bid-ask bounce bias (Canina et al. (1998)).

5 Results

Figure 1 shows the cumulative return of the price-weighted St. Petersburg Stock Exchange (SPSE) index shown on a log scale. Table 1 shows summary statistics for the underlying monthly return of the index for the entire period of February 1865 to July 1914 and for each decade of the period. For comparison, we also calculate summary statistics for the NYSE index constructed by Goetzmann, Ibbotson, and Peng (2001) over the same sample period.

Over the entire period, the annual geometric return of the SPSE index is 5.78%, but there are periods of higher and lower growth. The annual geometric return is 9.7% in the second half of the 1860s and 1.85% in the 1900s. The long-term mean is slightly below the 5.82% annual growth experienced by the NYSE index over the same period. This long-term mean, however, is not a good estimate of the equity premium provided by the St. Petersburg stock market because we know that, ex post, buy-and-hold investors lost 100% of their investments after the Revolution of 1917. Finally, we observe that the volatility of the index varies considerably. It is 11.03% over the entire sample period, with a high of 17.06% in the 1860s and a low of 6.98% in the 1880s.

5.1 Momentum Profits

We investigate the profitability of momentum strategies in this no-delegated-management setting. The prediction based on Vayanos and Woolley’s (2013) institutional theory is that the momentum effect should be relatively weak in the St. Petersburg stock market. Stated differently, we ask whether the existence of a delegated management structure is a necessary condition for price continuation patterns. This investigation is also of interest from the point of view that previously uncovered momentum profits could be a result of data snooping.

We follow Jegadeesh and Titman (1993) in forming the momentum strategies. The portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns. An equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio, and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. Table 2 presents the average monthly returns of these portfolios for J and K that vary from a quarter to a year. To ensure that our results are robust to the effect of non-synchronous trading and the bid-ask bounce, which can be more important in our setting than in modern markets, we also produce results for which we skip the most recent month in the portfolio formation period.

Interestingly, in our Russian sample, momentum strategies are consistently profitable across different values of J and K, with the exception of the case where $(J, K) = (3,\ 3)$. Similar to the results originally provided by Jegadeesh and Titman (1993), the most successful zero-cost strategy selects stocks based on their returns over the previous 12 months and then holds the portfolio for 3 months. As shown in Panel A, this strategy yields 68 basis points per month when there is not a lag between the portfolio formation period and the holding period. As shown in Panel B, momentum yields 77 basis points per month when there is a one-month lag between the formation period and the holding period. In general, the returns are higher when there is a lag between the formation period and the holding period (Panel B) than when the formation period and the holding period are contiguous

(Panel A).

The natural question to ask next is whether exposure to the market factor can explain the observed momentum profits.[13] We use the price-weighted SPSE index to proxy for the market portfolio. Table 3 presents results from two ways of adjusting for market risk: 1) using the simple market model; and 2) using the market model where betas are allowed to vary with market conditions[14].

Similar to the results presented in Table 2, the risk-adjusted excess returns are both economically meaningful and statistically significant, with the exception of the case where $(J, K) = (3, 3)$. The raw profits are generally higher than the excess returns adjusted by the simple market model, which, in turn, are generally higher than the excess returns adjusted by the market model where betas are allowed to vary. Overall, excess returns of the momentum strategies cannot be accounted for by adjustments for market risk.

Following the momentum literature, we focus the rest of the paper on the momentum strategy where $(J, K) = (6, 6)$ and the most recent month in the portfolio formation period is skipped. The results for this strategy are representative of the results for the other strategies and are available upon request. Figure 2 provides a plot of the cumulative returns of the buy portfolio and the sell portfolio of this strategy together with the cumulative return of the price-weighted SPSE index.

[13]We do not have the data to construct the small-minus-big (SMB) and high-minus-low (HML) factors of Fama and French's (1993) three factor model.

[14]Rouwenhorst (1998) is one of the first papers to point out momentum strategies' time-varying factor exposures and to use such an adjustment methodology. See also Grundy and Martin (2001).

5.2 The Effects of a Regulatory Change

As noted, the government of Imperial Russia enacted the law *PSZ* 3-9741 on June 8, 1893, which removed all restrictions that prohibited futures dealings in stocks. We presume that those restrictions were more binding for small and less sophisticated investors. As a result, after the enactment of the law, market participation by those who were more likely to be overconfident increased. If the momentum effect is caused by investor overconfidence as in Daniel, Hirshleifer, and Subrahmanyam (1998), then momentum profits should be higher during the post-1893 period than during the pre-1893 period. In contrast, the information-based theory of momentum proposed by Hong and Stein (1999) would predict that the momentum effect should be stronger in the earlier period, when market participation was narrower and information flow was slower.

To confirm the argument that market participation by less sophisticated investors increased after the enactment of *PSZ* 3-9741, we begin our analysis by looking at changes in aggregate liquidity. Specifically, less sophisticated investors tend to engage in noise trading. In Glosten and Milgrom's (1985) model, a risk-neutral market maker sets a bid-ask spread that allows expected noise-trading profits to offset expected informed-trading losses. When they believe that they face a pool of more informed traders, they react by increasing the bid-ask spread.[15] Consistent with this prediction, both Lee, Mucklow, and Ready (1993) and Greene and Smart (1999) find a positive link between noise trading and liquidity. Because we lack detailed transaction data, we use a liquidity measure that relies on the incidence of observed zero monthly returns.[16]

[15]Glosten and Milgrom (1985) assume a setting with asymmetric information. If, in contrast, there is no asymmetric information, as in Demsetz (1968), a smaller pool of traders is sufficient to cause the bid-ask spread to increase.

[16]See Lesmond, Ogden, and Trzcinka (1999) for the theoretical treatment and Bekaert, Harvey, and

Specifically, we measure illiquidity using the price-weighted proportion of zero monthly stock returns. Table 4 provides the results from our analysis on the liquidity effects of *PSZ* 3-9741. It shows averages for the full sample and the periods before and after June 1893, as well as differences in means between the two subsamples.

Over the full sample, the average incidence of zero returns is 14% for all stocks.[17] We also divide each cross-section using stock price, which we use throughout this paper as a proxy for size, to investigate cross-sectional heterogeneity. Consistent with the idea that liquidity increases with size, the average incidence of zero returns is 17% for low-price stocks and 13% for high-price stocks. More important, we see from the fourth row that liquidity improved substantially and significantly after the enactment of *PSZ* 3-9741, and that the improvement is larger among small stocks, which small investors tend to favor. The last row shows that this liquidity effect is not simply due to a trend in the underlying data. The evidence thus supports the argument that average investor sophistication decreased after *PSZ* 3-9741.

Next, we compare momentum profits before and after *PSZ* 3-9741 to differentiate between the overconfidence theory and the information diffusion theory. Panel A of Table 5 shows the first set of results. In the first row, we see that the winners minus losers momentum strategy generates small and statistically insignificant profits of 5 basis points per month during the period of February 1865 to May 1893. In contrast, the same momentum strategy delivers large and highly significant profits of 82 basis points per month during the period of June 1893 to July 1914. The difference in average momentum profits between the pre-1893 period and the post-1893 period is 77 basis points per month and is significant at the 1% level. It is also interesting to note that the difference is contributed by both higher returns

Lundblad (2007) for an application in emerging markets.

[17]Bekaert, Harvey, and Lundblad (2007) report average incidence of zero *daily* returns that range from 8% for Korea to 52% for Colombia.

from the winners portfolio (89 basis points vs. 63 basis points) and lower returns from the loser portfolio (7 basis points vs. 53 basis points) in the later period. Similar to the liquidity effect, a trend in the momentum return cannot explain this finding.

We formally test for a structural break with unknown break date in the average return of the momentum portfolio by applying the Quandt (1960) and Andrews (1993) methodology. The null hypothesis of the Quandt-Andrews test is constancy of the mean against the alternative of a significant break of unknown timing. The methodology involves calculating a Chow (1960) F-statistic for all possible break dates in the interior $\pi_0\%$ to $(1-\pi_0)\%$ of the sample.[18] The $supF$-statistic is the maximum of these F-statistics and it does not follow the F-distribution. We use the critical values provided by Andrews (1993) and Andrews (2003).

Figure 3 plots these Chow (1960) F-statistics. The maximum F-statistic is obtained on August 1893, just two months after the passage of *PSZ* 3-9741. Its value, the $supF$-statistic, is 11.849 with a p-value of 0.011. The evidence, therefore, is consistent with the view that a structural break in the momentum effect occurred around the time *PSZ* 3-9741 was enacted.

Panel B of Table 5 shows the results of a placebo test that we conducted using momentum returns from Britain during the period of August 1866 to December 1892.[19] Britain did not undergo a similar regulatory regime change as Russia did in 1893; thus, we should not detect a significant difference in average momentum returns between the pre-1893 period and the post-1893 period in Britain. We see that this is indeed the case - the difference is 2 basis points and not statistically significant. Taken together, our results are more consistent with the overconfidence explanation of momentum.

[18] We use 15% trimming in this paper.

[19] We thank Ben Chabot for providing this data.

5.3 Investigating Momentum Crashes

Daniel and Moskowitz (2013) document that, in the U.S. equity market over the period of January 1927 to March 2013, the momentum trade on many occasions experiences large crashes. These crashes are driven by the infrequent yet large-scale reversals of past losers. Specifically, Table 2 of their paper shows that the 15 worst monthly momentum returns range from -24.04% in January 1974 to -74.36% in August 1932. This raises the possibility that peso problems could explain momentum, i.e., high average momentum profits are compensation for bearing momentum crash risk (Rietz (1988); Burnside et al. (2010)). We investigate such peso events in our sample. For a deeper understanding of momentum and for risk management, it is also important to know more about the frequency as well as the magnitude of the crashes.

Table 6 presents higher-order statistics of the momentum strategies. Panels A and B present skewness and excess kurtosis, respectively. They indicate that the momentum returns are, in general, negatively skewed and leptokurtic. The skewness coefficients average -0.39 and are an order of magnitude smaller than the skewness coefficient of -4.7 reported by Daniel and Moskowitz (2013) for momentum in the U.S. stock market. The values of excess kurtosis range from 2.22 to 4.95.

We target extreme outcomes of the return distributions. Panel C shows the minimum, or most negative, momentum return observations, and Panel D shows the maximum return observations. The panels indicate that the minimum returns are similar in magnitude to the maximum returns. More important, there is no evidence of momentum crashes similar to those documented by Daniel and Moskowitz (2013) for the modern U.S. stock market. The minimum ranges from -8% to -16%, while the maximum ranges from 8% to 15%. These results stand in stark contrast to those of Daniel and Moskowitz (2013) and suggest that crashes may not be an inherent feature of the momentum trade. We leave it for future researchers to investigate whether momentum crashes are caused by modern institutional features, such as delegated management.

5.4 Characteristics of Momentum Strategies

The literature on momentum investing also has documented that momentum profits reverse in the long run. For example, Jegadeesh and Titman (2001) document that, while momentum portfolios yield significantly positive returns during the first 12 months following the portfolio formation period, their cumulative returns in months 12 to 60 are negative.[20] They argue that this evidence is consistent with behavioral theories of momentum and reversal, but inconsistent with the risk-based theory proposed by Conrad and Kaul (1998).

We run a similar experiment whereby we look at the performance of the momentum strategy in event time. Specifically, we investigate the average return on buying past winners and selling past losers in the hth month after the strategy is put into place. Table 7 presents the results for the first 36 months after portfolio formation.[21] The average momentum returns are uniformly positive in the first 12 months after portfolio formation, after which they turn negative. In untabulated results, we find some indication of time variation in the risk exposure of the event time portfolios, but it is not sufficient to explain the profits. Even though the profits turn negative in the second year after portfolio formation, they are not always statistically significant. These results are strikingly similar to those of Jegadeesh and Titman (1993), Rouwenhorst (1998), and Jegadeesh and Titman (2001).

Figure 4 presents cumulative momentum returns over a 36-month period after portfolio

[20] See also Rouwenhorst (1998).

[21] Due to the limitations of our historical dataset, we do not look beyond month 36.

formation. It reveals a substantial reversal of profits in the second and third years. Cumulative momentum profits increase monotonically until they reach about 6% at the end of month 12. Then, over the next 24 months, as much as half of those profits are reversed.

Jegadeesh and Titman (1993) measure momentum profits on size-based subsamples to examine whether the profitability of the strategy is confined to any particular subsample of stocks. Later researchers generally find that momentum profits decrease with firm size, consistent with predictions from behavioral theories. The idea is that information tends to be more uncertain and diffuse more slowly for small stocks (Hong, Lim, and Stein (2000); Zhang (2006)). Again, we use price to proxy for size and present average returns of the momentum portfolios for two price-based subsamples in Table 8. We find that momentum profits in the high-price subsample are all lower and less statistically significant than in the low-price subsample. For the strategy where $(J, K) = (12, 3)$, the average return is 1% with a t-statistic of 5.51 in the low-price subsample and 0.41% with a t-statistic of 2.86 in the high-price subsample.

Jegadeesh and Titman (1993) find that the momentum strategy incurs significant losses in January but achieves positive abnormal returns in each of the other months. Grinblatt and Moskowitz (2004) study this seasonality carefully and attribute it to tax-loss selling. Because the Russian government did not tax capital gains, we can perform a placebo test for their hypothesis using our sample. Table 9 provides the average returns of the momentum strategy in each month of the year. Consistent with the tax-loss selling hypothesis, we do not find a significant seasonal effect for momentum in Russia.[22] For example, the momentum strategy has statistically insignificant losses in January. In addition, the F-statistics show

[22]Chabot, Ghysels, and Jagannathan (2009) also do not find a seasonal effect in momentum profits using a sample of British stocks from the Victorian era, during which capital gains also were not taxed.

that differences in momentum returns across the months are not statistically significant.

Finally, we present a robustness check in Table 10 to ensure that our results are not due to our treatment of missing data. Firms could drop out of the universe due to bankruptcy, and the worst-case scenario is that equity investors get nothing. We ask whether assuming a -100% return for exit firms would materially change our results. Our prior is that this assumption grossly understates the actual returns and introduces additional noise into the estimation process, which the data largely bear out. The average returns of the buy-minus-sell momentum portfolios are roughly the same under the alternative treatment of exit firms. The t-statistics, however, are generally lower but still significant at conventional levels.

6 Conclusion

In this paper, we demonstrate momentum profitability in a novel, untouched sample. The setting of our experiment - 19th century St. Petersburg Stock Exchange - has the unique features of the absence of a delegated management structure and the occurrence of an exogenous shock to market composition. We try to distinguish between three theories of momentum that have received much attention in the academic literature: the overconfidence theory of Daniel, Hirshleifer, and Subrahmanyam (1998), the information-based theory of Hong and Stein (1999), and the institutional theory of Vayanos and Woolley (2013). Our evidence is most supportive of the behavioral theory that momentum is caused by investor overconfidence.

References

Abramov, A., and K. Akshentceva, 2014, The Determinants of Mutual Funds Performance in Russia, *Working paper* .

Andrews, Donald W. K., 1991, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation, *Econometrica* 59, 817–858.

Andrews, Donald W. K., 1993, Tests for Parameter Instability and Structural Change with Unknown Change Point, *Econometrica* 71, 395–397.

Andrews, Donald W. K., 2003, Tests for Parameter Instability and Structural Change with Unknown Change Point: A Corrigendum, *Econometrica* 71, 395–397.

Asness, Clifford S., Tobias J. Moskowitz, and Lasse Heje Pedersen, 2013, Value and Momentum Everywhere, *Journal of Finance* 68, 929–985.

Barberis, Nicholas, and Andrei Shleifer, 2003, Style investing, *Journal of Financial Economics* 68, 161–199.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny, 1998, A model of investor sentiment, *Journal of Financial Economics* 49, 307–343.

Barroso, Pedro, and Pedro Santa-Clara, 2013, Momentum has its moments, *Working paper* .

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2007, Liquidity and expected returns: Lessons from emerging markets, *Review of Financial Studies* 20, 1783–1831.

Berk, Jonathan B., Richard C. Green, and Vasant Naik, 1999, Optimal Investment, Growth Options, and Security Returns, *Journal of Finance* LIV, 1553–1607.

Burnside, Craig, Martin Eichenbaum, Isaac Kleshchelski, and Sergio Rebelo, 2010, Do Peso Problems Explain the Returns to the Carry Trade?, *Review of Financial Studies* 24, 853–891.

Canina, Linda, Roni Michaely, Richard Thaler, and Kent Womack, 1998, Caveat Compounder: A Warning about Using the Daily CRSP Equal-Weighted Index to Compute Long-Run Excess Returns, *Journal of Finance* LIII, 403–416.

Carhart, Mark M., 1997, On Persistence in Mutual Fund Performance, *Journal of Finance* LII, 57–82.

Chabot, Benjamin, Eric Ghysels, and Ravi Jagannathan, 2009, Momentum Cycles and Limits to Arbitrage Evidence from Victorian England and Post-Depression US Stocks Markets, *Working paper* .

Chow, Gregory C., 1960, Tests of Equality Between Sets of Coefficients in Two Linear Regressions, *Econometrica* 28, 591–605.

Chuang, Hongwei, and Hwai-Chung Ho, 2013, Implied Price Risk and Momentum Strategy, *Review of Finance* 18, 591–622.

Chui, Andy C.W., Sheridan Titman, and K.C. John Wei, 2003, Intra-industry momentum: the case of REITs, *Journal of Financial Markets* 6, 363–387.

Conrad, Jennifer, and Gautam Kaul, 1998, An Anatomy of Trading Strategies, *Review of Financial Studies* 11, 489–519.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998, Investor Psychology and Security Market Under- and Overreactions, *Journal of Finance* LIII, 1839–1885.

Daniel, Kent, and Tobias Moskowitz, 2013, Momentum Crashes, *Working paper* .

De Long, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann, 1990, Positive Feedback Investment Strategies and Destabilizing Rational Speculation, *Journal of Finance* XLV, 379–395.

Demsetz, Harold, 1968, The Cost of Transacting, *Quarterly Journal of Economics* 82, 33–53.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

Fama, Eugene F., and Kenneth R. French, 1996, Multifactor Explanations of Asset Pricing Anomalies, *Journal of Finance* LI, 55–84.

Geczy, Christopher, and Mikhail Samonov, 2013, 212 Years of Price Momentum (The World's Longest Backtest: 1801-2012), *Working paper* .

Glosten, Lawrence R., and Paul R. Milgrom, 1985, Bid, ask and transaction prices in a specialist market with heterogeneously informed traders, *Journal of Financial Economics* 14, 71–100.

Goetzmann, William N., Roger G. Ibbotson, and Liang Peng, 2001, A new historical database for the NYSE 1815 to 1925: Performance and predictability, *Journal of Financial Markets* 4, 1–32.

Goetzmann, William N., and Andrey D. Ukhov, 2006, British Investment Overseas 1870-1913: A Modern Portfolio Theory Approach, *Review of Finance* 10, 261–300.

Greene, Jason, and Scott Smart, 1999, Liquidity Provision and Noise Trading: Evidence from the "Investment Dartboard" Column, *Journal of Finance* 54, 1885–1899.

Grinblatt, Mark, and Bing Han, 2005, Prospect theory, mental accounting, and momentum, *Journal of Financial Economics* 78, 311–339.

Grinblatt, Mark, and Tobias J. Moskowitz, 2004, Predicting stock price movements from past returns: the role of consistency and tax-loss selling, *Journal of Financial Economics* 71, 541–579.

Grundy, Bruce D., and J. Spencer Martin, 2001, Understanding the Nature of the Risks and the Source of the Rewards to Momentum Investing, *Review of Financial Studies* 14, 29–78.

Hong, Harrison, Terence Lim, and Jeremy C Stein, 2000, Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies, *Journal of Finance* LV, 265–295.

Hong, Harrison, and Jeremy C. Stein, 1999, A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets, *Journal of Finance* LIV, 2143–2184.

Huang, Simon, 2013, The Momentum Gap and Return Predictability, *Working paper* .

Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, *Journal of Finance* XLVIII, 65–91.

Jegadeesh, Narasimhan, and Sheridan Titman, 2001, Profitability of Momentum Strategies: An Evaluation of Alternative Explanations, *Journal of Finance* LVI, 699–720.

Johnson, Timothy C., 2002, Rational Momentum Effects, *Journal of Finance* LVII, 585–608.

Lee, Charles M. C., Belinda Mucklow, and Mark J. Ready, 1993, Spreads, Depths, and the Impact of Earnings Information: An Intraday Analysis, *Review of Financial Studies* 6, 345–374.

Lesmond, David A., Joseph P. Ogden, and Charles A. Trzcinka, 1999, A New Estimate of Transaction Costs, *Review of Financial Studies* 12, 1113–1141.

Lizunov, P.V., 2004, *Sankt-Peterburgskaia birzha i rossiiskii rinok tsennikh bumag, 1703-1917* (Unknown, St. Petersburg).

Lou, Dong, 2012, A Flow-Based Explanation for Return Predictability, *Review of Financial Studies* 25, 3457–3489.

Lou, Dong, and Christopher Polk, 2013, Comomentum: Inferring Arbitrage Activity from Return Correlations, *Working paper* .

Moskowitz, Tobias J., and Mark Grinblatt, 1999, Do Industries Explain Momentum?, *Journal of Finance* LIV, 1249–1290.

Owen, Thomas C., 1991, *The corporation under Russian law, 1800-1917: A study in tsarist economic policy* (Cambridge University Press, Baton Rouge, LA).

Quandt, Richard E., 1960, Tests of the Hypothesis That a Linear Regression System Obeys Two Separate Regimes, *Journal of the American Statistical Association* 55, 324–330.

Rietz, Thomas A., 1988, The Equity Risk Premium: A Solution, *Journal of Monetary Economics* 22, 117–131.

Rouwenhorst, K. Geert, 1998, International Momentum Strategies, *Journal of Finance* LIII, 267–284.

Rouwenhorst, K. Geert, 1999, Local Return Factors and Turnover in Emerging Stock Markets, *Journal of Finance* LIV, 1439–1464.

Sagi, Jacob S., and Mark S. Seasholes, 2007, Firm-specific attributes and the cross-section of momentum, *Journal of Financial Economics* 84, 389–434.

Vayanos, Dimitri, and Paul Woolley, 2013, An Institutional Theory of Momentum and Reversal, *Review of Financial Studies* 26, 1087–1145.

Zhang, X. Frank, 2006, Information Uncertainty and Stock Returns, *Journal of Finance* LXI, 105–137.

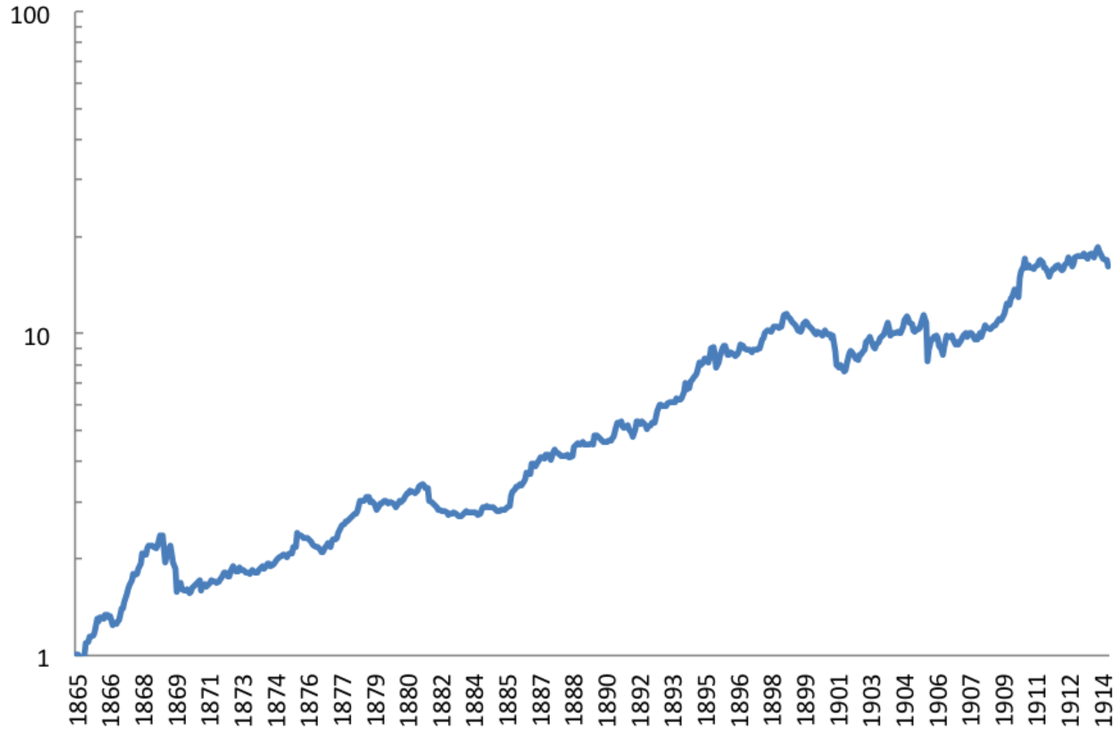

Figure 1: The Price-Weighted SPSE Index

This figure shows the cumulative return of the price-weighted SPSE index. The sample period is January 1865 to July 1914.

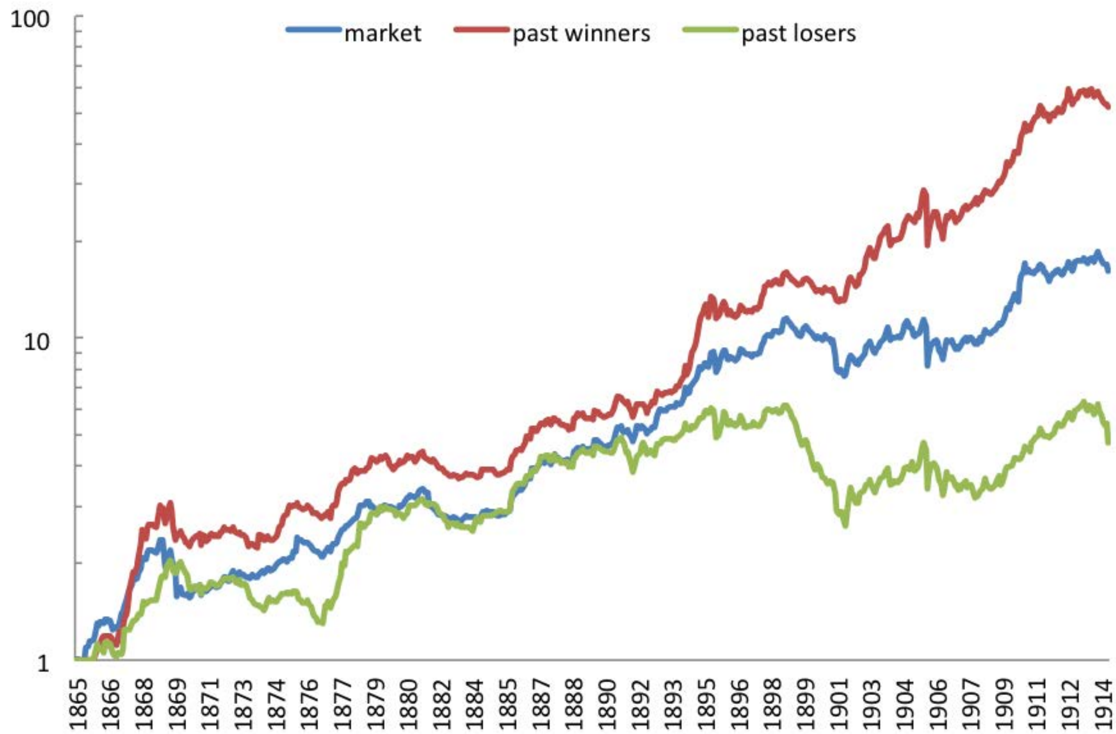

Figure 2: Momentum Performance in Imperial Russia

The momentum portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. This figure shows the cumulative returns of the price-weighted SPSE index, as well as the buy portfolio and the sell portfolio where $(J, K) = (6, 6)$. The sample period is January 1865 to July 1914.

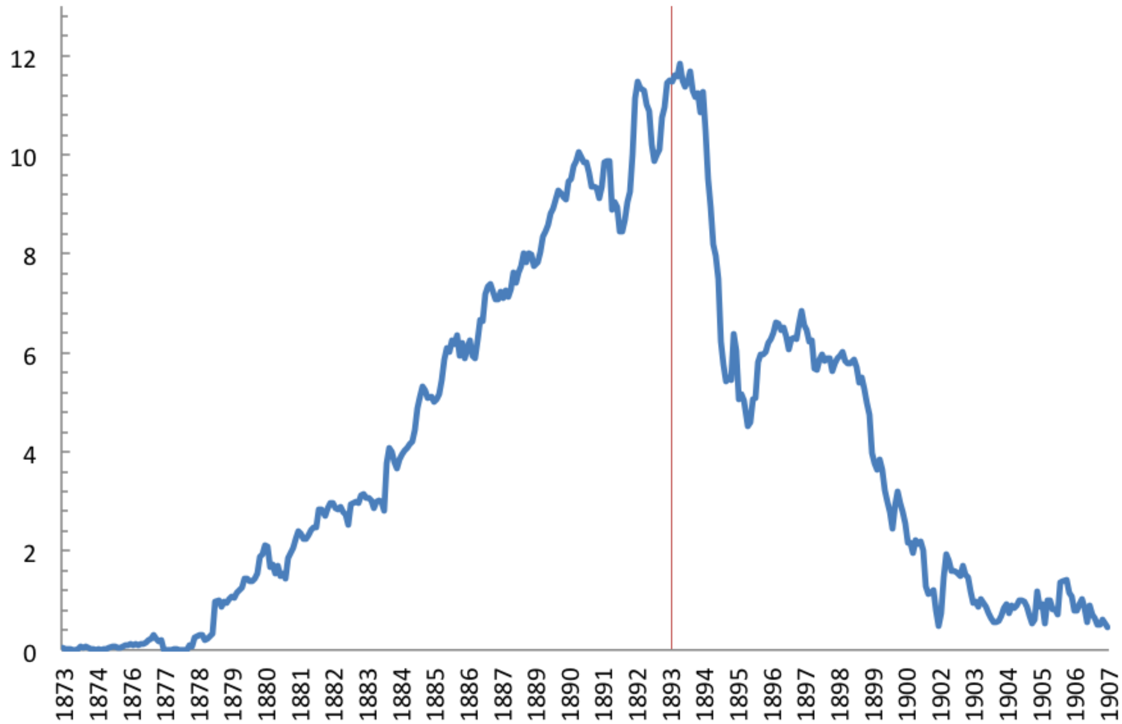

Figure 3: Chow (1960) F-statistics

This figure shows Chow (1960) F-statistics for structural breaks in the average momentum return between the first and last 15% of the sample period. The vertical line indicates the month of June 1893. F-statistics are computed using heteroskedasticity-and-autocorrelation-consistent covariance matrices of Andrews (1991). The sample period is January 1865 to July 1914.

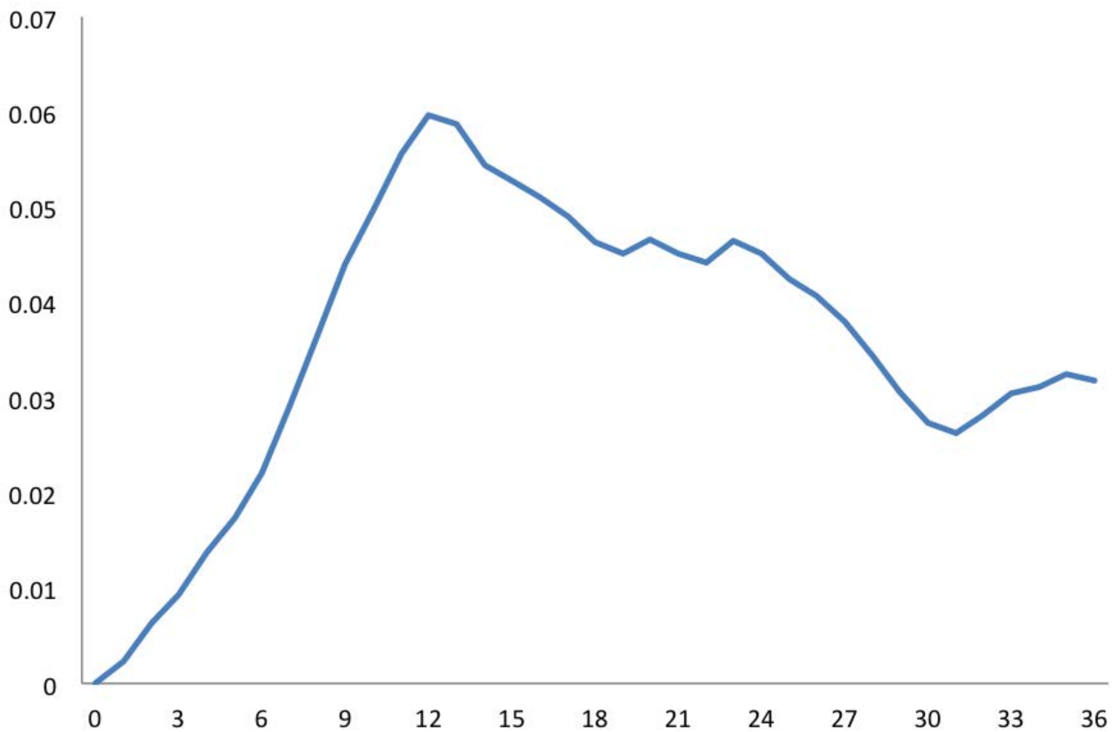

Figure 4: Cumulative Momentum Returns in Event Time

The momentum portfolios are formed based on 6-month lagged returns. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. This figure shows the average cumulative return to the zero-cost, buy minus sell, portfolio in each month following the formation period. The sample period is January 1865 to July 1914.

Table 1: Summary Statistics

This table presents summary statistics for the monthly return of the price-weighted SPSE index. The mean returns and standard deviation are in percentages and annualized. The sample period is January 1865 to July 1914.

Date	Arithmetic Mean	Geometric Mean	Standard Deviation
2/1865-7/1914	6.41	5.78	11.03
2/1865-12/1869	11.24	9.70	17.06
1/1870-12/1879	7.07	6.76	7.59
1/1880-12/1889	5.02	4.77	6.98
1/1890-12/1899	8.80	8.32	9.47
1/1900-12/1909	2.85	1.85	14.26
1/1910-7/1914	5.70	4.98	11.71
NYSE			
2/1865-7/1914	6.94	5.82	14.52

Table 2: Returns of Momentum Portfolios in Imperial Russia

The momentum portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. The average monthly returns of these portfolios are presented in this table. The values of J and K for the different strategies are indicated in the first column and row, respectively. The momentum portfolios in Panel A are formed using returns over the entire portfolio formation period, while the momentum portfolios in Panel B skip the most recent month in the formation period. t-statistics are in parentheses. The sample period is January 1865 to July 1914.

		Panel A				Panel B			
J	*K*=	3	6	9	12	3	6	9	12
3	Buy	0.0058	0.0069	0.0070	0.0074	0.0063	0.0072	0.0072	0.0072
		(3.85)	(4.81)	(5.18)	(5.40)	(4.23)	(4.98)	(5.21)	(5.27)
	Sell	0.0043	0.0041	0.0040	0.0032	0.0038	0.0041	0.0042	0.0039
		(3.04)	(3.04)	(2.99)	(2.44)	(2.65)	(2.94)	(3.11)	(2.94)
	Buy-Sell	0.0014	0.0028	0.0030	0.0043	0.0021	0.0030	0.0030	0.0035
		(1.16)	(2.89)	(3.47)	(5.35)	(1.91)	(3.24)	(3.83)	(4.94)
6	Buy	0.0066	0.0073	0.0080	0.0079	0.0075	0.0075	0.0081	0.0078
		(4.36)	(5.06)	(5.67)	(5.58)	(4.90)	(5.19)	(5.66)	(5.48)
	Sell	0.0037	0.0037	0.0028	0.0027	0.0031	0.0033	0.0026	0.0027
		(2.69)	(2.65)	(2.10)	(2.06)	(2.19)	(2.29)	(1.87)	(2.00)
	Buy-Sell	0.0028	0.0036	0.0051	0.0052	0.0040	0.0039	0.0051	0.0048
		(2.31)	(3.17)	(5.15)	(5.58)	(3.25)	(3.56)	(5.37)	(5.44)
9	Buy	0.0071	0.0083	0.0082	0.0079	0.0076	0.0082	0.0081	0.0077
		(4.79)	(5.72)	(5.72)	(5.51)	(5.08)	(5.63)	(5.59)	(5.30)
	Sell	0.0034	0.0024	0.0025	0.0027	0.0026	0.0020	0.0024	0.0028
		(2.38)	(1.72)	(1.83)	(2.01)	(1.86)	(1.46)	(1.75)	(2.14)
	Buy-Sell	0.0035	0.0058	0.0056	0.0052	0.0047	0.0063	0.0057	0.0047
		(2.83)	(5.16)	(5.30)	(5.09)	(3.90)	(5.55)	(5.39)	(4.75)
12	Buy	0.0083	0.0082	0.0078	0.0075	0.0086	0.0083	0.0080	0.0075
		(5.67)	(5.56)	(5.39)	(5.17)	(5.61)	(5.51)	(5.35)	(5.02)
	Sell	0.0016	0.0019	0.0023	0.0027	0.0008	0.0017	0.0022	0.0029
		(1.13)	(1.39)	(1.68)	(2.02)	(0.55)	(1.25)	(1.65)	(2.20)
	Buy-Sell	0.0068	0.0062	0.0056	0.0048	0.0077	0.0067	0.0059	0.0047
		(5.66)	(5.10)	(4.69)	(4.26)	(6.25)	(5.61)	(5.21)	(4.37)

Table 3: Risk-Adjusted Excess Returns

The momentum portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. The most recent month in the portfolio formation period is skipped. This table presents the risk-adjusted returns of the zero-cost, buy minus sell, portfolios. The values of J and K for the different strategies are indicated in the first column and row, respectively. The returns in Panel A are adjusted by regressing on the excess return of the price-weighted SPSE index. The returns in Panel B are adjusted by running regressions of the form

$$r_t = \alpha + \beta^{+} U_t r_{M,t} + \beta^{-}(1 - U_t) r_{M,t} + \epsilon_t,$$

where U_t is a dummy variable that is one if the excess return of the SPSE index is non-negative and zero otherwise. t-statistics are in parentheses. The sample period is January 1865 to July 1914.

J	*K*= 3	6	9	12
Panel A: Risk-Adjusted Excess Returns				
3	0.0021	0.0030	0.0030	0.0034
	(1.92)	(3.25)	(3.83)	(4.95)
6	0.0039	0.0039	0.0051	0.0048
	(3.28)	(3.57)	(5.40)	(5.50)
9	0.0047	0.0062	0.0057	0.0047
	(3.92)	(5.57)	(5.43)	(4.79)
12	0.0078	0.0067	0.0059	0.0047
	(6.35)	(5.68)	(5.29)	(4.45)
Panel B: Market Dependent Risk-Adjusted Excess Returns				
3	0.0029	0.0033	0.0028	0.0034
	(1.94)	(2.63)	(2.69)	(3.64)
6	0.0035	0.0038	0.0044	0.0045
	(2.17)	(2.55)	(3.39)	(3.81)
9	0.0042	0.0048	0.0046	0.0043
	(2.59)	(3.19)	(3.24)	(3.27)
12	0.0059	0.0051	0.0050	0.0045
	(3.61)	(3.21)	(3.32)	(3.15)

Table 4: The Effects of *PSZ* 3-9741 on Illiquidity

In the spirit of Bekaert, Harvey, and Lundblad (2007), the illiquidity measure is the price-weighted proportion of zero monthly stock returns. This table presents tests of the difference in illiquidity before and after *PSZ* 3-9741, a Russian law dated June 8, 1893. The law removed all restrictions that prohibited futures dealings in stocks. These dealings are defined as any purchase of stock in the absence of cash and with delivery at a certain time in the future. The results in the last row are obtained by regressing on a dummy variable that is one if the month is on or after June 1893 and zero otherwise and a trend variable. t-statistics are in parentheses.

	All Stocks	Low-Price	High-Price
Full sample	0.1353	0.1679	0.1260
	(22.56)	(22.75)	(20.27)
Pre-1893: February 1865-May 1893	0.1694	0.2180	0.1555
	(19.91)	(20.38)	(17.35)
Post-1893: June 1893-July 1914	0.0896	0.1008	0.0865
	(12.33)	(12.80)	(11.46)
Post-1893 Minus Pre-1893	-0.0797	-0.1173	-0.0690
	(-6.83)	(-8.30)	(-5.64)
Post-1893 Minus Pre-1893	-0.1275	-0.1871	-0.1115
controlling for trend	(-5.65)	(-6.87)	(-4.70)

Table 5: The Effects of *PSZ* 3-9741 on Momentum Returns

The momentum portfolios are formed based on 6-month lagged returns and held for 6 months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. This table presents tests of the difference in average momentum returns before and after *PSZ* 3-9741, a Russian law dated June 8, 1893. The law removed all restrictions that prohibited futures dealings in stocks. These dealings are defined as any purchase of stock in the absence of cash and with delivery at a certain time in the future. The momentum portfolios in Panel A are formed using stocks listed on the St. Petersburg Stock Exchange from February 1865 to July 1914. The momentum portfolios in Panel B are formed using stocks listed on the London Stock Exchange from August 1866 to December 1907. The results in the last row of each panel are obtained by regressing on a dummy variable that is one if the month is on or after June 1893 and zero otherwise and a trend variable. t-statistics are in parentheses.

	Winners (W)	Losers (L)	W-L
Panel A: Momentum in Russia (February 1865-July 1914)			
Pre-1893: February 1865-May 1893	0.0063	0.0053	0.0005
	(3.83)	(3.15)	(0.33)
Post-1893: June 1893-July 1914	0.0089	0.0007	0.0082
	(3.56)	(0.29)	(5.33)
Post-1893 Minus Pre-1893	0.0026	-0.0046	0.0077
	(0.89)	(-1.58)	(3.53)
Post-1893 Minus Pre-1893	0.0116	-0.0036	0.0142
controlling for trend	(2.05)	(-0.64)	(3.32)
Panel B: Momentum in Britain (August 1866-December 1907)			
Pre-1893: August 1866-May 1893			0.0036
			(2.54)
Post-1893: June 1893-December 1907			0.0034
			(1.73)
Post-1893 Minus Pre-1893			-0.0002
			(-0.07)
Post-1893 Minus Pre-1893			-0.0013
controlling for trend			(-0.30)

Table 6: Higher-Order Statistics of Momentum Portfolios

The momentum portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. This table presents the higher-order statistics of the zero-cost, buy minus sell, portfolios. The values of J and K for the different strategies are indicated in the first column and row, respectively. Panel A and Panel B present skewness and excess kurtosis, respectively. Panel C presents the smallest observed monthly returns. Panel D presents the largest observed monthly returns. The sample period is January 1865 to July 1914.

J	*K*=	3	6	9	12
		Panel A: Skewness			
3		-0.25	-0.31	-0.39	-0.25
6		-0.24	-0.83	-0.25	-0.27
9		-0.55	-0.42	-0.44	-0.37
12		-0.25	-0.47	-0.52	-0.45
		Panel B: Kurtosis			
3		4.54	5.14	4.94	4.50
6		4.06	6.41	4.20	4.55
9		2.61	2.59	2.70	2.53
12		2.93	2.61	2.68	2.59
		Panel C: Minimum			
3		-0.12	-0.10	-0.09	-0.08
6		-0.14	-0.16	-0.11	-0.10
9		-0.12	-0.12	-0.11	-0.10
12		-0.12	-0.12	-0.12	-0.11
		Panel D: Maximum			
3		0.13	0.10	0.09	0.08
6		0.15	0.11	0.11	0.11
9		0.12	0.10	0.10	0.09
12		0.15	0.11	0.10	0.10

Table 7: Momentum Returns in Event Time

The momentum portfolios are formed based on 6-month lagged returns. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. This table presents the average returns of the zero-cost, buy minus sell, portfolio in each month following the formation period. h is the month after portfolio formation. The sample period is January 1865 to July 1914.

h	Avg. Monthly Return	t-stat	h	Avg. Monthly Return	t-stat
1	0.0023	1.56	19	-0.0011	-0.65
2	0.0040	2.80	20	0.0014	0.90
3	0.0030	2.02	21	-0.0014	-0.95
4	0.0043	2.91	22	-0.0009	-0.56
5	0.0037	2.70	23	0.0021	1.48
6	0.0045	3.21	24	-0.0013	-0.86
7	0.0071	4.92	25	-0.0026	-1.71
8	0.0073	5.55	26	-0.0016	-1.03
9	0.0069	4.71	27	-0.0026	-1.78
10	0.0054	3.63	28	-0.0035	-2.45
11	0.0057	3.99	29	-0.0037	-2.35
12	0.0038	2.80	30	-0.0031	-2.05
13	-0.0009	-0.70	31	-0.0011	-0.67
14	-0.0040	-3.09	32	0.0018	1.11
15	-0.0016	-1.14	33	0.0022	1.28
16	-0.0016	-1.14	34	0.0008	0.45
17	-0.0020	-1.22	35	0.0013	0.85
18	-0.0026	-1.66	36	-0.0006	-0.41

Table 8: Returns of Price-Based Momentum Portfolios

The momentum portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. The average monthly returns of these portfolios, formed using price-based subsamples of stocks, are presented here. The values of J and K for the different strategies are indicated in the first column and row, respectively. Panel A and Panel B present, respectively, the momentum portfolios formed using the low-price subsample and the high-price subsample. t-statistics are in parentheses. The sample period is January 1865 to July 1914.

		Panel A: Low-Price				Panel B: High-Price			
J	*K*=	3	6	9	12	3	6	9	12
3	Buy	0.0077	0.0082	0.0084	0.0083	0.0047	0.0052	0.0055	0.0056
		(4.58)	(4.87)	(5.20)	(5.14)	(3.05)	(3.50)	(4.01)	(4.19)
	Sell	0.0036	0.0044	0.0045	0.0041	0.0032	0.0035	0.0038	0.0033
		(1.94)	(2.43)	(2.57)	(2.48)	(2.23)	(2.74)	(3.02)	(2.63)
	Buy-Sell	0.0041	0.0037	0.0038	0.0042	0.0016	0.0015	0.0018	0.0023
		(2.57)	(2.95)	(3.46)	(4.44)	(1.26)	(1.53)	(2.14)	(3.02)
6	Buy	0.0073	0.0080	0.0091	0.0088	0.0055	0.0061	0.0064	0.0062
		(4.12)	(4.74)	(5.41)	(5.23)	(3.29)	(3.89)	(4.39)	(4.39)
	Sell	0.0026	0.0033	0.0025	0.0022	0.0030	0.0029	0.0028	0.0028
		(1.42)	(1.79)	(1.45)	(1.36)	(2.29)	(2.20)	(2.12)	(2.15)
	Buy-Sell	0.0044	0.0042	0.0060	0.0060	0.0025	0.0028	0.0034	0.0030
		(2.60)	(2.68)	(4.32)	(4.79)	(1.73)	(2.35)	(3.40)	(3.18)
9	Buy	0.0076	0.0093	0.0098	0.0094	0.0059	0.0067	0.0063	0.0061
		(4.48)	(5.31)	(5.65)	(5.44)	(3.74)	(4.50)	(4.36)	(4.27)
	Sell	0.0015	0.0013	0.0015	0.0020	0.0032	0.0026	0.0029	0.0032
		(0.75)	(0.72)	(0.90)	(1.25)	(2.38)	(1.94)	(2.18)	(2.47)
	Buy-Sell	0.0059	0.0071	0.0078	0.0068	0.0025	0.0037	0.0035	0.0029
		(3.06)	(4.45)	(5.11)	(4.92)	(1.92)	(2.95)	(3.05)	(2.57)
12	Buy	0.0095	0.0095	0.0102	0.0095	0.0065	0.0066	0.0063	0.0058
		(5.29)	(5.46)	(5.82)	(5.44)	(3.99)	(4.29)	(4.25)	(4.02)
	Sell	-0.0011	0.0008	0.0015	0.0024	0.0024	0.0025	0.0029	0.0038
		(-0.58)	(0.47)	(0.85)	(1.39)	(1.76)	(1.85)	(2.14)	(2.80)
	Buy-Sell	0.0100	0.0078	0.0081	0.0066	0.0041	0.0037	0.0033	0.0019
		(5.51)	(4.82)	(5.02)	(4.40)	(2.86)	(2.73)	(2.60)	(1.56)

Table 9: Momentum Returns by Calendar Months

The momentum portfolios are formed based on 6-month lagged returns and held for 6 months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. This table presents the average returns of the zero-cost, buy minus sell, portfolio by calendar months. t-statistics are in parentheses. p-values for the F-test that the returns are jointly equal in all calendar months are in brackets. The sample period is January 1865 to July 1914.

	All Stocks	Low-Price	High-Price
Jan.	-0.0044	-0.0103	0.0011
	(-1.06)	(-1.31)	(0.22)
Feb.	-0.0001	0.0048	-0.0046
	(-0.02)	(0.64)	(-1.13)
Mar.	0.0001	-0.0043	0.0012
	(0.02)	(-0.91)	(0.31)
Apr.	0.0035	0.0063	0.0002
	(1.07)	(1.43)	(0.03)
May	0.0003	0.0038	-0.0012
	(0.06)	(0.77)	(-0.26)
Jun.	0.0045	0.0027	-0.0004
	(1.24)	(0.56)	(-0.13)
Jul.	0.0144	0.0136	0.0153
	(3.57)	(2.88)	(3.49)
Aug.	0.0060	0.0042	0.0060
	(2.31)	(1.24)	(1.97)
Sep.	0.0054	0.0049	0.0056
	(1.20)	(0.86)	(1.99)
Oct.	0.0057	0.0087	0.0042
	(1.76)	(1.76)	(1.26)
Nov.	0.0054	0.0078	0.0033
	(1.25)	(1.46)	(0.56)
Dec.	0.0065	0.0086	0.0038
	(2.12)	(1.65)	(0.91)
F-statistic	1.55	1.33	1.45
	[0.11]	[0.20]	[0.15]

Table 10: Sensitivity to Treatment of Exit Firms

The momentum portfolios are formed based on J-month lagged returns and held for K months. The stocks are ranked in ascending order on the basis of the lagged returns and an equally weighted portfolio of stocks in the lowest past return tercile is the sell portfolio and an equally weighted portfolio of the stocks in the highest return tercile is the buy portfolio. The average monthly returns of these portfolios are presented in this table. The values of J and K for the different strategies are indicated in the first column and row, respectively. The results in Panel A are presented earlier and do not assume exit firms have a -100% return. The results presented in Panel B assume exit firms have a -100% return. t-statistics are in parentheses. The sample period is January 1865 to July 1914.

		Panel A				Panel B			
J	$K=$	3	6	9	12	3	6	9	12
3	Buy	0.0063	0.0072	0.0072	0.0072	0.0008	0.0023	0.0022	0.0024
		(4.23)	(4.98)	(5.21)	(5.27)	(0.45)	(1.39)	(1.37)	(1.44)
	Sell	0.0038	0.0041	0.0042	0.0039	-0.0031	-0.0026	-0.0018	-0.0015
		(2.65)	(2.94)	(3.11)	(2.94)	(-1.70)	(-1.47)	(-1.05)	(-0.93)
	Buy-Sell	0.0021	0.0030	0.0030	0.0035	0.0035	0.0048	0.0040	0.0041
		(1.91)	(3.24)	(3.83)	(4.94)	(2.33)	(3.65)	(3.64)	(3.80)
6	Buy	0.0075	0.0075	0.0081	0.0078	0.0025	0.0024	0.0028	0.0028
		(4.90)	(5.19)	(5.66)	(5.48)	(1.32)	(1.34)	(1.54)	(1.58)
	Sell	0.0031	0.0033	0.0026	0.0027	-0.0034	-0.0027	-0.0030	-0.0027
		(2.19)	(2.29)	(1.87)	(2.00)	(-1.95)	(-1.49)	(-1.66)	(-1.54)
	Buy-Sell	0.0040	0.0039	0.0051	0.0048	0.0055	0.0049	0.0054	0.0051
		(3.25)	(3.56)	(5.37)	(5.44)	(3.05)	(2.98)	(3.41)	(3.49)
9	Buy	0.0076	0.0082	0.0081	0.0077	0.0029	0.0030	0.0032	0.0031
		(5.08)	(5.63)	(5.59)	(5.30)	(1.54)	(1.57)	(1.71)	(1.75)
	Sell	0.0026	0.0020	0.0024	0.0028	-0.0029	-0.0035	-0.0029	-0.0024
		(1.86)	(1.46)	(1.75)	(2.14)	(-1.65)	(-1.85)	(-1.55)	(-1.28)
	Buy-Sell	0.0047	0.0063	0.0057	0.0047	0.0056	0.0066	0.0059	0.0054
		(3.90)	(5.55)	(5.39)	(4.75)	(3.18)	(3.40)	(3.31)	(3.06)
12	Buy	0.0086	0.0083	0.0080	0.0075	0.0035	0.0033	0.0031	0.0029
		(5.61)	(5.51)	(5.35)	(5.02)	(1.70)	(1.67)	(1.60)	(1.54)
	Sell	0.0008	0.0017	0.0022	0.0029	-0.0045	-0.0036	-0.0029	-0.0019
		(0.55)	(1.25)	(1.65)	(2.20)	(-2.57)	(-1.87)	(-1.54)	(-1.03)
	Buy-Sell	0.0077	0.0067	0.0059	0.0047	0.0079	0.0071	0.0062	0.0050
		(6.25)	(5.61)	(5.21)	(4.37)	(3.99)	(3.46)	(3.12)	(2.72)