Two Centuries of Multi-Asset Momentum

(Equities, Bonds, Currencies, Commodities, Sectors and Stocks)

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Abstract

Extending price momentum tests to the longest available histories of global financial assets, including country equities, government bonds, currencies, commodities, sectors and U.S. stocks, we create a 215-year history of cross-sectional multi-asset momentum, and confirm the significance of the momentum premium inside and across asset classes. Consistent with stock-level results, we document a large variation of momentum portfolio betas, conditional on the direction and duration of the state of the asset class in which the momentum portfolio is built. A significant recent rise in pair-wise momentum portfolio correlations suggests features of the data important for empiricists, theoreticians and practitioners alike.

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The academic study of price momentum has grown extensively since Jegadeesh and Titman (1993) found that buying winning stocks and selling losers generated significant positive returns over one through ten month holding periods. Indeed, there is a momentum to the momentum literature. We did a search for the term 'momentum' in the SSRN database and plot the number of studies per year that mention momentum either in the title or the abstract, shown in Figure I. For example, in 2013 there are approximately 300 papers containing the 'momentum' term. The continuing academic interest in the momentum strategy is paralleled among both institutional and, recently, retail investors via strategies and products including momentum-focused ETFs, liquid alternatives, and various trend-driven rotation strategies (Antonacci (2014), Faber (2013)). In fact, the cumulative increase of capital allocated to this strategy might have partly caused the significant recent increase of pair-wise correlations between momentum returns across different asset classes.

We set out to create and examine the longest possible history of the global asset momentum effect to better understand its time-series properties, and to better explain the general characteristics already discovered in more recent history. In addition, documenting momentum "crashes" (Daniel and Moskowitz (2014)) in any given asset class would be useful since, while they appear in recent experience, they do so rarely. We find that they are more frequent before the second half of the 20th century, creating a potential underestimation of the inherent risk associated with the premia if only 1950 - present be considered.

The first contribution of this study is the creation of a long-run dataset of global financial asset return histories back to 1800. Using Global Financial Data databases and additional data available through Bloomberg, we create an expanded dataset going back to 1800, which includes 47 country equity indices, 48 currencies (including Euro), 43 government bond indices, 76 commodities, 301 country-sectors, and 34,006 U.S. stocks. In addition to mapping and organizing the large quantity of time-series, we also create spliced time-series in cases where multiple indices were available, in order to create the longest possible histories for the individual countries and sectors. The splicing effort had an especially notable impact on the availability of long-run country-sector data, extended to 1800 for 33 countries. A comprehensive map of identifiers and link dates used in this study is available in Appendix, and asset return characteristics are shown in Table I.

The second contribution of this study is the extension of the price momentum history back to 1800 for this extended sample of assets, both within and across six asset classes. We test for the cross-sectional momentum effect on the mostly untested monthly data from 1800 to 2014. For example, to our knowledge all studies of cross-sectional country-level momentum begin at or after 1965 (Moskowitz, Ooi and Pedersen (2012)). However, there are two recent papers that extend trend and industry momentum tests into the 19th century (Lemperiere *et al.* (2014), and Szakmary and Zhou (2013)). We document that on average, since 1800, momentum effect appears significant in all asset classes, except in commodity spot prices where it is significantly opposite.[2] In Figure III, we plot the 10-year rolling and log-cumulative excess returns of the average of the six intra-asset class momentum portfolios (country-equities, currencies, country-bonds, commodities, country-sectors, U.S. stocks) plus one cross-asset class momentum portfolio (equities, currencies, bonds, and commodities). Generating a 215-year history of global multi-asset class price momentum, we document that the effect is consistently significant in each asset class, across asset classes, and in combination.

Between 1800 and 2014, country-equity momentum has the largest average long-short spread of 0.88% per month (t-stat 10.6), followed by currencies with a spread of 0.51% per month (t-stat 9.6). Inverse commodity momentum generates 0.45% per month (t-stat 5.5), U.S. stock momentum generates 0.51% per month (t-stat 6.0), country-neutral sector momentum generates 0.36% per month (t-stat 6.6), and global country bond momentum averages 0.13% per month (t-stat 2.3). Cross-asset class momentum strategy, consisting of four asset classes, generates 0.45% per month (t-stat 10.2). The equally-weighted combination of the six intra-asset class level plus one cross-asset class momentum strategies averages a long-short spread of 0.45% per month (t-stat 15.4).

The third contribution of this study is the replication of the dynamic beta property of the widely studied in the U.S. stock momentum portfolios (Grundy and Martin (2001), Geczy and Samonov (2016)). We confirm that the long-short momentum portfolios exhibit significant variation of beta to the average return of the corresponding asset class from which portfolios are formed, consistent with literature. These effects are present in each of the six asset classes and in the cross-asset class momentum. One consequence of this effect is evidenced by the large

[2] Since commodity futures data essentially start after 1959, we measure commodity momentum and return using changes in spot prices, which significantly differ from the futures returns.

difference of the average trailing market return preceding the months with the largest and the lowers momentum returns. Specifically, on average, the assets return 12% preceding the 20 most positive momentum months, and 0% preceding the 20 most negative ones. Further, we explore the relation between momentum portfolio betas and the sign and duration of the trailing market state, resulting in conclusions consistent with Geczy and Samonov (2016), and now generalized to the six asset classes. Specifically, the longer an up or down market state persists, the larger the absolute value of the momentum portfolio beta, creating a dynamic risk profile of momentum over a given market cycle of the corresponding asset class.

Finally, a number of additional observations become possible from the long-run data. First, we observe strong mean reversion in commodity spot prices, an effect which is very persistent over the entire sample. The effect is especially strong in the commodities that do not have futures data, while it deteriorates in the commodities that do have a futures contract – adding potential evidence to the research on financialization of commodity markets (Hamilton and Wu (2012), Basak and Pavloval (2013), Corbet and Twomey (2014), Van Hemert (2014)). Second, we test for the short-run and long-run reversal effects and find consistent evidence of long-run reversion and short-run continuation, with the exception of the U.S. stocks, which experience a short-run reversal (consistent with Asness, Moskowitz and Pedersen (2013)). Third, we are able to compare momentum to its time-series cousin, the trend indicator, which is gaining increasing popularity in institutional and retail portfolios (Han and Zhou (2012), Clare et al. (2012), Hurst *et al.* (2012), Faber (2013), Antonacci (2014), Lemperiere *et al.* (2014)). We find that when a comparable definition is used, momentum outperforms trend, yet both remain highly significant. Finally, we document two additional versions of momentum effects: first we observe momentum in the momentum time-series themselves, consistent with style-timing literature (Chen De Bondt (2004) and Kim (2010)); and second, we observe that country bond momentum is cross-sectionally priced not only it the bond market but also in the country equity market, similar to the findings by Lee, Naranjo and Sirmans (2014).

The rest of the paper is organized as follows: Section I highlights some of the prior literature; Section II describes the data and momentum construction methodology; Section III discusses the results; Section IV documents the sources of momentum profits and its dynamics

over market cycles; Section V explores the robustness of the results and alternative weighting methods; Section VI documents two additional momentum portfolios; Section IX concludes.

I. Background

We build upon, extend and broaden the following studies: "Global Tactical Cross-Asset Allocation: Applying Value and Momentum Across Asset Classes" Blitz and van Vliet (2008), "Time Series Momentum" Moskowitz, Ooi and Pedersen (2012), and "Value and Momentum Everywhere" Asness, Moskowitz and Pedersen (2013). Blitz and van Vliet momentum history starts in 1986 with 49 assets; Moskowitz, Ooi and Pedersen start in 1965 using 58 assets, and Asness, Moskowitz and Pedersen start in 1975 with 65 assets. This study starts in 1800 and covers 515 non-stock assets and 34,795 U.S. stocks. Figure II displays the number of assets in this study over time.

In individual asset classes we build upon a number of studies. For example, Menkhoff, *et al.* (2011) study momentum in 48 currencies since 1976. Miffre and Rallis (2006), Erb and Harvey (2006) and Gorton, Hayashi and Rouwenhorst (2012) study momentum in more than 30 commodities since 1969. In equity markets, Chan, Hameed and Tong (2000) study momentum in 23 country indices since 1980, Balvers and Wu (2001) document momentum in 18 countries since 1969, and Muller and Ward (2010) document momentum in 70 countries since 1970. Rouwenhorst (1998) documents momentum in international stocks since 1980. Jostova *et al.* (2010), Durham (2013), and Lee (2014) respectively document momentum in corporate bonds, term structure of interest rates and the CDS market. Szakmary and Zhou (2013) extend industry momentum to 1871. In asset-class momentum we achieve similar results to Lemperiere, *et al.* (2014) who extend asset class trend strategies to 1800. In addition, in cross-momentum momentum tests, we extend Chen De Bondt (2004) and Kim (2010) who study style momentum in U.S. stocks and in global financial assets, respectively.

Dynamic properties of momentum portfolio risks, and specifically the beta component, have been studied extensively in the stock-level data in Korati and Shanken (1992), Moskowitz, (1999), Grundy and Martin (2001), Chordia and Shivakumar (2002), Griffin and Martin (2003), and Daniel and Moskowitz (2014). Our results document a strongly dynamic beta component of momentum portfolios in each asset class. Coupled with the recently increased pair-wise

correlations across momentum strategies, and a large number of previously unobserved 10-year momentum drawdowns over the data since 1800, our analysis highlights the inherent risks in the strategy, potentially not fully appreciated by the investment community.

Lead-lag momentum ('spill-over momentum'), in which cross-sectional momentum of one asset class correlates with subsequent returns in another asset class, has been examined recently by Bakshi and Panayotov (2013) and Lu and Jacobsen (2014) who document respectively that carry trade profits are predicted by commodity price movements and by equity momentum. Gebhardt, Hvidkjaer, and Swaminathan (2005) also document a spillover momentum from company stocks into bonds. Lee, Naranjo and Sirmans (2014) document a spillover effect from CDS momentum to stock returns in the U.S. stock-level data. We document similar results in country-level equity and fixed income indices, finding over the long-run that bond momentum leads country equity returns.

The literature on trends has rapidly grown as a parallel, time-series manifestation of momentum results in and across asset classes (*e.g.*, Han and Zhou (2012), Clare *et al.* (2012), Faber (2013), and Antonacci (2014)). We run comparison tests between the time-series and cross-sectional specifications, and find that while both are significant, when comparable signal definitions are used cross-sectional returns have greater statistical significance over the full sample.

Finally, in commodities, spot price mean reversion has been studied by several authors including Bessembinder, Coughenour, Seguin, and Smoller (1995), Irwin, Zulauf and Jackson (1996), Schwartz and Smith (2000) and Wang (2004). We also, inadvertently, contribute to the literature on the financialization of commodity markets by documenting disappearance of spot price mean reversion in the commodities that have traded futures. For example, Slade and Thille (2006) find that a presence of derivatives lowers the level of return of the underlying commodity, while Basak and Pavlova (2013) show that commodities which are included in an index have higher inner dependencies than the ones not included in the index. Hamilton and Wu (2013) disagree and do not find evidence of index fund investing affecting commodity futures prices. Corbet and Twomey (2014) find evidence that introduction of large commodity ETFs significantly increase commodity volatility. Zaremba (2014) reports a finding that commodities that have large non-commercial investor participation experience significant degradation of

momentum and basis premia. And most recently, Van Hemert (2014) finds that monthly flows in and out of CTA funds around month-end trading days are the main driver of commodity futures momentum.

II. Data and Methodology

All primary data are downloaded from the Global Financial Data (GFD). The U.S. stock and U.S. sector-level data is from Geczy and Samonov (2016), and the Center for Research on Security Prices (CRSP). Supplemental data that cover the more recent years is obtained from Bloomberg and is used to extend the earlier histories. We also obtain data country short-term yield data from Federal Reserve (FRED), and early U.S. T-Bill data from Jeremy Siegel's website. Most of the price data start on December 31, 1798; consequently, for the majority of asset classes, price momentum returns start on January 31, 1800; and all data end on May 2014. Sector momentum portfolios start on 1804, and U.S. stock momentum returns start on 1801. In a separate section on commodities, we use data back to 1531. Our dataset contains data for 47 country-equity indices, 48 currencies (including the Euro), 43 government-bond indices, 76 commodities, 301 country-sectors, and 34006 U.S. stocks. For each asset class, we construct both the price-only and total return versions of momentum return time-series, while maintaining the definition of momentum as price-only changes, used in both price and total return results. For equity and bond markets, our total return data is back to 1800. For sectors, the total return data is limited to the U.S country and for commodities, total returns are limited to the post-1959 period with data for the commodity futures. For currencies, total returns are derived by adding the relative return of the corresponding country's risk free rate returns vs. the U.S. T-bill. In addition, while the default momentum portfolio returns are in local currencies, we also construct USD versions, to test for robustness. While the quality of many of the indices in the GFD database, especially in the early history, is less robust than the customary indices of today, we believe they do provide an important estimate of the behavior of financial assets during the early history. A detailed discussion of the data is provided in Appendix A.

Our measure of momentum is the 10 month change in price with a 2 month skip defined as $P_{i,t-2} / P_{i,t-12.}$ If data are available, we start all momentum computations on December 31, 1798 and generate the first month of momentum strategy return on January 31, 1800. The first 13 months of price data are split between the 11 months used to compute the 10-month momentum,

2 months skipped for the reversal effect, and 1 month to compute the first portfolio return.[3] We skip the two months of the reversal effect preserving consistency of momentum definitions between asset classes and the U.S. stocks, used in Geczy and Samonov (2016). We test this assumption by studying the return of the skipped months by themselves, and momentum with 'skip 1 month' and 'no skip.' In all assets, except for the U.S. stocks and country bonds, the results are more conservative when the 2 months are skipped, consistent with AMP (2013).

The default momentum strategy goes long the third of assets with the highest momentum, (the winner portfolio W), and shorts the third of assets with the lowest momentum (the looser portfolio L). All asset returns are equally-weighted within the W and L portfolios, and the strategy rebalances monthly. Our results mainly focus on the one-month-forward returns of the momentum premium, but we do test the longer-term structure of the payoffs up to 36 months. For robustness, we also compute the GDP and volatility-weighted versions of momentum portfolios, with similar results.

Because commodity spot price returns behave differently from rolled futures, our commodity spot momentum results are significantly negative, opposite from the standard results that utilize the rolled futures to measure returns. We discuss this further in the results section, but it is important to note that, except if noted otherwise, our commodity spot momentum results reported in tables use the inverse of the standard momentum definition (*i.e.* $P_{i,t-12} / P_{i,t-2}$).

The global country-neutral sector momentum portfolio is construed by ranking sectors on momentum within their corresponding countries first, assigning each sector to either a W or L portfolio for each country. The global country-neutral sector momentum portfolio holds all the individual country W and L portfolio positions. We report results for each individual country as well as for the combined portfolio.

III. Momentum Over the Long-Run

A. Overall Results

[3] One-month reversal in the U.S. stocks is documented by Poterba and Summers (1988), and Jegadeesh (1990).

Momentum returns are significant in all six asset classes and across the four asset classes. A way to summarize our findings is to create a combined momentum strategy that equally weights the six individual strategies and the cross-asset class momentum strategy. We equally weight the monthly return streams of the winners, the losers, and the W-L spreads of each individual momentum strategy.

$$CombPort(t) = 1/n \sum_{n=1}^{7} Port(n,t) \quad (1)$$

Table II shows that during the complete history, the W-L *CombPort* generates price-only average return of 0.45% per month (t-stat 15.4) and total return of 0.35% per month (t-stat 12.7). For comparison, during the same period, we document that the global country equity total return averages 0.86% per month (t-stat 15.8), as shown in Table I. Over the same period, the average U.S T-bill rate is 0.36% per month, resulting in the global equity risk premium of 0.5% per month. Hence, implementation and transaction cost issues aside, the momentum premia of 0.45% per month is on par with the global country equity risk premia of 0.5%. It is an important empirical result that is yet to be reconciled and included in the standard financial models, such as the latest Fama and French five factor model (Fama and French (2014).

Over 10-year rolling periods, *CombPort* momentum is positive during most of the 215-year history with three negative 10-year periods in the 19th century. During the rest of the history, the 10-year rolling return to the W-L combined portfolio varies between 5% and 10%, with occasional momentum bubbles, such as in the 1930s and 1990s when the annualized 10-year spread varies around 15%. Consistent with the U.S. Stock momentum results, on average, the spread is higher in the 20th century than it is in the 19th century. This could be attributed either to the data quality or perhaps some more fundamental characteristic of more active financial markets. Table II shows the returns to the combined and individual momentum strategies measured both in price changes and total returns. Figure III plots the cumulative and annualized 10-year rolling excess returns of the *CombPort*, W, and L Portfolios.

Over the full history, country equity momentum has the largest W-L spread of 0.88% per month (t-stat 10.6), followed by currencies with the spread of 0.51% per month (t-stat 9.6). Inverse commodity momentum generates 0.45% per month (t-stat 5.5), U.S. stock momentum generates 0.51% per month (t-stat 6.0), country-sector momentum generate 0.36% per month (t-

stat 6.6), and global country bond momentum generates 0.13% per month (t-stat 2.3). Cross-asset class momentum strategy consisting of 4 asset classes generates 0.45% per month (t-stat 10.2). Results are symmetrical in terms of the contribution from the winner and loser portfolios. The largest asymmetry occurs in currencies where the loser portfolio excess return vs. average is -0.33% per month compared to the winner portfolio's excess return vs. average of 0.18% per month, shown in Table II.

Table III shows the calendar decade returns for each of the seven and combined momentum strategies. It is apparent that there are more negative decades in individual asset class momentum portfolios in the 19th century, and fewer in the 20th. The *CombPort* momentum history does experience one negative calendar decade in the 1820s, and it has three negative 10-year rolling periods in the 1820s, 1850s and 1860s as noted above. This long-run view provides both the out-of-sample support for the long-run profitability of momentum across asset classes as well as a caution about the potential long-run risks of extended underperformance as seen in the 19th century data.

B. Country Equity Momentum

The cleanest and longest data series is available for the country equity indices. Perhaps as a result, momentum in the country equity category is the strongest averaging 0.88% per month, which is consistent with results from analysis of a shorter timeframe covered in literature (for example, APM (2013) finds momentum spread of 0.88% per month between 1978 and 2011). The W portfolio contributes 0.52% vs. average country equity return (t-stat 11.7), while the L contributes -0.34% vs average (t-stat -7.9). Using the total return definition of returns, we get slightly lower results with overall W-L spread of 0.66% per month (t-stat 7.5), 0.35% of excess return coming from W and -0.31% from the L. This decrease might be partly attributable to the decreased sample size, as the average number of countries per month drops from 18.4 in the price-only to 12.8 in the total return dataset. In Geczy and Samonov (2016), we confirm that dividend yields of the W and L price momentum sorted portfolios are not statistically different.

Another observation from the data is a unique 20-year period from the late 1970s to late 1990s, during which country equity momentum local price returns reached extremely high levels. For example, at the peak, the annualized 10-year rolling W excess return reaches 47.6% in 1993

shown in Figure IV. During this time, many countries in our sample experienced periods of hyperinflation which distort the local currency results. When converted to USD, the returns during this period almost halve in size, with the W portfolio's USD excess return reaching the 10-year rolling peak of 26.1% per year. Nevertheless, this 20-year period is still the most profitable streak for country equity momentum compared to the rest of the history.

Finally, it is useful to note the 32-year period from 1840 to 1872, during which the 10-year rolling W-L country equity momentum return is negative. These results rely only on five countries with data during that period; nevertheless, they are consistent with the observation from the U.S. stock-level momentum study (Geczy and Samonov (2016)), where we show at least four decade-long negative momentum returns in the 19th century. All of this empirically suggests a non-zero probability of extended periods of underperformance of the country equity momentum.

C. Currency Momentum

Between 1800 and 2014, currency spot momentum generates a significant premium of 0.51% per month, with 0.18% of excess return contributed by the W and -0.33% by the L portfolios. These results are consistent with published literature; for example, Menkhoff *et al.* (2011) document 0.69% per month of the 9-month spot momentum. However, the time-series examination of the momentum profits reveals a very inconsistent nature of the currency momentum premia (Figure IV). Momentum in currencies is heavily affected by the periods with severe currency volatilities caused by various events associated with pegging / un-pegging of exchange rates, currency devaluations, gold standard changes, hyper-inflations and wars. Specifically, three periods stand out: 1920 to 1930; 1940 to 1950, and 1980 to 1990. During all three periods, currency spot momentum experiences large W-L returns, with 10-year rolling spread reaching the peaks of 39% in 1926, 14% in 1951 and 51.4% in 1991.

Interestingly, when adjusted for the interest rate differentials between countries, the 1980 - 2000 period momentum results become negative during this period. This is caused by the hyper-inflationary countries, in which interest rates more than offset the changes in currency spots. Of course, in many of these instances, capital flows are restricted, hence this is meant to be an illustrative exercise whose purpose is breadth and length, and not the implementation

feasibility of currency portfolios. During the rest of the history, adjusting spot returns for interest rates has little effect on currency momentum, except in the very beginning of the sample in the 1810s.

Overall, data point to two key long-run features of currency momentum. First, the selection of currencies and their corresponding country exchange rate regime, interest and inflation rates, has a large effect on the currency momentum returns. Secondly, returns to currency momentum are even less consistent than in other asset classes, and are heavily clustered around periods with severe currency volatilities.

D. Government Bond Momentum

Having the lowest volatility of all asset classes, government bond momentum generates the lowest returns, with 0.23% of total return spread (t-stat 3.8). Bond price-only momentum, where price is proxied by P = 1 / Yield, generates 0.13% per month (t-stat 2.3). These results are consistent with literature that generally finds weaker momentum results in bonds than other asset classes. For example, AMP (2013) finds no significance in the fixed income momentum factor, and Jostova *et al.* (2010) document 0.37% per month in corporate bond momentum. In that light, our long-run results, utilizing the large number of bonds, generates robust evidence that, although less than in other asset classes, momentum is statistically present in government bonds. Figure IV shows the 10-year rolling history of W and L total excess returns. Consistent with other asset classes, bond momentum returns during the 19th century are more volatile and experience larger frequency of 10-year negative returns, yet high volatility also occurs in the 1920s and 1950s. The most recent period from 1990 to 2014 experiences the largest and longest stretch of positive performance. Over the long-run, converting the local bond returns to USD results in no significant difference for momentum returns (W-L spread of 0.26% in USD vs. 0.23% in local currency, as shown in Table II).

E. Commodity Momentum (or Mean Reversion)

Unfortunately, there are no electronically available commodities futures data before 1959. Unlike other asset classes, because of the very strong seasonal and cyclical supply/demand effects and the resulting backwardation and contango of the futures curves, continuously rolled futures have a significantly different return path than spot price returns (Fama *et al.* 1987,

Pindyck 2001, Gorton *et al.* 2005., Erb *et al.* 2006). This difference of returns has an important implication for price momentum tests. Specifically, in prior academic studies of commodity momentum, returns are measured via the rolled futures returns, and commodity spot prices are proxied by the near-term futures price. It has been successfully shown that both commodity spot price and futures price momentum are priced in the futures market (Gorton *et al.* 2007, Fuertes *et al.* 2013). However, when commodity spot prices, such as the ones available from GFD, are used to measure performance of the momentum premia, results become significantly negative, indicating 10-month mean reversion rather than return continuation. Results in Table II for the commodity category display the reverse momentum strategy ($P_{i,t-12} / P_{i,t-2}$) in order to make them comparable and combinable with other asset momentum returns.

Commodity spot mean reversion was studied by several authors in the past including Bessembinder, Coughenour, Seguin, and Smoller (1995), Irwin, Zulauf and Jackson (1996), Schwartz and Smith (2000) and Wang (2004) among others. Our results come out from the attempt to capture momentum in commodity spots, which instead exhibit mean reversion. We investigate mean-reversion further and summarize results in Table IV (which reports the returns to direct commodity momentum ($P_{i,t-2} / P_{i,t-12}$)). Hence, our starting point becomes the -0.46% monthly W-L return to direct commodity spot momentum portfolio from 1800 to 2014. To explore mean reversion further, first, we use all available commodity data back to 1531 (!) and get very similar results. Specifically, from 1531 to 2014, the average W-L commodity spot momentum generates -0.57% per month (t-stat -8.3) (Figure V).

Secondly, since 1959, we use 46 commodity futures (list available in Appendix D) and compute momentum portfolio returns using the near term rolled and un-rolled future price changes, which is the conventional proxy for the spot price. Since 1959, direct momentum W-L portfolio return measured in future spot returns is -0.07% per month, compared to the typically reported 0.97% per month when the rolled future return is used. Hence, since 1959, using the 46 commodities that have futures data, neither momentum nor mean reversion exist in spot returns. We validate this fact by using a subset of GFD spot prices for the same 46 commodities that have futures data after 1959. This results in direct momentum W-L return of -0.08% per month since 1959 – very similar to the -0.07% observed in the futures spot returns. We then test these same 46 commodities over the full sample and observe a significantly negative return. From 1800 to

2014, the 46-commodity momentum portfolio generates -0.29% (t-stat -3.3). Therefore, using the 46 commodities that have futures starting in 1959, we observe significant 10-month mean reversion in spot prices before 1959 and insignificant after.

This result raises a question of whether the mean reversion effect in spot prices is affected by the presence of traded futures for the corresponding commodities. There is a long and recently still vibrant debate of whether presence of commodity speculators in the derivatives markets changes the risk / return properties of the underlying commodities (for example Slade and Thille (2006) Basak and Pavlova (2013), Hamilton and Wu (2013), Corbet and Twomey (2014), Zaremba (2014)). We are interested in whether the presence of derivatives markets affects the returns of the cross-sectional mean reversion factor in the spot prices – raising the traditional question of whether the phenomenon was arbitraged away with the presence of easily traded and liquid instruments.

To investigate this, we construct momentum portfolios from the remaining 30 commodity spots (out of 76 total) that do not have a traded future since 1959. In this subset, the mean reversion effect both before and after 1959 is very significant. From 1959 to 2014, the momentum portfolio built using the 30 commodities without futures generates -0.82% per month (t-stat -3.4), compared to -0.07% per month using the 46 commodities with futures. Over the longer timeframe, from 1800 to 2014, the 30-commodity momentum portfolio returns -0.95% per month (t-stat -6.1), compared to -0.29% per month (t-stat -3.3) for the 46 commodities with futures. Since futures markets have been active before 1959, it is possible that this financialization of mean reversion had been occurring before 1959. Overall, it appears that commodities which do not have a traded future experience significant mean reversion before and after 1959, while the commodities with traded futures experience weaker mean reversion before 1959 and no mean reversion after. This adds some empirical validity to a hypothesis that the presence of traded futures eliminates the mean reversion effect in the spot prices, as shown in Figure V and Table IV,

We look into commodity spot seasonality as one potential explanation of the mean reversion effect. Commodity seasonality was studied by several authors including recently by Sorensen (2002) and Borovka and Geman (2006). When ranking commodity spots on 10-month trailing return, the momentum portfolio will be significantly loading on the seasonality effect.

During the months that the seasonal pressures on spot prices are highest, the trailing spot price momentum for that commodity is strongest, placing it into the winner or loser portfolio. Hence, potentially, a portion of the negative return to momentum comes from the reversion of the seasonal nature. To study this, we try different ways of removing the seasonality component. First, we test a definition of momentum that looks at 12-month change in spot prices, effectively looking at the price change between the same calendar months of different years, as a result taking out any intra-year seasonal effect. The W-L 12-month momentum return is almost identical to the 10-month momentum (-0.45%, t-stat -5.7 for the 12-month momentum vs. -0.46%, t-stat -5.7 for the 10-month momentum, Table IV, Figure V).

Secondly, we construct a 12-month rolling average price for each commodity, and measure our standard 10-month momentum signal using the 12-month average price. Averaging the price removes the seasonality component, and the momentum signal attempts to capture the trend changes. Results become even more significantly negative. From 1800 to 2014, the W-L portfolio averages -0.77% (t-stat -9.2) per month (Table IV, "De-seasonal_1").

Next, we apply a 10-year rolling auto-regressive model with 11 dummy variables to directly remove the influences of each of the 12 calendar months. Specifically, we estimate the following regression each month for each commodity using the trailing 120 months of data:

$$r_{i,t} = b_0 + b_1 * D_1 + b2 * D_2 \ldots . b_{11} * D_{11} + e_{i,t} \qquad (2)$$

where $r_{i,t}$ is the return of commodity *i* during month *t*, and $D_1..D_{11}$ are dummy variables corresponding to 11 calendar months.

To construct the second de-seasonal measure of momentum, we compute the 10-month cumulative residual return, where residuals come from equation (2) (Table IV, "De-seasonal_2"). The complete removal of all 12 auto-correlations results in insignificant momentum results (-0.12% t-stat -1.5). Yet, by definition, momentum is driven by some autocorrelation between trailing months and future months; therefore, complete removal of all 12 autocorrelations removes momentum and mean reversion effects that arise from the non-seasonal features as well as the seasonal ones. Given the evidence in our sample, we cannot attribute the mean reversion effect to the seasonality component of commodity spot prices. In sum, it appears that there is

significant mean reversion outside of the seasonality effect present in commodity spot prices that do not have a futures contract.

F. Country-Neutral Sector Momentum

A significant expansion of our sample of momentum results occurs due to our global country-neutral sector momentum portfolios, which utilize data for 301 sectors from 33 countries. Between 1804 and 2014, the country-neutral W-L sector portfolio generates 0.36% per month (t-stat 6.6), with 0.16% coming from the W and -0.20% from the L portfolios. This result is consistent with the U.S.-only sector momentum return spread of 0.3% from 1800 to 2014 (Geczy and Samonov (2016)), and is about double the 0.16% per month alpha level reported by Szakmary and Zhou (2013) between 1871 and 2014. Importantly, the country-neutral sector momentum profits are positive in 30 out of the 33 countries, in which we have data for at least six sectors. The three negative countries (China, New Zealand and Russia) have the fewest number of sectors and the shortest data histories, which could be partially responsible for the negative results. Of the 30 countries with positive sector momentum, 23 have W-L average return t-statistics above 2, shown in Table V. Considering the small number of sectors in W and L portfolios (maximum of three, if all 11 sectors are available), these results appear robust. The combination of all countries' winner sectors outperforms the average of all sectors by 0.16% per month (t-stat 5.4), and the loser sectors underperform by -0.20% per month (t-stat -6.7). As a result of strong diversification, inherent in combining 33 country-level sector momentum strategies, country-neutral sector momentum W-L return spread is highly consistent over rolling 10-year timeframes, as compared to individual asset classes. Figure IV shows the 10-year rolling excess returns of the W and L country-neutral sector momentum portfolios, displaying significant persistence in the spread since mid-1800. Nevertheless, the 10-year rolling W-L return experiences negative periods during the 1830s and 1850s, but not since.

Because sector momentum portfolios are country-neutral, there is no reason to convert the returns to USD from local prices, as only, the fractionally small, relative outperformance of the W vs. the L portfolios would be subject to any currency fluctuation, under the assumption that the collateral is invested in USD. Total return version of the sector momentum, which only uses the U.S. sector total return data from CRSP, averages 0.81% per month (t-stat 6.7) from 1927 to 2014.

G. Cross-Asset Class Momentum

In addition to the six momentum strategies described above, we construct a cross-asset class momentum portfolio from the four asset classes in our study (equities, bonds, currencies and commodities). Each asset class is defined as the equally-weighted average return of the underlying. The resulting W-L momentum spread is 0.45% per month (t-stat 10.2), with 0.22% excess return coming from the W and -0.23% from the L portfolios. This effect is surprisingly consistent, given that there are only two assets per long and short portfolios. The correlation between this cross-asset class momentum and individual asset class returns is relatively low: the highest is with equities at 27%, next largest is with currencies at 22%, and it is about 18% with currencies and 17% with bonds. In total returns, the spread is even more significant, averaging 0.64% per month (t-stat 11.9), with 0.32% of excess return coming from the W and L portfolios. Because of the strong diversification of each asset class across individual assets, the cross-asset momentum results have the highest t-statistics of any other momentum time-series, only surpassed by the combination of all momentum time-series together. Figure IV demonstrates the long-term profitability and cyclicality of the 10-year rolling W-L portfolio.

There has been an increase in popularity of the ass class momentum investment products and literature, as witnessed by a recent escalation of blogs, books, and other conversations dedicated to exploiting asset class trends and momentum (for example Antonacci 2014, Greserman and Kaminsky 2014). We believe it is prudent to pay attention to the long-run properties and potential outcomes of momentum investing, which include both the long periods of negative performance as well as short periods of momentum crashes. As in individual asset classes, the cross-asset class momentum is not immune to 10-year long drawdowns, as can be witnessed in the 1860's, 1870's, and more recently in 2000's. Yet, supported by the new data, over the long-run, asset class momentum is a statistically robust and consistent effect.

H. Short-Term and Long-Term Reversals

Traditionally, in the post-1925 U.S. stock-level momentum tests, one month of returns is skipped after the momentum signal is computed and before capturing the returns (Jagadeesh and Titman (1993)). The month is skipped because, at least historically, there is a reversal effect in the *t-1* month stock return, which is has been attributed to the bid-ask bounce (Gautam and

Nimalendran (1990)). In the pre-1925 U.S. stock data, this effect seems to last two months; hence in our stock-level study we skip two months instead of one. To remain consistent, in our global asset momentum tests we also skip two months. In addition to consistency, skipping an extra month adds a layer of comfort that a hypothetical investor would have plenty of time to invest in the strategy, avoiding any look-ahead bias problems – although, of course, such global multi-asset class investment capabilities did not arise until much later than the inception date used in this study. Nevertheless, we test reversal months by themselves as well as versions of momentum that skip only one month, or zero months.

We document that the reversal effect does not exist in the asset-level data and is actually positive and significant in most asset classes. Table VI shows the results of the one-month and two-month reversal strategies across all asset classes. The combined average return is 0.32% per month (t-stat 10.5) for the two-month effect and is 0.50% per month (t-stat 17) for the one-month momentum. Only U.S. stocks experience the reversal effect (-0.76% for one-month and -1.05% for two-month). In individual asset classes, one-month continuation is strongest in equities with 1.03% per month, cross-asset with 0.71%, and commodities with 0.67% per month.

In addition, we compute results using a momentum definition that does not skip the reversal months, and that skips only one month instead of two. For equities, commodities, sectors, and asset classes, results, without skipping any months, improve due to the additional return arising from the last two months, while, for bonds and U.S. stocks, they deteriorate significantly. The U.S. stock results were expected due to the negative impact of the reversal months discussed above, but the bond results indicate the strong influence of the *t-12* and *t-11* months that get dropped when the reversal months are included. Overall, our momentum definition that skips the last two months is both consistent with our prior stock-level results and is more conservative for other asset classes, with the exception of bond momentum, which seems to benefit from the definition that skips two months and includes the *t-12* and *t-11* months.

We also review the longer-term structure of momentum profits by measuring returns of momentum portfolios in the non-overlapping future month *t* after portfolio formation. Table VII shows the average W-L total returns in local currencies to the six asset class momentum strategies in the future months. Similar to reported stock-level results, all asset class momentum portfolios have positive returns up at least to Month 10 after portfolio construction, except for

commodities, which turns negative in Month 7 (note: here we are using only the commodity futures data since 1959, consistent with our total return definition for commodities). As seen in the stock-level data, momentum portfolios experience significant reversion after month ten, and lasting up to 36 months (consistent with the returns of the mean reversion version of the value factor (AMP (2013)). One exception to long-term mean reversion is the currency total return momentum portfolio, which, when defined using the set of countries and interest rates in our study, does not seem to experience mean reversion over the full timeframe. However, these results might be heavily influenced by the periods of high currency volatility discussed earlier. In sum, both near-term momentum and longer-term reversion seem to be a strong feature of asset returns across asset classes and time.

IV. Sources of Momentum Profits

A. Momentum Correlations

Average 5-year rolling correlation between the seven W-L momentum portfolios over the full period is quite low at 9% with long cycles of variability (Table VIII, Figure VI). However, consistent with reported results (AMP 2013), and highlighting a potentially alarming trend from the risk management perspective, we document significant recent rise in cross-momentum correlations. As of May 2014, the end of our data series, the 5-year cross-momentum correlation reaches the all-time high of 41%. Correlations have been trending up since the reaching a low point in the 1950s, and they have long surpassed the previous maximum level of 22% reached in 1934. On the one hand, we can observe cyclical variation in correlations throughout the history, which makes the recent period's upward cycle statistically possible within the longer distribution of outcomes. On the other hand, especially since 1999, the correlations have been increasing beyond the historical range and at an increasing rate.

Across individual strategies, the U.S. stock and country-neutral sector momentum exhibits the highest correlation of 21% between 1800 and 2014, and 69% in the last 5 years. The next highest long-run correlation is 15% between the U.S. stock momentum and country equity momentum, reaching 50% over the last five years. Currency momentum has a correlation with equity momentum of 15% over the long-run and 37% over the last 5 years. Our recent results are consistent with AMP (2013), who, for example, report a recent correlation of 40% between global stock momentum and country index momentum. However, the long-run nature of our data

and the clearly observable upward trend in correlations strongly indicate that the diversification benefits of momentum investing across global asset classes has been significantly diminished over the past several decades. Moreover, it is difficult not to relate this increase to continued global market integration and especially the increased allocation of investment capital to momentum strategies, consistent with the increased academic and investment community interest mentioned earlier. Increased correlation has important risk management implications for momentum tilted strategies and products.

B. Common vs. Asset-Specific Momentum

Following the Grundy and Martin (2001) methodology, we test whether the asset-specific momentum is the significant driver of the W-L portfolio. Using a 60-month rolling regression (requiring a minimum of 37 months of data), we decompose momentum returns into asset-specific momentum and factor momentum by regressing each asset's return on a dummy variable and the average return of all assets in the corresponding asset class

$$r_{i,t} = a_0 * D_t + a_1 * (1-D_t) + b_i * r_{ma,t} + e_i, \quad (3)$$

where $D_t = 1$ during the momentum formation months (*t-12:t-2*) and 0 elsewhere (*t-13:t-60*); $r_{i,t}$ is the month *t* asset-level return; $r_{ma,t}$ is the month *t* asset class return (average of all assets in the asset class in which momentum portfolio is built). Asset-specific momentum strategy uses a_0 as the ranking input (10-month asset-specific momentum), and the factor-related return momentum strategy uses $b_{i,t} * r_{ma,t:[t-12:t-2]}$ as the ranking input. Results in Table IX confirm the U.S. stock-level results, showing that asset-specific momentum is positive and significant. Between 1801 and 2014, the combined asset-specific W-L portfolio average spread is 0.35% per month (t-stat 13.4) vs. the raw average of 0.45% (t-stat 15.4).

In equities, currencies, sectors and U.S. stocks, the common component is not priced, while asset-specific momentum is significant. Commodity reverse momentum experiences the largest deterioration from raw to asset-specific return (from 0.45% to 0.11% per month). A similar effect is observed in the cross-asset class level momentum, where the common component is expected to play a much larger role. Cross-asset class specific returns average 0.22% per month (t-stat 5.3), while the common-factor momentum component averages 0.31% (t-stat 7.1). Finally, in bonds, the common-factor momentum is also significant at 0.19% per

month (t-stat 2.9), but bond-specific momentum is not decreased compared to raw at 0.14% vs. 0.13% (t-stat 2.6 vs. 2.3).

Overall, there is strong expanded evidence that momentum effect is significant in asset-specific momentum formulations, while there is some weak evidence that in some asset classes, such as bonds and commodity spots, beta momentum has a contribution to the overall spread as well.

C. Market States and Momentum Profits

We extend and confirm the effect that momentum profits are higher following up markets vs. down markets, documented in the stock-level tests (Cooper, Gutierrez, Hameed (2014), Daniel and Moskowitz (2014)). Table X reports the results. Between 1800 and 2014, the combined momentum return following an up market is 0.56% per month while it is 0.15% following a down market, vs. 0.45% over the full period. In country equities, the variation is the largest, varying from 1.05% following up markets and 0.17% following down markets. All asset classes display similar dispersion, except for commodities, which is expected because of the inverse momentum definition used. These are strong results, which are in effect out-of-sample, as initially discovered in the stock-level data. They are also achieved with no forward-looking information as the market states are defined from the trailing returns, effectively enabling tradable estimation of expected momentum premia by asset class. At least part of this variation is attributable to the dynamic nature of momentum's betas, which is dependent on the direction and duration of the realized market state.

The alpha and beta of each momentum strategy relative to the average return of each asset class is shown in Table X and are computed using the following regressions.

$$r_{mo,t} = a_{mo} + B_{mo} * D_t * r_{ma,t} + e_{mo,t} \quad (4)$$

and

$$r_{mo,t} = a_{mo} + B_{moDOWN} * D_{tDOWN} * r_{ma,t} + B_{moUP} * D_{tUP}\, r_{ma,t} + e_{mo,t}, \quad (5)$$

where dummy variable D_t {down, up} is: 1 if the cumulative performance of the average asset class return over months t-12 to t-2, is {negative, positive}.

All alphas remain positive and statistically significant, except for bond momentum that drops slightly below significance level (t-stat 1.8). The strongest alpha is for the equity momentum of 0.64% per month (t-stat 8.2). Following Kothari and Shanken (1992) and Grundy and Martin (2001), we compute up and down market beta and observe the same magnitude and direction of variation in the momentum beta as in the stock-level betas.

For example, equity momentum beta varies from 0.63 in the up markets to -0.56 in the down markets. Currency momentum beta to USD vs. global currencies, is 0.93 in the up market and -0.8 in the down market. Bond momentum beta varies from 0.53 in the up market to -0.48 in the down market. Similar results are observed in the sectors, stocks, and cross-asset class momentum. In commodities, the effect is naturally reversed since commodity momentum uses the negative definition of momentum. The combined portfolio beta varies from 0.23 (t-stat 10) to -0.51 (t-stat -16), pointing to the fact that the dynamic nature of beta in momentum portfolios is a major characteristic of the risk of the strategy, initially observed in the stock-level data.

Extending the tests of optionality of momentum portfolios (Daniel and Moskowitz (2014)), we run the following regression:

$$r_{mo,t} = a_0 + a_b * D_t + b_0 * r_{ma,t} + b_b * D_t * r_{ma,t} + b_{b,U} * D_t * D_{upmonth,t} * r_{ma,t} + e_{b,t,} \qquad (6)$$

where the dependent variable is the W-L portfolio and the independent variables are a constant, an indicator for market state D_t: 1 if the cumulative performance of the Market over months t-12 to t-2 is negative and 0 otherwise, market return $r_{ma,t}$, and a contemporaneous up-market indicator $D_{upmonth,t:}$ 1 if the contemporaneous market return is positive and 0 otherwise.

Results in Table XI.A confirm the statistically significant negative $b_{b,U}$ coefficients for country equity, currency, commodity, country-neutral sector and U.S. stock momentum portfolios. It is also negative but not statistically significant for bonds, and insignificantly positive for the cross-asset class momentum. According to Daniel and Moskowitz (2014), the negative loading on $b_{b,U}$ indicates the presence of optionality. Specifically, their interpretation is that in bear markets, the momentum portfolio is in effect short a call option on the market. The stark significant difference in b_0 and b_b coefficients reconfirms the beta variation driven by the state of the asset class in which momentum portfolios are built. Importantly, during the months when the contemporaneous market return is positive, the momentum betas ($b_0 + b_b + b_{b,U}$) are

more negative than during the contemporaneous negative market return months ($b_0 + b_b$), except in commodities and cross-asset class momentum (Commodity momentum's inverse definition drives the commodity effect). This difference in betas during market reversals is an inherit risk factor inside the momentum portfolios. Alphas during the positive market states are significant in each asset class except for bonds, and down market alphas remain significantly positive only for the country-neutral sector and U.S. stock momentum.

The above results are corroborated by looking at the top 20 most positive and negative momentum portfolio returns, shown in Table XI.B. The average W-L return during the highest 20 months is 15%, and the trailing market returns during the period of momentum portfolio formation is 12%. For the most negative 20 months, the average W-L return is -13%, and the trailing average market return is 0%, significantly lower than 15% for the highest 20 months. While the difference in trailing market conditions seem to impact momentum profits in each asset class, the impact of the contemporaneous market return only appears in the U.S. equities. The contemporaneous market return averages 12% during the 20 most negative U.S. stock momentum months, while it is only 2% during the most positive months. However, in other asset classes, the contemporaneous marker returns are higher in the most positive months than during the negative ones. Perhaps this is driven by the lack of the reversal effect in the asset classes outside the U.S. equities. Or perhaps, momentum optionality effect is only present in the stock momentum, and not asset level momentum. In either case, this raises an important question for further research.

Following the logic of Geczy and Samonov (2016), we further investigate the relationship between the asset class market state and momentum betas by introducing the duration variable, which measures the length of a given market state. A state duration variable is created by summing the number of consecutive months in positive / negative market states until the state changes. This variable provides additional visibility into momentum portfolio beta dynamics over the course of a market state. We compute the exposure of momentum beta to market state duration in the following way: First, a 10-month rolling momentum beta is obtained by regressing monthly momentum returns ($r_{mo,t}$) on a constant and an equally-weighted market return ($r_{ma,t}$).

$$r_{mo,t} = a_{mo} + b_{mo} * r_{ma,t} + e_{mo,t}. \quad (6)$$

Next, calculated $B_{mo,t}$ are regressed on the market state duration variable:

$$B_{\mathrm{mo,t}} = a_b + Coef_{\mathrm{b}} * \mathrm{Duration}_{\mathrm{t}} + e_{\mathrm{b,t}}, \quad (7)$$

where Duration is the length of the consecutive months in a given state. For example, if the market state has been positive for 2 months in a row, duration is set to 2. Market state is positive if the cumulative performance of the Market portfolio over months t-12 to t-2 is positive and 0 otherwise. Market portfolio is defined as the equally-weighted average returns of assets in the asset class in which a given momentum portfolio is built.

Overall, for every additional month of continuation of a given market state, the combined momentum W-L portfolio beta increases by 0.01 (t-stat 6.9) in the direction of the market return as shown in Table XII. When broken up into up markets and down markets, the coefficient of beta on duration variable is larger in the down markets for several asset classes, pointing to the fact that down market momentum beta decreases faster than it increases in the up markets. The magnitude and significance of this effect is consistent across asset classes and up / down market states. As in the stock-level data, we observe a significant intra-state relationship between momentum beta and state duration – once again pointing to the dynamic risk nature of momentum profits. We add to evidence that the longer a market state persists in a given asset class, the stronger the corresponding asset class' momentum beta becomes, creating a strong dynamic feature of momentum's risk.

V. Robustness Checks

A. Outliers

We apply a consistent outlier winsorization across all asset class returns, which set any return greater than 100% equal to100%, except in the stock-level data, in which we follow the 50% winsorization cut off. We find that at most, less than 0.09% of any asset class data sample is affected by this filter and 0.53% of the stock-level data (Table I). Data spot checking reveals that most of these large changes are caused by erroneous data, which are expected over such an extended sample. We carry out momentum robustness tests with the Winsor boundaries set at 150% and 50% in addition to the default 100%. The overall results do not change shown in Table XIII. Specifically, between 1800 and 2014, the *CombPort* averages 0.43% per month with 50% winsor filter, 0.44% per month with 150% filter and 0.45% per month with 100% filter. In

individual momentum strategies, differences are of similar magnitudes. The main advantage of using the outlier filters is the avoidance of one-off data errors that end up distorting averages and compounded returns. Further manual data cleaning might be warranted to manually research each of the data discontinuities and to avoid the top-down Winsor filter. However, we believe our outlier handling is significantly more conservative than the typical elimination of the W and L 0.5% of the entire sample (for example Jostova et al. (2010)).

B. Alternative Weightings

To estimate the robustness of the equally-weighted approach, we create a standard deviation and real GDP-weighted versions of the momentum portfolios. The real GDP weighting is available for bonds and equities where we have the real GDP data for the corresponding countries. GDP-weighted results are stronger for the country equity momentum and weaker for bond momentum. Between 1800 and 2014, country equity W-L portfolio return averages 1.16% per month (t-stat 7.9) in the GDP- weighted version vs. 0.88% in the equally-weighted version, shown in Table XIV. However, the GDP-weighted bond momentum portfolio spread becomes insignificant at 0.06% per month. It is possible that country bond momentum comes from the smaller countries, while country equity momentum is slightly stronger in larger countries.

The volatility-weighted momentum is available for all asset classes and uses an inverse of the 10-year rolling standard deviation to weight individual. The overall volatility-weighted results are lower than equally-weighted version. Between 1800 and 2014, the combined momentum W-L return averages 0.32% per month (t-stat 15.2) vs. equally-weighted 0.45% (t-sat 15.4), shown in Table XV. However due to reduced volatility, the t-statistics are effectively the same. The reduction of the W-L returns and volatilities is observed in each asset class. In summary, the momentum effects remain statistically significant when alternative weightings are used, creating robustness to the equally-weighted results.

VI. Trend and Other Momentum

A. Trend vs. Momentum

An increasingly popular subject in the momentum literature has been the discussion about time-series trend as a factor. One of the challenges behind comparing the trend approaches is the variety of definitions that exist ranging from trailing return sign, to various thresholds, relative

strength and moving averages. Another challenge is the choice of the alternative asset in which to invest the capital of the position that gets 'turned-off' when the trend signal is negative. For example, Clare *et al.* (2012) and Faber (2013) use a definition of trend that compares price of an asset at time *t* to the *x*-month moving average of the price and goes long the asset whose price is above the moving average, and otherwise invests in cash. In contrast, Hurst *et al.* (2012), study equally-weighted 1-, 3-, and 12-month time-series return signs and go long the positive assets, and short the negative assets, effectively always being fully invested. Antonacci (2014) defines trend as the sign of the asset's *x*-month return over the 90-day T-bill and goes long the positive return assets and goes long the T-bill for the cases when the sign reverses. Lemperiere *et al.* (2014) define an exponentially-weighted constant volatility 5-month moving average version of the trend. Finally, using U.S. stock data, Han and Zhou (2012) eliminate the arbitrary choice of the look-back window by computing cross-sectional payoff coefficients to all possible look-back windows between 3 and 1000 days. In a way, by allowing the data to drive the optimal in-sample signs and lengths of each look-back window, this approach highlights the challenge of arriving at a consistent definition of a trend. Cross-sectional momentum is also subject to the look-back problem, but at least the relative ranking eliminates the need to create arbitrary rules of inclusion / exclusion, and alternative asset selection.

We create a trend strategy that is most comparable to the cross-sectional momentum definition. We measure the sign of the direction in asset price over P_{t-2} / P_{t-12} months, the same months used to compute the momentum metric. If the direction of change is positive, we assign the asset into the winner trend portfolio; otherwise, into a loser portfolio. So, effectively it is still a cross-sectional distribution, but centered on zero return, rather than equally-sized buckets.

Trend results are summarized in Table XVI. In short, this version of trend does not outperform momentum in any of the asset classes, but it is a statistically significant factor in each asset class. As expected, the average returns are very similar between the two strategies. Average W-L trend portfolio across all assets generates 0.38% per month (t-stat 14.5) compared to momentum spread of 0.45% (t-stat 15.4). The correlations between W-L trend and momentum portfolios are 0.76 on average. The lack of perfect correlation is mainly due to the asset class beta timing component that introduces additional volatility not present in W-L momentum portfolios. Given the results, and the significance of the asset class momentum described above,

it seems consistent to compute cross-asset class and within asset-class momentum strategies separately, and then combine the two strategies, rather than combining at them at the signal level, which is what effectively occurs in the trend signal portfolio. Of course, given the wide variety of trend definitions, it is possible to find versions of the trend that outperforms traditional momentum, but the variations are difficult to attribute to any fundamental variable other than the documented momentum in both asset classes and assets within each asset class.

B. Cross-Momentum Momentum

To take our tests of momentum one step further, we study if there is a momentum effect in the momentum time-series themselves. Factor timing using momentum has spurred growing interest especially as used in some investment management applications. For example, Tibbs, Eakins and DeShurko (2008) find style momentum in Russell style indices. We use six individual asset class momentum W-L histories and the cross-asset class momentum return as the seventh. The momentum strategy goes long the two highest 10-month momentum strategies, and shorts the two bottom 10-month momentum strategies, skipping the last two months. In this case, the universe is the average of the seven momentum W-L returns, which is 0.5% per month. The resulting W-L strategy returns 0.38% per month (t-stat 5.2), shown in Table XVII. The W momentum basket returns 0.76% per month, while the L basket returns 0.43% per month. Hence there is some evidence that dynamically allocating capital between various momentum strategies has a positive expected return. Of course, in practice, significant transaction costs might take away the significance of cross-asset momentum timing. Also, this strategy naturally relies on the relatively low correlations between individual momentum portfolios; and given the recent correlations between many of the momentum time-series have increased dramatically, the momentum timing will likely result in lower Sharpe ratios in the future than in the past.

C. Cross-Asset 'Spill Over' Momentum

Finally, we test the idea that cross-sectional momentum in one asset class leads to cross-sectional profits in another class. There is a rising literature interest in cross-asset predictability. (Bakshi and Panayotov (2013), Ready, Roussanov and Ward (2013), Lu and Jacobsen (2014)). Similar to Lee, Naranjo, and Sirmans (2014), who find that momentum in credit default swaps

leads stock returns, we find that country's bond momentum cross-sectionally leads country equity returns.

We follow our standard momentum definition applied to country bond total return indices and create W and L portfolios from the corresponding country equity indices. Hence, we apply cross-sectional bond momentum to rank equity markets. The strategy is rebalanced monthly, and all returns are in local currencies, both in price-only and total returns. Due to data availability in the interception of country bond and equity indices, the first W-L "spillover" portfolio becomes feasible in 1846. Since then, the W-L return to this strategy averages 0.59% per month (t-stat 7.0), and is highly consistent overtime shown in Table XVII. The W portfolio averages an excess return of 0.31% per month (t-stat 6.8) and the L -0.21% per month (t-stat -4.8). The 10-year rolling return of this strategy is highly variable over time with occasional very negative periods such as in the 1860s, 1910s, 1930s and 2000s. However, over the long-run, there is some evidence that bond momentum might lead equity momentum in the large cross-section of countries. This effect could be studied further, especially as it relates to interest rate momentum, which is the common factor between the two asset classes.

VII. Conclusion

We utilize a large amount of historical asset class data to create an out-of-sample test of asset-level price momentum back to 1800 in country equities, bonds, currencies, commodities, sectors and stocks. We find that the effect is significantly priced in each asset class, across asset classes, and across momentum portfolios themselves. We also observe a spillover effect from country bond indices to country equity markets. Momentum alphas are statistically significant, and momentum betas experience a statistically strong dynamic variation driven by the up-and-down-market-states effect which was observed in the stock-level data. We also observe significant mean reversion in commodity spot prices instead of the traditional momentum effect, and document the disappearance of the effect in commodities that have a futures contract. We compare the cross-sectional momentum to a time-series trend strategy, and find comparable results, with momentum having slightly higher returns. We confirm the absence of short-term reversal effect in all assets except the U.S. stocks and the presence of long-term reversal in all asset classes. Perhaps most relevant for momentum investors is the observation that there has been a significant rise in correlations between individual momentum strategies, leading to

increased strategy risk of overcrowding. In addition, even though over the long-run momentum returns are very robust, there are many decade-long periods when the spread returns to momentum are negative, highlighting the inherent risk in this strategy.

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Table I

Descriptive Statistics

Table shows total number of unique assets used in the study and their average equally-weighted monthly returns for each asset class. Returns are measured in local price (spot) changes and local total returns. Total returns are defined as: Equities include dividends; Currencies add USD minus Foreign T-bill return; Bonds include interest; Commodities use Futures Returns. Total return for Sectors and Stocks use U.S. stock-level CRSP returns. Outliers are defined as monthly returns > 100%.

		Local Price Return				Local Total Return		
	# of Assets	Dates	Average	(t-stat)	Outliers %	Dates	Avearge	(t-stat)
Equities	47	*1798 - 2014*	0.50%	**13.9**	0.04%	*1798 - 2014*	0.86%	**15.8**
Currencies	48	*1798 - 2014*	0.23%	**7.4**	0.01%	*1798 - 2014*	0.02%	0.7
Bonds	43	*1798 - 2014*	0.14%	**3.8**	0.02%	*1798 - 2014*	0.57%	**18.4**
Commodities	76	*1798 - 2014*	0.43%	**9.9**	0.08%	*1959 - 2014*	0.36%	**2.4**
Global Sectors	301	*1803 - 2014*	0.40%	**8.6**	0.16%	*1927 - 2014*	1.01%	**5.2**
U.S. Stocks	34795	*1800 - 2014*	0.49%	**5.2**	0.53%	*1927 - 2014*	1.14%	**5.7**

Table II

Global Multi-Asset Class Momentum

In each month (t), momentum strategy uses top and bottom thirds of 10-month (skipping 2 moths) price (spot) changes (P_{t-2}/P_{t-12}) to designate winners and losers {W and L}. Commodity Spot strategy uses reverse momentum (P_{t-12}/P_{t-2}). Momentum portfolios {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average return of the corresponding asset class. Table shows average 1-month forward return after portfolio formation. Return is measured using local price changes and local total returns. For total return results: Equities include dividends; Currencies add USD minus foreign T-bill return; Bonds include interest; Commodities use futures returns; Sectors and Stocks use for the U.S. market using CRSP returns. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an equally-weighted average of the seven momentum return time-series. USD returns for equities, bonds and commodities are derived by adding changes in the currency spots to local returns.

		Price Return				Total Return		
	Assets	Dates	Portfolio	Average	(t-stat)	Dates	Average	(t-stat)
1	Equities (Local)	*1800 - 2014*	W-L	0.88%	**10.6**	*1800 - 2014*	0.66%	**7.5**
			W	0.52%	**11.7**		0.35%	**7.4**
			L	-0.34%	**-7.9**		-0.31%	**-6.7**
2	Equities (USD)	*1800 - 2014*	W-L	0.68%	**7.9**	*1800 - 2014*	0.63%	**5.7**
			W	0.36%	**7.9**		0.28%	**5.0**
			L	-0.32%	**-7.0**		-0.35%	**-5.8**
3	Currencies	*1800 - 2014*	W-L	0.51%	**9.6**	*1800 - 2014*	0.43%	**8.2**
			W	0.18%	**7.1**		0.20%	**-7.4**
			L	-0.33%	**-9.9**		-0.23%	**8.3**
4	Bonds (Local)	*1800 - 2014*	W-L	0.13%	**2.3**	*1800 - 2014*	0.23%	**3.8**
			W	0.09%	**2.9**		0.12%	**3.7**
			L	-0.04%	-1.4		-0.11%	**-3.0**
5	Bonds (USD)	*1800 - 2014*	W-L	0.14%	1.9	*1800 - 2014*	0.26%	**3.3**
			W	0.07%	1.8		0.15%	**3.7**
			L	-0.07%	-1.7		-0.10%	**-2.4**
6	Commodities	*1800 - 2014*	W-L	0.45%	**5.5**	*1960 - 2014*	0.97%	**4.1**
			W	0.25%	**5.5**		0.48%	**3.8**
			L	-0.20%	**-4.3**		-0.48%	**-3.6**
7	Global Sectors	*1804 - 2014*	W-L	0.36%	**6.6**	*1927 - 2014*	0.59%	**5.7**
			W	0.16%	**5.4**		0.30%	**5.5**
			L	-0.20%	**-6.7**		-0.29%	**-5.1**
8	U.S. Stocks	*1801 - 2014*	W-L	0.51%	**6.0**	*1927 - 2014*	0.81%	**6.7**
			W	0.29%	**6.4**		0.40%	**6.7**
			L	-0.23%	**-4.9**		-0.41%	**-6.4**
9	Cross-Asset	*1801 - 2014*	W-L	0.45%	**10.2**	*1801 - 2014*	0.66%	**12.1**
			W	0.22%	**10.1**		0.33%	**10.6**
			L	-0.23%	**-10.3**		-0.34%	**-11.5**
10	Combined	*1800 - 2014*	W-L	0.45%	**15.4**	*1800 - 2014*	0.40%	**14.0**
			W	0.24%	**15.5**		0.20%	**13.6**
			L	-0.22%	**-13.8**		-0.20%	**-13.0**

Table III

Global Multi-Asset Class Momentum by Decade

In each month (t), momentum strategy designates assets into thirds based on 10-month price change (P_{t-2}/P_{t-12}). Long-short {W-L} portfolios are long the highest third and short the lowest third of momentum assets. Returns are equally-weighted. Table shows annualized 10-year returns of momentum {W-L} portfolios. Return is measured using local price (spot) changes. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an average of the seven long-short momentum returns.

Decade	Equities	Currencies	Bonds	Commodities	Global Sectors	U.S. Stocks	Cross-Asset	Combined
1810	-4%	-1%	2%	4%	1%	3%	1%	1%
1820	1%	-8%	-3%	-8%	1%	0%	4%	-1%
1830	3%	1%	1%	1%	0%	6%	4%	3%
1840	-1%	-1%	-2%	4%	1%	4%	1%	1%
1850	-6%	0%	-1%	-3%	-4%	6%	5%	0%
1860	-2%	-3%	1%	-1%	6%	1%	0%	1%
1870	-2%	-2%	3%	-3%	8%	7%	7%	3%
1880	6%	0%	3%	0%	4%	6%	2%	4%
1890	1%	1%	2%	8%	3%	-3%	3%	2%
1900	3%	2%	2%	11%	2%	-4%	2%	3%
1910	2%	2%	0%	12%	3%	1%	2%	3%
1920	6%	14%	-4%	10%	3%	-2%	12%	6%
1930	12%	24%	7%	9%	7%	15%	3%	12%
1940	0%	1%	3%	15%	3%	0%	6%	5%
1950	5%	14%	1%	5%	2%	6%	8%	6%
1960	18%	2%	2%	4%	8%	11%	6%	7%
1970	9%	8%	0%	8%	7%	10%	5%	7%
1980	40%	18%	0%	-7%	7%	15%	13%	12%
1990	70%	51%	2%	7%	8%	11%	20%	23%
2000	26%	16%	0%	4%	5%	13%	2%	10%
2010	11%	1%	1%	11%	6%	4%	8%	6%
Average	10%	7%	1%	4%	4%	5%	5%	5%

Table IV

Commodities

This table shows results of various commodity momentum strategies. All definitions assign the top third of price changes to Winner and bottom third to Loser portfolios. Momentum portfolios {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average return of all commodities. 'Direct 10 M' Momentum uses the standard definition P_{t-2}/P_{t-12} without reversing the sign. '76 GFD Spots' uses all commodities with available spot data. '46 Futures Spots' uses the un-rolled near term commodity future price. '46 Futures Rolled' uses the rolled near-term commodity future returns. '46 GFD Spots' uses the GFD spot data for the same 46 commodities which have futures data. '30 GFD spots' uses the remaining 30 out of the 76 commodities that do not have a traded futures instrument. 'Direct 12 M' momentum definition is P_{t-2}/P_{t-14}. 'De-seasonal 1' uses a 12-month average price measure in the momentum formulation $P_{(12m\ ave)t-2}/P_{(12m\ ave)\ t-12}$. 'De-seasonal 2' removes all auto-correlation using a 10-year rolling regression to estimate 12-lag autocorrelations, $r_{i,t} = b_1 * D_1 + b2 * D_2 \ldots b_{12} * D_{12} + e_{i,t}$ and measures the 10-month momentum of the residual returns.

Assets	Definition	Dates	Port	Returns	(t-stat)
76 GFD Spots	Direct_10m Skip 2	*1531 - 2014*	W-L	-0.57%	**-8.3**
			W	-0.21%	**-5.8**
			L	0.29%	**7.7**
76 GFD Spots	Direct_10m Skip 2	*1801 - 2014*	W-L	-0.46%	**-5.7**
			W	-0.21%	**-4.5**
			L	0.25%	**5.7**
46 Futures Rolled	Direct_10m Skip 2	*1959 - 2014*	W-L	0.97%	**4.1**
			W	0.48%	**3.8**
			L	-0.48%	**-3.6**
46 Futures Spots	Direct_10m Skip 2	*1959 - 2014*	W-L	-0.07%	-0.3
			W	-0.01%	-0.1
			L	0.06%	0.4
46 GFD Spots	Direct_10m Skip 2	*1959 - 2014*	W-L	-0.07%	-0.4
			W	-0.03%	-0.4
			L	0.04%	0.5
46 GFD Spots	Direct_10m Skip 2	*1801 - 2014*	W-L	-0.29%	**-3.3**
			W	-0.11%	**-2.3**
			L	0.18%	**3.9**
30 GFD Spots	Direct_10m Skip 2	*1959 - 2014*	W-L	-0.82%	**-3.4**
			W	-0.37%	**-2.9**
			L	0.45%	**3.3**
30 GFD Spots	Direct_10m Skip 2	*1801 - 2014*	W-L	-0.92%	**-6.2**
			W	-0.41%	**-4.7**
			L	0.61%	**6.6**
76 GFD Spots	Direct_12m Skip 2	*1801 - 2014*	W-L	-0.45%	**-5.7**
			W	-0.21%	**-4.5**
			L	0.24%	**5.5**
76 GFD Spots	Deseasonal_1 (12m average)	*1801 - 2014*	W-L	-0.77%	**-9.2**
			W	-0.36%	**-7.9**
			L	0.40%	**8.6**
76 GFD Spots	Deseasonal_2 (remove all)	*1801 - 2014*	W-L	-0.12%	-1.5
			W	-0.04%	-0.9
			L	0.08%	1.8

Table V

Global Country-Neutral Sector Momentum

In each month (t), Country-Sector momentum strategy uses the top and bottom thirds of 10-month (skipping 2) price changes of Sectors (P_{t-2}/P_{t-12}) to designate winners and losers {W and L}. Momentum portfolios {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average return of the asset class. Table shows average 1-month forward return after portfolio formation. Return is measured using local sector price changes.

			Average Price Return			(t-stat)		
Country	Start Date	# Sectors	W-L	W	L	W-L	W	L
Australia	02/29/1876	11	0.37%	0.14%	-0.21%	**2.2**	1.5	**-2.4**
Austria	02/28/1923	9	0.65%	0.29%	-0.25%	**2.8**	**2.5**	**-2.1**
Belgium	02/28/1935	10	0.70%	0.34%	-0.36%	**4.9**	**4.3**	**-4.7**
Canada	08/31/1915	11	0.64%	0.33%	-0.31%	**4.7**	**4.5**	**-4.1**
Chile	02/29/1928	8	1.04%	0.42%	-0.42%	**3.9**	**2.8**	**-2.4**
China	05/31/1994	6	-0.21%	-0.06%	0.15%	-0.5	-0.3	0.6
Columbia	02/29/1928	8	0.16%	0.02%	-0.13%	0.7	0.1	-0.9
Denmark	01/31/1916	11	0.44%	0.25%	-0.20%	**2.8**	**3.1**	**-2.4**
Finland	11/30/1931	11	0.47%	0.26%	-0.20%	**2.8**	**3.1**	**-2.3**
France	01/31/1858	11	0.77%	0.38%	-0.37%	**6.0**	**5.5**	**-5.4**
Germany	01/31/1905	11	0.47%	0.21%	-0.20%	**4.0**	**3.1**	**-2.7**
Iceland	01/31/1994	9	1.70%	0.81%	-0.82%	**3.1**	**2.7**	**-2.9**
Greece	02/28/1953	8	0.88%	0.43%	-0.45%	**2.7**	**2.6**	**-2.6**
Indonesia	02/28/1990	6	1.13%	0.47%	-0.66%	**2.5**	1.9	**-2.8**
Italy	02/28/1986	9	0.66%	0.19%	-0.46%	**3.0**	1.6	**-4.2**
Japan	02/28/1934	10	0.24%	0.10%	-0.14%	1.2	0.9	-1.3
Korea	02/29/1976	8	0.85%	0.50%	-0.36%	**2.5**	**2.7**	-1.9
Netherlands	02/28/1929	10	0.28%	0.15%	-0.14%	1.5	1.7	-1.5
New Zealand	12/31/1992	7	-0.33%	-0.45%	-0.12%	-0.7	-1.7	-0.4
Norway	01/31/1984	11	0.21%	0.11%	-0.08%	1.1	1.1	-0.9
Pakistan	08/31/1961	7	0.21%	0.10%	-0.11%	0.9	0.8	-0.8
Peru	01/31/1928	7	1.47%	0.63%	-0.61%	**3.6**	**3.0**	**-2.9**
Philippines	02/28/1953	7	1.07%	0.46%	-0.61%	**3.1**	**2.4**	**-3.2**
Portugal	02/28/1939	9	0.39%	0.18%	-0.22%	1.4	1.3	-1.5
Russia	10/31/1994	6	-0.48%	-0.21%	0.22%	-0.7	-0.6	0.6
Singapore	11/30/1963	7	0.70%	0.34%	-0.35%	**2.7**	**2.5**	**-2.7**
South Africa	02/28/1911	10	0.75%	0.32%	-0.42%	**4.8**	**3.8**	**-5.0**
Spain	04/30/1941	10	0.67%	0.25%	-0.42%	**3.7**	**2.4**	**-4.1**
Sweden	02/28/1907	11	0.16%	0.10%	-0.06%	1.2	1.4	-0.9
Switzerland	02/28/1931	10	0.41%	0.20%	-0.20%	**2.9**	**2.9**	**-2.7**
Thailand	05/31/1976	10	0.81%	0.41%	-0.38%	**2.1**	**2.0**	-1.7
United Kingdom	08/31/1868	11	0.21%	0.09%	-0.12%	**2.7**	**2.3**	**-2.9**
USA	02/29/1804	11	0.42%	0.24%	-0.18%	**4.4**	**4.6**	**-3.4**
Overall	02/29/1804	301	0.36%	0.16%	-0.20%	**6.6**	**5.4**	**-6.7**

Table VI

Reversal (Skip) Months

In each month (t), momentum strategy uses the top and bottom thirds of 1-month, 2-month, 10-month without skip, 10-month with 1-month skip, and 10-month with 2-month skip to designate winners and losers {W and L}. Momentum long-short {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average return of the asset class. Table shows average 1-month forward return after portfolio formation. Return is measured using local price (spot) changes and local total returns. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an equally-weighted average of the seven momentum return time-series.

				1-month Reversal		2-month Reversal		10-month no Skip		10-month Skip 1m		10-month Skip 2m	
	Assets	Dates	Portfolio	Average	(t-stat)	Average	(t-stat)	Average	(t-stat)	Average	(t-stat)	Average	(t-stat)
1	Equities	*1800 - 2014*	W-L	1.19%	**14.8**	1.03%	**12.9**	0.95%	**11.2**	0.85%	**10.0**	0.88%	**10.6**
			W	0.65%	**14.8**	0.57%	**13.2**	0.56%	**12.3**	0.50%	**11.2**	0.52%	**11.7**
			L	-0.47%	**-11.7**	-0.39%	**-9.6**	-0.34%	**-8.0**	-0.31%	**-7.1**	-0.34%	**-7.9**
2	Currencies	*1800 - 2014*	W-L	0.57%	**10.3**	0.55%	**10.7**	0.44%	**7.6**	0.52%	**9.6**	0.51%	**9.6**
			W	0.21%	**7.1**	0.20%	**7.6**	0.14%	**4.8**	0.18%	**6.7**	0.18%	**7.1**
			L	-0.35%	**-11.7**	-0.34%	**-11.6**	-0.30%	**-9.1**	-0.34%	**-10.8**	-0.33%	**-9.9**
3	Bonds	*1800 - 2014*	W-L	0.04%	**0.7**	-0.09%	**-1.4**	-0.18%	**-3.0**	-0.08%	**-1.3**	0.13%	**2.3**
			W	0.07%	**2.1**	-0.02%	**-0.6**	-0.06%	**-1.8**	0.00%	**0.0**	0.09%	**2.9**
			L	0.03%	**0.9**	0.06%	**1.9**	0.12%	**3.7**	0.08%	**2.4**	-0.04%	**-1.4**
4	Commodities	*1800 - 2014*	W-L	1.36%	**16.5**	0.67%	**8.2**	1.28%	**16.0**	1.10%	**13.5**	0.45%	**5.5**
			W	0.72%	**15.7**	0.38%	**8.4**	0.67%	**14.8**	0.56%	**12.4**	0.25%	**5.5**
			L	-0.62%	**-13.5**	-0.29%	**-6.4**	-0.59%	**-12.8**	-0.50%	**-10.7**	-0.20%	**-4.3**
5	Global Sectors	*1804 - 2014*	W-L	0.45%	**8.4**	0.35%	**6.1**	0.26%	**4.4**	0.24%	**4.5**	0.36%	**6.6**
			W	0.21%	**6.6**	0.16%	**5.2**	0.13%	**4.0**	0.11%	**3.9**	0.16%	**5.4**
			L	-0.24%	**-8.4**	-0.19%	**-6.1**	-0.13%	**-4.1**	-0.13%	**-4.3**	-0.20%	**-6.7**
6	U.S. Stocks	*1801 - 2014*	W-L	-0.49%	**-6.4**	-0.73%	**-9.2**	-0.47%	**-5.3**	0.26%	**2.9**	0.51%	**6.0**
			W	-0.20%	**-5.0**	-0.31%	**-7.9**	-0.16%	**-3.6**	0.18%	**3.8**	0.29%	**6.4**
			L	0.30%	**6.9**	0.42%	**9.5**	0.31%	**6.2**	-0.08%	**-1.7**	-0.23%	**-4.9**
7	Cross-Asset	*1801 - 2014*	W-L	0.66%	**15.7**	0.67%	**15.6**	0.55%	**13.0**	0.44%	**10.4**	0.45%	**10.2**
			W	0.33%	**15.6**	0.33%	**15.6**	0.28%	**13.0**	0.22%	**10.3**	0.22%	**10.1**
			L	-0.33%	**-15.6**	-0.33%	**-15.5**	-0.28%	**-13.0**	-0.22%	**-10.4**	-0.23%	**-10.3**
8	Combined	*1800 - 2014*	W-L	0.50%	**17.0**	0.32%	**10.5**	0.37%	**12.0**	0.45%	**14.9**	0.45%	**15.4**
			W	0.27%	**17.3**	0.18%	**11.2**	0.21%	**13.2**	0.24%	**15.3**	0.24%	**15.5**
			L	-0.23%	**-14.7**	-0.14%	**-8.9**	-0.16%	**-9.8**	-0.21%	**-12.8**	-0.22%	**-13.8**

Table VII

Term Structure Momentum Total Returns

In each month (t), momentum strategy designates assets into thirds based on 10-month price change (P_{t-2}/P_{t-12}). Long-short {W-L} portfolios are long the highest third and short the lowest third of momentum assets. Returns are equally-weighted. Table shows return of momentum {W-L} portfolios for month (t) after portfolio formation. Return is measured using local total returns.

Months	Equities	Currencies	Bonds	Commodities	Global Sectors	U.S. Stocks
t=1	0.66%	0.43%	0.23%	0.97%	0.59%	0.81%
t=2	0.52%	0.41%	0.20%	0.86%	0.50%	0.64%
t=3	0.37%	0.35%	0.23%	0.59%	0.42%	0.50%
t=4	0.27%	0.36%	0.20%	0.16%	0.35%	0.44%
t=5	0.14%	0.35%	0.12%	0.20%	0.30%	0.32%
t=6	0.04%	0.32%	0.08%	0.09%	0.27%	0.23%
t=7	0.08%	0.30%	0.19%	-0.14%	0.25%	0.16%
t=8	0.06%	0.27%	0.16%	-0.23%	0.15%	0.03%
t=9	-0.09%	0.30%	0.06%	-0.41%	0.09%	-0.03%
t=10	-0.11%	0.26%	0.05%	-0.51%	-0.05%	-0.16%
t=11	-0.22%	0.26%	-0.13%	-0.68%	-0.11%	-0.35%
t=12	-0.15%	0.27%	-0.09%	-0.53%	-0.16%	-0.36%
t=13	-0.06%	0.30%	0.07%	-0.59%	-0.09%	-0.20%
t=14	-0.03%	0.27%	0.08%	-0.51%	-0.09%	-0.21%
t=15	-0.01%	0.23%	0.09%	-0.31%	-0.11%	-0.20%
t=16	0.02%	0.17%	0.14%	-0.55%	-0.20%	-0.20%
t=17	-0.06%	0.18%	-0.09%	-0.49%	-0.09%	-0.22%
t=18	0.00%	0.21%	-0.06%	-0.23%	-0.07%	-0.16%
t=19	0.07%	0.15%	0.15%	-0.41%	-0.09%	-0.13%
t=20	0.02%	0.19%	0.20%	-0.59%	-0.07%	-0.15%
t=21	0.03%	0.20%	0.18%	-0.38%	-0.08%	-0.15%
t=22	0.06%	0.19%	0.11%	-0.52%	-0.08%	-0.12%
t=23	-0.03%	0.20%	-0.06%	-0.46%	-0.11%	-0.24%
t=24	0.03%	0.20%	-0.07%	-0.22%	-0.10%	-0.18%
t=25	0.24%	0.26%	0.13%	-0.08%	-0.06%	-0.06%
t=26	0.21%	0.24%	0.14%	0.00%	-0.12%	-0.04%
t=27	0.15%	0.23%	0.16%	0.18%	-0.14%	-0.05%
t=28	0.10%	0.22%	0.12%	-0.07%	-0.09%	-0.03%
t=29	0.03%	0.19%	-0.04%	-0.09%	-0.12%	-0.11%
t=30	0.02%	0.19%	0.01%	-0.12%	-0.06%	-0.11%
t=31	0.09%	0.18%	0.10%	0.15%	-0.02%	-0.03%
t=32	0.07%	0.18%	0.11%	0.15%	-0.06%	-0.08%
t=33	0.10%	0.18%	0.06%	0.15%	-0.03%	-0.08%
t=34	0.09%	0.16%	0.04%	0.02%	-0.04%	-0.06%
t=35	-0.11%	0.10%	-0.14%	0.02%	-0.07%	-0.15%
t=36	-0.06%	0.15%	-0.13%	-0.05%	0.02%	-0.15%

Table VIII

Momentum Correlations

In each month (t), momentum strategy designates assets into thirds based on 10-month price change (P_{t-2}/P_{t-12}). Long-short {W-L} portfolios are long the highest third and short the lowest third of momentum assets. Returns are equally-weighted. Table shows pair-wise correlations of momentum {W-L} portfolios. Return is measured using local price (spot) changes. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns.

Full History	Equities	Currencies	Bonds	Commodities	Global Sectors	U.S. Stocks	Cross-Asset
Equities							
Currencies	15%						
Bonds	7%	0%					
Commodities	0%	4%	2%				
Global Sectors	12%	8%	6%	5%			
U.S. Stocks	15%	3%	6%	7%	21%		
Cross-Asset	27%	22%	18%	17%	14%	13%	

2009-2014	Equities	Currencies	Bonds	Commodities	Global Sectors	U.S. Stocks	Cross-Asset
Equities							
Currencies	37%						
Bonds	34%	60%					
Commodities	20%	22%	8%				
Global Sectors	63%	51%	42%	31%			
U.S. Stocks	50%	57%	40%	34%	69%		
Cross-Asset	27%	64%	47%	27%	51%	60%	

Table IX

Asset-Specific and Common-Factor Momentum

For each month (t), the following one-factor model is estimated for all assets with returns for at least 37 months within a 60-month rolling window, $r_{i,t} = a_0 * D_t + a_1 * (1-D_t) + B_i * r_{ma,t} + e_i$, where $D_t = 1$ if t : {t-12,…,t-2}, and 0 otherwise; $r_{ma,t}$ is the equally-weighted market portfolio. Momentum returns {W-L} $_{rmo,t}$ and market returns $r_{ma,t}$ are equally-weighted, rebalanced monthly. Asset-specific momentum strategy computes momentum using *a0*, and the factor-related return momentum strategy uses $B_{i,t} * r_{ma,t:\{t-12:t-2\}}$

				Overall		Asset-Specific		Common Factor	
	Assets	Dates	Portfolio	Average	(t-stat)	Average	(t-stat)	Average	(t-stat)
1	Equities	*1800 - 2014*	W-L	0.88%	**10.6**	0.74%	**9.2**	-0.03%	-0.4
			W	0.52%	**11.7**	0.41%	**9.4**	0.02%	0.4
			L	-0.34%	**-7.9**	-0.29%	**-7.0**	0.06%	1.3
2	Currencies	*1800 - 2014*	W-L	0.51%	**9.6**	0.51%	**9.8**	0.07%	1.2
			W	0.18%	**7.1**	0.19%	**7.3**	0.00%	-0.1
			L	-0.33%	**-9.9**	-0.32%	**-10.7**	-0.07%	**-2.5**
3	Bonds	*1800 - 2014*	W-L	0.13%	**2.3**	0.14%	**2.6**	0.19%	**2.9**
			W	0.09%	**2.9**	0.10%	**3.3**	0.11%	**2.9**
			L	-0.04%	-1.4	-0.04%	-1.3	-0.08%	**-2.6**
4	Commodities	*1800 - 2014*	W-L	0.45%	**5.5**	0.11%	1.5	0.09%	1.1
			W	0.25%	**5.5**	0.04%	1.0	0.15%	**3.2**
			L	-0.20%	**-4.3**	-0.08%	-1.8	0.06%	1.3
5	Global Sectors	*1804 - 2014*	W-L	0.36%	**6.6**	0.54%	**8.1**	-0.12%	-1.6
			W	0.16%	**5.4**	0.28%	**7.8**	-0.02%	-0.5
			L	-0.20%	**-6.7**	-0.25%	**-6.7**	0.09%	**2.1**
6	U.S. Stocks	*1801 - 2014*	W-L	0.51%	**6.0**	0.30%	**5.5**	-0.03%	-0.5
			W	0.29%	**6.4**	0.17%	**5.8**	0.03%	0.9
			L	-0.23%	**-4.9**	-0.13%	**-4.2**	0.06%	1.8
7	Cross-Asset	*1801 - 2014*	W-L	0.45%	**10.2**	0.22%	**5.3**	0.31%	**7.1**
			W	0.22%	**10.1**	0.11%	**5.3**	0.15%	**7.2**
			L	-0.23%	**-10.3**	-0.11%	**-5.3**	-0.15%	**-7.0**
8	Combined	*1800 - 2014*	W-L	0.45%	**15.4**	0.35%	**13.4**	0.07%	**2.5**
			W	0.24%	**15.5**	0.18%	**13.2**	0.06%	**4.0**
			L	-0.22%	**-13.8**	-0.17%	**-11.8**	-0.01%	-0.5

Table X

Relation Between Investment Period Factor Exposure and Formation Period Factor Realizations

In each month (t), momentum strategy uses the top and bottom thirds of 10-month (skipping 2) price (spot) changes (P_{t-2}/P_{t-12}) to designate winners and losers {W and L}. Momentum long-short {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average return of the asset class. Table shows average 1-month forward return during UP, DOWN and all market states. Return is measured using local price (spot) changes. Regression 1 estimates: $r_{mo,t,i} = a_{mo} + B_{mo}\, r_{ma,t,i} + e_{mo,i}$. Regression 2 estimates: $r_{mo,t,i} = a_{mo,i} + B_{moDown} * D_{tDown} * r_{ma,t,i} + B_{moUP} * D_{tUP}\, r_{ma,t,i} + e_{mo,i}$, where dummy variable D_t {Down, Up} is: 1 if the cumulative performance of the asset class *i* over months *t-12* to *t-2*, is {Down, Up}. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an equally-weighted average of the seven momentum return time-series.

				Raw			Intercept		Beta		Intercept		Beta Up		Beta Down	
	Assets	Dates	Portfolio	Up	Down	Ave	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
1	Equities	*1800 - 2014*	W-L	1.05%	0.17%	0.88%	0.64%	**8.2**	0.24	**8**	0.44%	**6.0**	0.63	**19**	(0.56)	**-12**
			W	1.42%	0.15%	1.05%	0.40%	**9.3**	1.19	**72**	0.29%	**7.1**	1.41	**76**	0.73	**27**
			L	0.26%	-0.03%	0.18%	-0.30%	**-7.1**	0.93	**57**	-0.20%	**-5.0**	0.73	**40**	1.33	**50**
2	Currencies	*1800 - 2014*	W-L	0.74%	0.08%	0.51%	0.46%	**8.7**	0.21	**6**	0.27%	**6.0**	0.93	**25**	(0.80)	**-18**
			W	-0.11%	0.03%	0.71%	0.17%	**7.0**	(0.92)	**-61**	0.09%	**4.3**	(0.63)	**-36**	(1.31)	**-63**
			L	-0.85%	-0.04%	0.02%	-0.29%	**-9.0**	(1.13)	**-55**	-0.18%	**-6.3**	(1.57)	**-68**	(0.52)	**-19**
3	Bonds	*1800 - 2014*	W-L	0.23%	-0.02%	0.13%	0.10%	1.8	0.15	**5**	0.04%	0.7	0.53	**14**	(0.48)	**-10**
			W	0.41%	-0.02%	0.23%	0.07%	**2.1**	1.14	**66**	0.03%	1.1	1.34	**63**	0.81	**30**
			L	0.17%	-0.01%	0.10%	-0.04%	-1.2	0.99	**59**	0.00%	-0.2	0.81	**40**	1.30	**50**
4	Commodities	*1800 - 2014*	W-L	0.36%	0.55%	0.45%	0.50%	**6.2**	(0.18)	**-5**	0.57%	**7.1**	(0.41)	**-10**	0.30	**5**
			W	0.76%	0.46%	0.68%	0.23%	**5.2**	0.99	**49**	0.28%	**6.2**	0.85	**36**	1.28	**37**
			L	0.39%	-0.09%	0.24%	-0.28%	**-6.0**	1.17	**57**	-0.31%	**-6.8**	1.29	**52**	0.94	**27**
5	Global Sectors	*1804 - 2014*	W-L	0.44%	0.18%	0.36%	0.39%	**7.0**	(0.07)	**-3**	0.33%	**6.0**	0.14	**5**	(0.36)	**-11**
			W	0.72%	0.23%	0.57%	0.15%	**4.9**	1.02	**80**	0.12%	**4.1**	1.11	**68**	0.89	**47**
			L	0.28%	0.04%	0.21%	-0.24%	**-7.9**	1.09	**87**	-0.20%	**-6.9**	0.97	**60**	1.25	**68**
6	U.S. Stocks	*1801 - 2014*	W-L	0.72%	0.18%	0.51%	0.60%	**7.1**	(0.18)	**-10**	0.44%	**5.7**	0.21	**9**	(0.56)	**-25**
			W	1.12%	0.24%	0.78%	0.30%	**6.6**	0.98	**105**	0.21%	**5.2**	1.19	**99**	0.78	**66**
			L	0.40%	0.06%	0.27%	-0.30%	**-7.0**	1.16	**129**	-0.23%	**-5.7**	0.97	**83**	1.33	**116**
7	Cross-Asset	*1801 - 2014*	W-L	0.54%	0.16%	0.45%	0.31%	**7.0**	0.40	**10**	0.24%	**5.5**	0.69	**16**	(0.61)	**-7**
			W	0.68%	0.14%	0.55%	0.16%	**7.0**	1.19	**59**	0.12%	**5.5**	1.33	**61**	0.69	**17**
			L	0.14%	-0.02%	0.10%	-0.16%	**-6.9**	0.79	**39**	-0.12%	**-5.3**	0.64	**29**	1.31	**31**
8	Combined	*1800 - 2014*	W-L	0.56%	0.15%	0.45%	0.45%	**15**	(0.02)	-1	0.38%	**13**	0.23	**10**	(0.51)	**-16**
			W	0.69%	0.11%	0.65%	0.15%	**9**	1.04	**88**	0.12%	**7**	1.14	**82**	0.83	**43**
			L	0.11%	-0.05%	0.16%	-0.31%	**-16**	1.05	**81**	-0.27%	**-14**	0.90	**60**	1.35	**64**

Table XI

Momentum Optionality

Panel A shows the results of the following regress: $r_{mo,t} = a_0 + a_b * D_t + b_0 * r_{ma,t} + b_b * D_t * r_{ma,t} + b_{b,U} * D_t * D_{upmonth,t} * r_{ma,t} + e_{b,t}$, where the dependent variable is the W-L portfolio and the independent variables are a constant, an indicator for market state D_t: 1 if the cumulative performance of the Market over months t-12 to t-2 is negative and 0 otherwise, market return $r_{ma,t}$, and a contemporaneous up-market indicator $D_{upmonth,t}$: 1 if the contemporaneous market return is positive and 0 otherwise. Panel B shows the top 20 most negative and most positive momentum return months.

Panel A	Assets	Parameter	a_0	a_b	b_0	b_b	$b_{b,u}$	R^2_{adj}
1	Equities	*Estimate*	0.55%	-0.01%	0.63	-0.97	-0.50	17%
		t-stat	**6.02**	-0.04	**18.28**	**-11.98**	**-4.09**	
2	Currencies	*Estimate*	0.43%	-0.28%	0.86	-1.43	-0.29	24%
		t-stat	**7.34**	**-2.61**	**21.82**	**-18.47**	**-2.79**	
3	Bonds	*Estimate*	0.08%	-0.06%	0.57	-1.09	-0.01	12%
		t-stat	1.06	-0.49	**15.36**	**-11.87**	-0.10	
4	Commodities	*Estimate*	0.60%	0.20%	-0.41	0.98	-0.43	5%
		t-stat	**6.14**	0.95	**-9.46**	**7.26**	**-2.37**	
5	Global Sectors	*Estimate*	0.29%	0.28%	0.23	-0.59	-0.28	10%
		t-stat	**4.36**	**2.03**	**8.01**	**-9.28**	**-3.12**	
6	U.S. Stocks	*Estimate*	0.50%	0.39%	0.28	-0.69	-0.31	28%
		t-stat	**5.30**	**2.20**	**12.41**	**-15.74**	**-5.56**	
7	Cross-Asset	*Estimate*	0.25%	-0.14%	0.70	-1.53	0.24	12%
		t-stat	**4.96**	-1.05	**15.84**	**-9.87**	1.01	

Panel B		Top 20 Most Positive Months			Top 20 Most Negative Months		
1800-2014	Assets	W-L	$Market_t$	$Market_{t-2:t-12}$	W-L	$Market_t$	$Market_{t-2:t-12}$
1	Equities	19%	5%	26%	-16%	1%	8%
2	Currencies	13%	2%	12%	-13%	0%	2%
3	Bonds	15%	5%	11%	-12%	2%	0%
4	Commodities	15%	5%	7%	-12%	2%	1%
5	Global Sectors	13%	2%	7%	-11%	2%	-3%
6	U.S. Stocks	17%	2%	13%	-20%	12%	-12%
7	Cross-Asset	10%	1%	7%	-8%	1%	4%
	Average	15%	3%	12%	-13%	3%	0%

Table XII

Momentum Beta as a Function of Market State Duration

Table shows the results of the following regression: $B_{mo,t} = a_b + Coef_b * \text{Duration}_t + e_{b,t}$, where $B_{mo,t}$ is computed from the 10 - month regression ending on month t-2: $r_{mo,t} = a_{mo} + B_{mo} * r_{ma,t} + e_{mo,t}$ where $r_{ma,t}$ is the equally-weighted average of assets in each asset class, and $r_{mo,t}$ is the {W-L} portfolio return.

				UP		DOWN		ALL	
	Assets	Dates	Parameter	a_b	$Coeff_b$	a_b	$Coeff_b$	a_b	$Coeff_b$
1	Equities	*1800 - 2014*	Estimate	-0.17	0.01	-0.13	0.01	-0.13	0.01
			t-stat	**-2.8**	**4.2**	0.7	**3.3**	**-2.3**	**4.7**
2	Currencies	*1800 - 2014*	Estimate	0.14	0.01	0.52	0.06	0.16	0.01
			t-stat	1.8	**5.0**	**7.4**	**7.3**	**2.2**	**5.6**
3	Bonds	*1800 - 2014*	Estimate	-0.21	0.03	0.15	0.03	-0.04	0.02
			t-stat	**-3.1**	**5.6**	**2.2**	**4.9**	-0.7	**6.4**
4	Commodities	*1800 - 2014*	Estimate	-0.04	-0.01	-0.21	-0.02	-0.08	-0.01
			t-stat	-0.5	**-3.6**	**-3.5**	-1.7	-1.2	**-3.5**
5	Global Sectors	*1804 - 2014*	Estimate	-0.15	0.01	0.00	0.02	-0.12	0.01
			t-stat	**-2.8**	**4.6**	0.1	**4.5**	**-2.5**	**5.2**
6	U.S. Stocks	*1801 - 2014*	Estimate	-0.34	0.02	-0.09	0.03	-0.26	0.02
			t-stat	**-7.2**	**6.7**	-1.9	**4.9**	**-6.4**	**7.4**
7	Cross-Asset	*1801 - 2014*	Estimate	0.11	0.01	0.45	0.07	0.12	0.01
			t-stat	1.6	**5.1**	**7.0**	**8.3**	1.7	**5.4**
8	Combined	*1800 - 2014*	Estimate	-0.22	0.01	0.00	0.03	-0.19	0.01
			t-stat	**-5.3**	**6.1**	-0.1	**6.5**	**-5.2**	**6.9**

Table XIII

Robustness of Outlier Filters

In each month (t), momentum strategy uses the top and bottom thirds of 10-month (skipping 2) price (spot) changes (P_{t-2}/P_{t-12}) to designate winners and losers {W and L}. Momentum portfolios {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average return of the corresponding asset class. Table shows average 1-month forward return after portfolio formation. Return is measured using local price changes and local total returns. Results show the effect of outlier monthly returns winsorized at 50, 100 and 150%.

				Outliers +/- 50%		Outliers +/- 150%		Outliers +/- 100%	
	Assets	Dates	Portfolio	Average	(t-stat)	Average	(t-stat)	Average	(t-stat)
1	Equities	*1800 - 2014*	W-L	0.82%	**10.8**	0.89%	**10.6**	0.88%	**10.6**
			W	0.48%	**11.9**	0.52%	**11.7**	0.52%	**11.7**
			L	-0.32%	**-8.2**	-0.34%	**-8.0**	-0.34%	**-7.9**
2	Currencies	*1800 - 2014*	W-L	0.50%	**9.8**	0.51%	**9.5**	0.51%	**9.6**
			W	0.18%	**7.6**	0.18%	**6.5**	0.18%	**7.1**
			L	-0.32%	**-10.2**	-0.33%	**-9.6**	-0.33%	**-9.9**
3	Bonds	*1800 - 2014*	W-L	0.12%	**2.2**	0.15%	**2.6**	0.13%	**2.3**
			W	0.08%	**2.8**	0.10%	**2.9**	0.09%	**2.9**
			L	-0.04%	**-1.2**	-0.05%	**-1.6**	-0.04%	**-1.4**
4	Commodities	*1800 - 2014*	W-L	0.43%	**5.7**	0.46%	**5.5**	0.45%	**5.5**
			W	0.23%	**5.7**	0.25%	**5.3**	0.25%	**5.5**
			L	-0.19%	**-4.6**	-0.21%	**-4.3**	-0.20%	**-4.3**
5	Global Sectors	*1804 - 2014*	W-L	0.36%	**6.6**	0.42%	**6.5**	0.38%	**6.2**
			W	0.16%	**5.4**	0.22%	**6.1**	0.20%	**6.1**
			L	-0.20%	**-6.7**	-0.20%	**-5.8**	-0.18%	**-5.2**
6	U.S. Stocks	*1801 - 2014*	W-L	0.51%	**6.0**	0.40%	**4.0**	0.44%	**4.6**
			W	0.29%	**6.4**	0.30%	**5.7**	0.29%	**5.9**
			L	-0.23%	**-4.9**	-0.10%	**-1.9**	-0.15%	**-3.0**
7	Cross-Asset	*1801 - 2014*	W-L	0.43%	**10.3**	0.44%	**10.1**	0.45%	**10.2**
			W	0.21%	**10.2**	0.22%	**10.0**	0.22%	**10.1**
			L	-0.22%	**-10.4**	-0.23%	**-10.2**	-0.23%	**-10.3**
8	Combined	*1800 - 2014*	W-L	0.43%	**15.6**	0.44%	**14.5**	0.45%	**15.4**
			W	0.23%	**15.7**	0.25%	**15.2**	0.24%	**15.5**
			L	-0.21%	**-13.9**	-0.20%	**-12.1**	-0.22%	**-13.8**

Table XIV

Momentum, GDP-Weighted

In each month (t), momentum strategy uses the top and bottom thirds of 10-month (skipping 2) price (spot) changes (P_{t-2}/P_{t-12}) to designate winners and losers {W and L}. Momentum long-short {W-L, W, L} $r_{mo,t}$ are Real GDP-weighted, except for Commodities and U.S. Stocks, which are equally-weighted, rebalanced monthly. Table shows average 1-month forward return after portfolio formation. Return is measured using local price (spot) changes and local total returns. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an equally-weighted average of the seven momentum return time-series.

			Local Price Return			Local Total Return		
	Assets	Dates	Portfolio	Average	(t-stat)	Dates	Average	(t-stat)
1	Equities	*1800 - 2014*	W-L	1.16%	**7.9**	*1800 - 2014*	0.81%	**6.3**
			W	0.68%	**8.2**		0.41%	**5.5**
			L	-0.33%	**-3.9**		-0.32%	**-3.8**
2	Currencies	*1800 - 2014*	W-L	0.84%	**8.0**	*1800 - 2014*	0.44%	**2.5**
			W	0.27%	**4.8**		0.15%	**-3.5**
			L	-0.48%	**-6.7**		-0.27%	**4.0**
3	Bonds	*1800 - 2014*	W-L	0.06%	0.7	*1800 - 2014*	0.18%	**3.4**
			W	-0.05%	-0.8		0.10%	**2.9**
			L	-0.10%	-1.4		-0.06%	**-1.7**
4	Commodities	*1800 - 2014*	W-L	0.45%	**5.5**	*1960 - 2014*	0.97%	**4.1**
			W	0.25%	**5.5**		0.48%	**3.8**
			L	-0.20%	**-4.3**		-0.48%	**-3.6**
5	Global Sectors	*1804 - 2014*	W-L	0.35%	**4.3**	*1927 - 2014*	0.59%	**5.7**
			W	0.14%	**3.1**		0.30%	**5.5**
			L	-0.21%	**-4.5**		-0.29%	**-5.1**
6	U.S. Stocks	*1801 - 2014*	W-L	0.51%	**6.0**	*1927 - 2014*	0.81%	**6.7**
			W	0.29%	**6.4**		0.40%	**6.7**
			L	-0.23%	**-4.9**		-0.41%	**-6.4**
7	Cross-Asset	*1801 - 2014*	W-L	0.28%	**4.5**	*1801 - 2014*	0.50%	**6.0**
			W	0.14%	**4.4**		0.26%	**5.6**
			L	-0.14%	**-4.4**		-0.24%	**-5.6**
8	Combined	*1800 - 2014*	W-L	0.43%	**11.3**	*1800 - 2014*	0.35%	**10.1**
			W	0.22%	**10.3**		0.18%	**9.4**
			L	-0.21%	**-9.2**		-0.17%	**-8.2**

Table XV

Momentum, Volatility-Weighted

In each month (t), momentum strategy uses the top and bottom thirds of 10-month (skipping 2) price (spot) changes (P_{t-2}/P_{t-12}) to designate winners and losers {W and L}. Momentum long-short {W-L, W, L} $r_{mo,t}$ are weighted by the inverse of 10-year trailing standard deviation, rebalanced monthly. Table shows average 1-month forward return after portfolio formation. Return is measured using local price (spot) changes and local total returns. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an equally-weighted average of the seven momentum return time-series.

			Local Price Return			Local Total Return		
	Assets	Dates	Portfolio	Average	(t-stat)	Dates	Average	(t-stat)
1	Equities	*1800 - 2014*	W-L	0.77%	**10.0**	*1800 - 2014*	0.64%	**8.1**
			W	0.45%	**9.9**		0.34%	**7.7**
			L	-0.30%	**-8.0**		-0.30%	**-6.9**
2	Currencies	*1800 - 2014*	W-L	0.27%	**5.5**	*1800 - 2014*	0.28%	**5.5**
			W	0.06%	**2.3**		0.12%	**-5.6**
			L	-0.21%	**-6.7**		-0.16%	**6.1**
3	Bonds	*1800 - 2014*	W-L	0.10%	**2.0**	*1800 - 2014*	0.18%	**3.2**
			W	0.08%	**2.9**		0.10%	**3.0**
			L	-0.02%	-0.7		-0.08%	**-2.1**
4	Commodities	*1800 - 2014*	W-L	0.16%	**2.2**	*1960 - 2014*	0.84%	**4.1**
			W	0.16%	**3.5**		0.40%	**3.5**
			L	0.00%	-0.1		-0.44%	**-3.5**
5	Global Sectors	*1804 - 2014*	W-L	0.27%	**5.5**	*1927 - 2014*	0.58%	**6.0**
			W	0.21%	**6.5**		0.29%	**5.6**
			L	-0.06%	**-2.1**		-0.29%	**-5.4**
6	U.S. Stocks	*1801 - 2014*	W-L	0.46%	**6.0**	*1927 - 2014*	0.81%	**6.7**
			W	0.28%	**7.3**		0.40%	**6.7**
			L	-0.18%	**-4.0**		-0.41%	**-6.4**
7	Cross-Asset	*1801 - 2014*	W-L	0.40%	**11.8**	*1801 - 2014*	0.57%	**12.0**
			W	0.21%	**11.8**		0.36%	**12.4**
			L	-0.18%	**-10.7**		-0.22%	**-8.8**
8	Combined	*1800 - 2014*	W-L	0.32%	**15.2**	*1800 - 2014*	0.50%	**21.8**
			W	0.18%	**15.7**		0.27%	**22.1**
			L	-0.14%	**-12.1**		-0.23%	**-18.8**

Table XVI

Global Multi-Asset Class Trend

In each month (t), trend strategy uses positive and negative values of 10-month price changes (P_{t-2}/P_{t-12}) to designate positive trend and negative trend {W and L}. Trend portfolios {W-L, W, L} $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average of the asset class. Table shows average 1-month forward return after portfolio formation. Return is measured using local price (spot) changes, and local total returns. Commodity Spot strategy uses reverse momentum (P_{t-12}/P_{t-2}). Country-Sectors Total Returns use U.S. sectors only. Cross-Asset Class strategy uses the four asset classes (equities, currencies, bonds and commodities) local price returns. Combined Strategy is an equally-weighted average of the seven trend return time-series.

			Local Price Return			Local Total Return		
	Assets	Dates	Portfolio	Average	(t-stat)	Dates	Average	(t-stat)
1	Equities	*1800 - 2014*	W-L	0.73%	**10.3**	*1800 - 2014*	0.28%	**2.7**
			W	0.24%	**8.5**		0.10%	**3.4**
			L	-0.39%	**-8.3**		-0.13%	**-1.6**
2	Currencies	*1800 - 2014*	W-L	0.42%	**8.8**	*1800 - 2014*	0.12%	**1.9**
			W	0.19%	**7.4**		0.05%	**-2.3**
			L	-0.22%	**-8.1**		-0.06%	**2.5**
3	Bonds	*1800 - 2014*	W-L	0.01%	0.2	*1800 - 2014*	0.02%	**0.3**
			W	0.01%	0.2		0.00%	**-0.2**
			L	-0.01%	-0.1		-0.03%	**-0.4**
4	Commodities	*1800 - 2014*	W-L	0.38%	**4.6**	*1960 - 2014*	0.81%	**4.6**
			W	0.17%	**3.3**		0.34%	**3.4**
			L	-0.20%	**-4.8**		-0.47%	**-4.9**
5	Global Sectors	*1804 - 2014*	W-L	0.61%	**9.8**	*1927 - 2014*	0.27%	**2.1**
			W	0.23%	**7.4**		0.04%	**0.9**
			L	-0.36%	**-9.3**		-0.16%	**-2.0**
6	U.S. Stocks	*1801 - 2014*	W-L	0.42%	**5.9**	*1927 - 2014*	0.68%	**6.8**
			W	0.16%	**3.8**		0.20%	**2.8**
			L	-0.25%	**-6.4**		-0.48%	**-9.7**
7	Cross-Asset	*1801 - 2014*	W-L	0.47%	**9.8**	*1801 - 2014*	0.66%	**13.2**
			W	0.15%	**7.2**		0.17%	**8.8**
			L	-0.29%	**-10.3**		-0.38%	**-13.1**
8	Combined	*1800 - 2014*	W-L	0.38%	**14.5**	*1800 - 2014*	0.18%	**7.9**
			W	0.15%	**11.2**		0.07%	**6.7**
			L	-0.22%	**-14.5**		-0.11%	**-7.1**
Correlation w Momentum				76%			63%	

Table XVII

Other Momentum

In each month (t), momentum strategy uses the top and bottom thirds of P_{t-2}/P_{t-12} to designate winners and losers {W and L}. Momentum portfolios $r_{mo,t}$ are equally-weighted, rebalanced monthly. {W, L} is the excess return over the equally-weighted average. Table shows average 1-month forward return. Return is measured using local price (spot) changes and local total returns. Combined Strategy is an equally-weighted average of the original seven momentum return time-series. Cross-Momentum uses the momentum of the seven momentum time-series to form momentum portfolios. Bonds for Equities uses Country Bond momentum to form Country Equity {W-L} portfolios.

				Local Price (Spot) Ret			Local Total Ret	
	Assets	Dates	Portfolio	Average	(t-stat)	Dates	Average	(t-stat)
1	Combined	*1800 - 2014*	W-L	0.45%	**15.4**	*1800 - 2014*	0.40%	**14.0**
			W	0.24%	**15.5**		0.20%	**13.6**
			L	-0.22%	**-13.8**		-0.20%	**-13.0**
2	Cross - Momentum	*1801 - 2014*	W-L	0.38%	**5.2**	*1801 - 2014*	0.20%	**2.7**
			W	0.26%	**6.1**		0.19%	**4.3**
			L	-0.12%	**-3.0**		-0.02%	**-0.6**
3	Bonds for Equities	*1800 - 2014*	W-L	0.59%	**7.0**	*1800 - 2014*	0.50%	**7.2**
			W	0.31%	**6.8**		0.28%	**7.3**
			L	-0.21%	**-4.8**		-0.22%	**-5.9**

Figure I

Momentum of Momentum Literature

Number of Academic Papers in SSRN returned when searched for the term "Momentum".

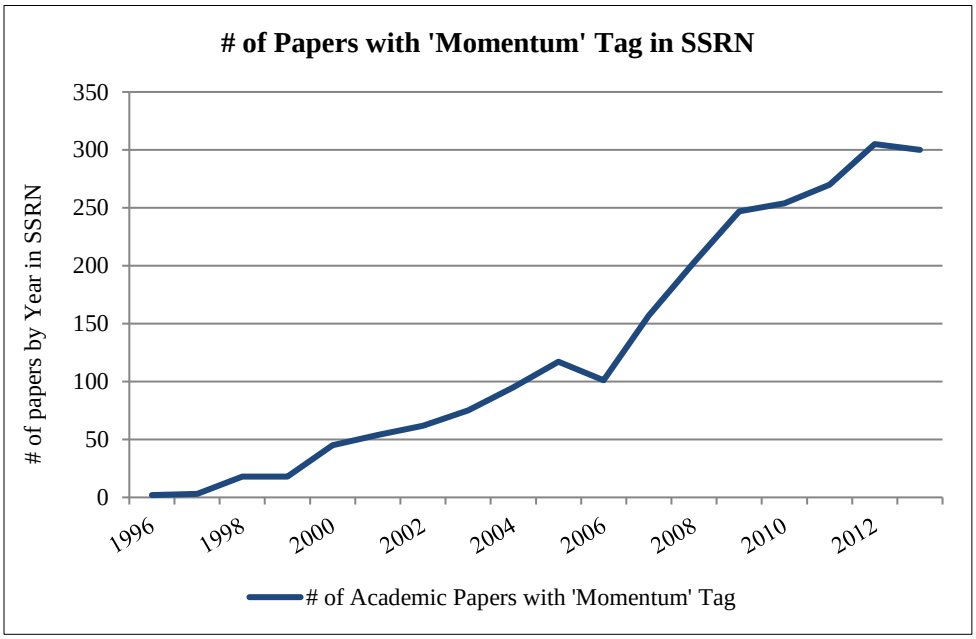


Figure II

Number of Assets

Number of assets with price data per asset class. Country-Sectors and U.S. Stocks are excluded from this graph.

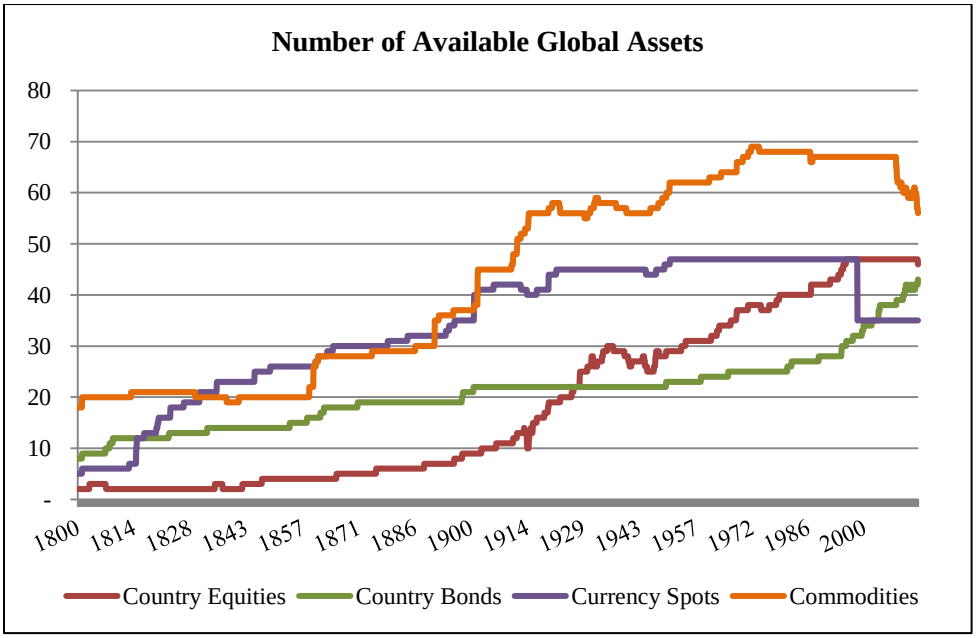
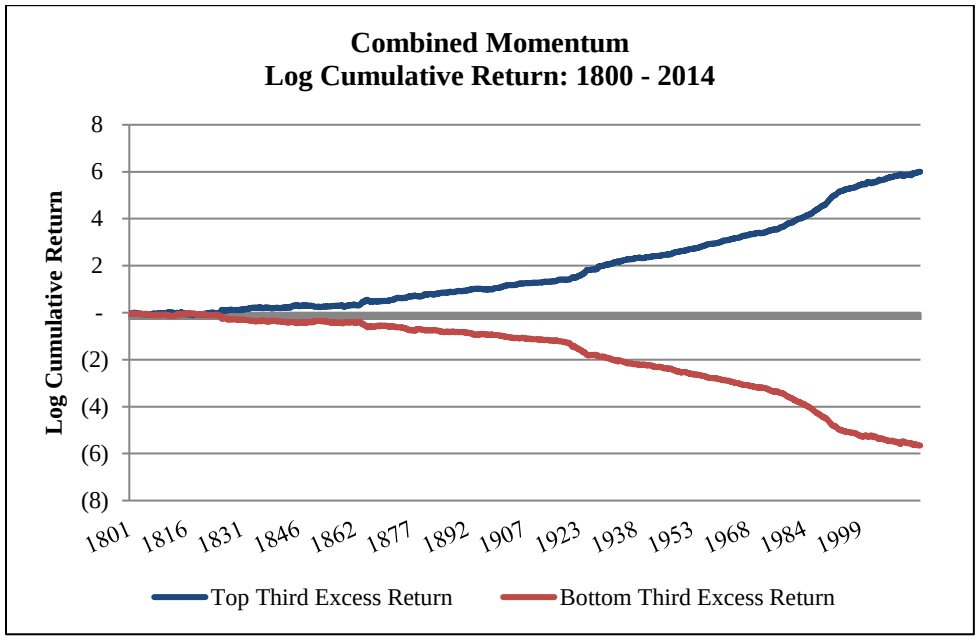


Figure III

Combined Momentum

Combined Strategy is an equally-weighted average of the seven momentum return time-series (Equities, Currencies, Bonds, Commodities, Sectors, Stocks and Cross-Asset class). Graphs show the log-cumulative and 10-year rolling long-short returns.



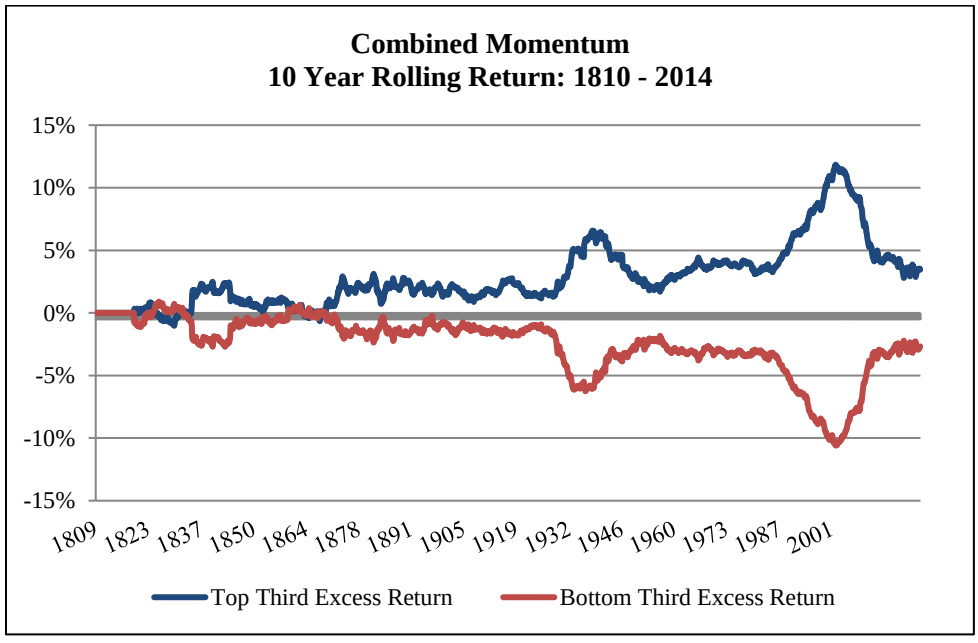
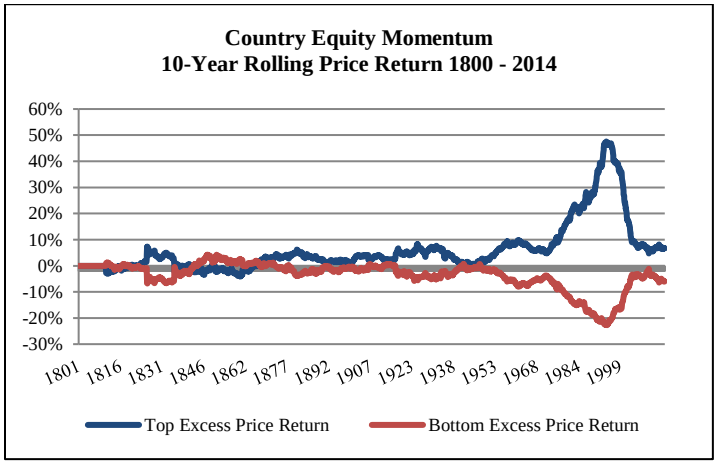
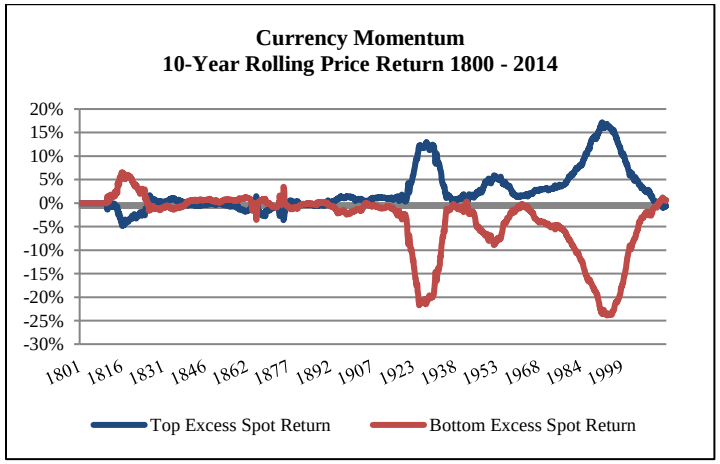


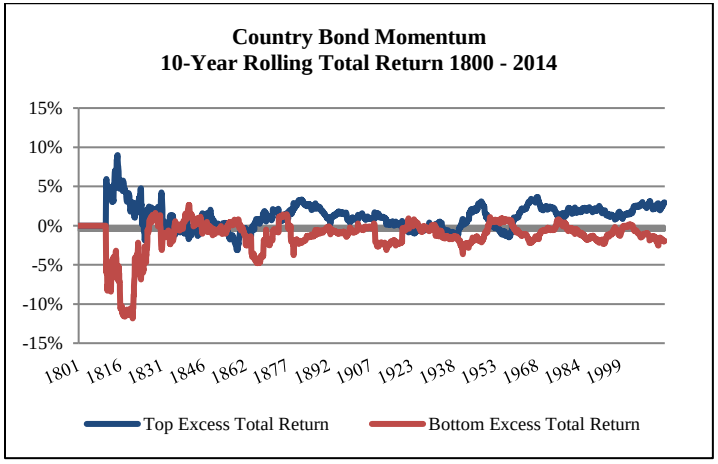
Figure IV

Individual Asset Class Momentum

Figure shows the average 10-year rolling returns to the Top and Bottom momentum portfolios in excess of the average return of the asset class (Equities, Currencies, Bonds, Commodities, Sectors, Stocks and Cross-Asset class).







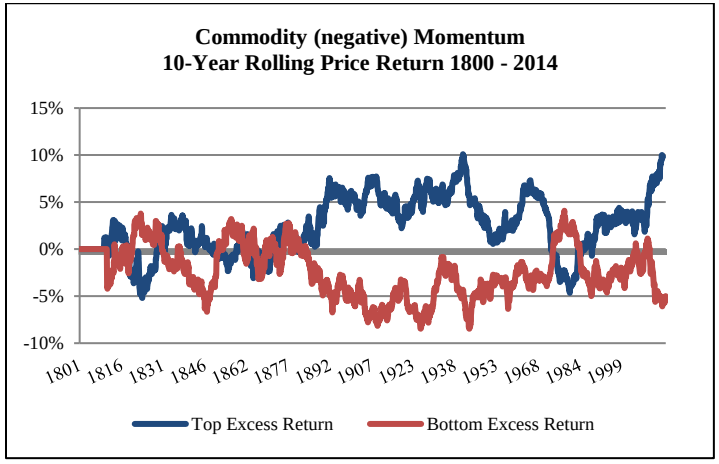
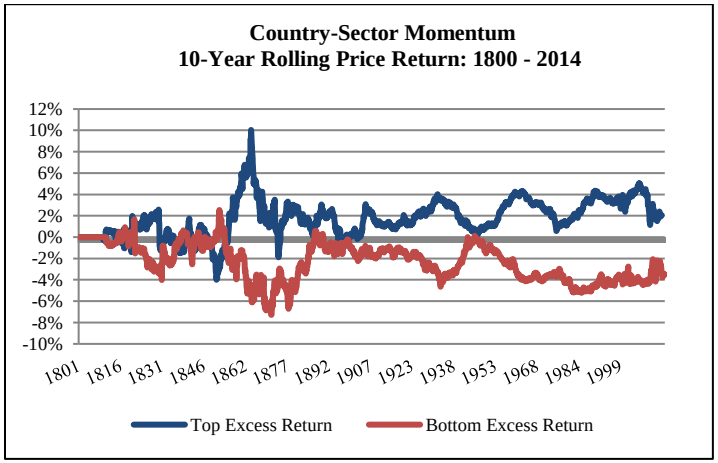
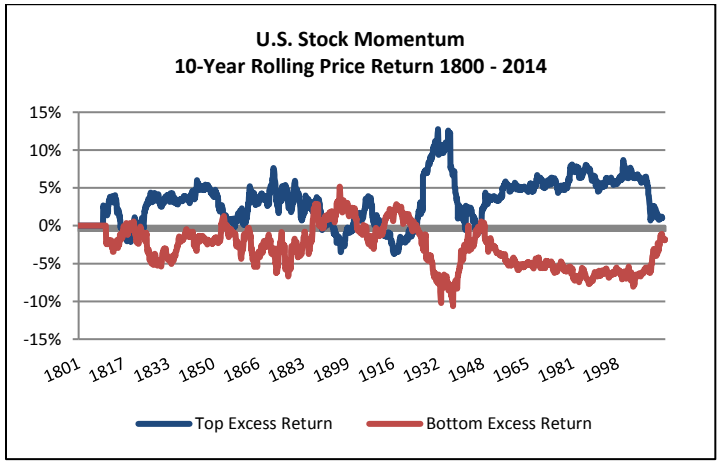


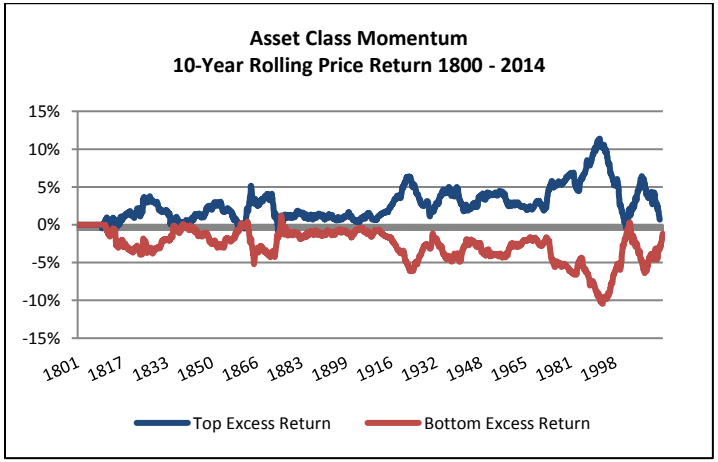
Figure IV

Individual Asset Class Momentum

Figure shows the average 10-year rolling returns to the Top and Bottom momentum portfolios in excess of the average return of the asset class (Equities, Currencies, Bonds, Commodities, Sectors, Stocks and Cross-Asset class).







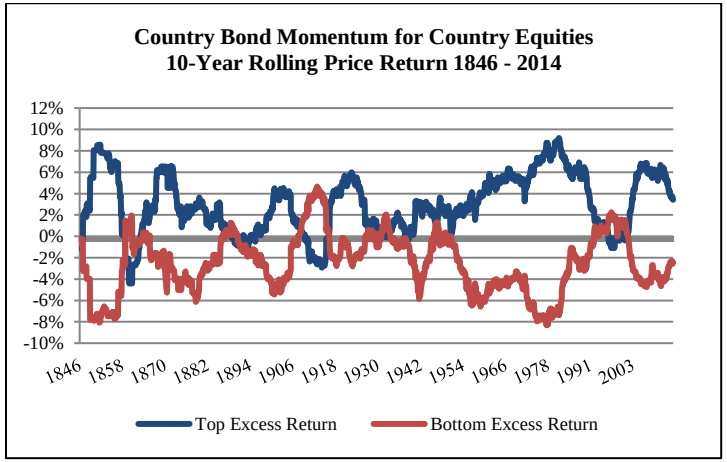
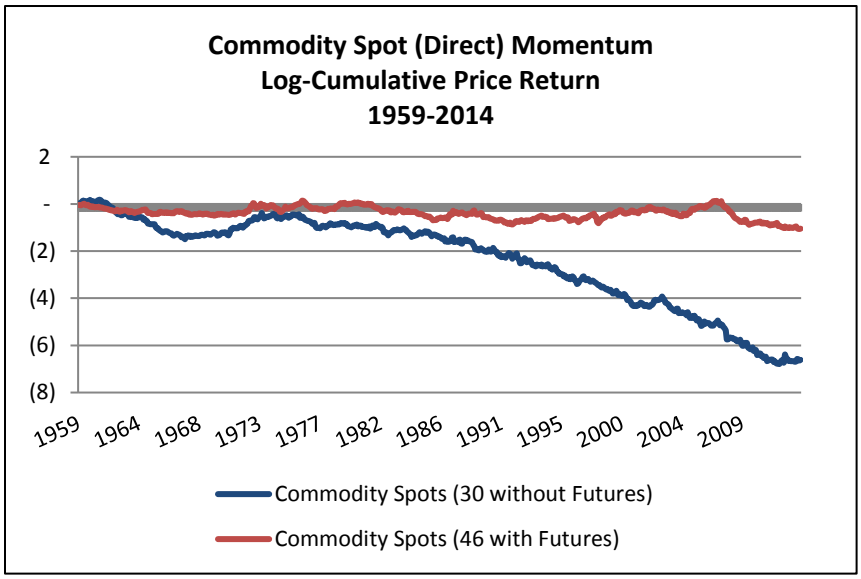


Figure V

Commodity Spots

Figure shows the log cumulative long-short direct momentum portfolio returns built with commodity spots. '30 without Futures' builds 10-month momentum long-short portfolios from the 30 commodity spots that do not have futures data since 1959. '46 with Futures' builds 10-month momentum long-short portfolios from the 46 commodity spots that do have futures data since 1959. 'Direct 10 M' Momentum uses the standard definition P_{t-2}/P_{t-12} used in this paper without reversing the sign. 'Direct 12 M' momentum definition is $P_{t-2}/P_{t-14.}$ 'De-seasonal 1' uses a 12-month average price measure in the momentum formulation $P_{(12m\ ave)t-2}$ /$P_{(12m\ ave)\ t-12}$. 'De-seasonal 2' removes all auto-correlation using a 10-year rolling regression to estimate 12-lag autocorrelations, $r_{i,t} = b_1 * D_1 + b2 * D_2 \ldots b_{12} * D_{12} + e_{i,t}$ and measures the 10-month momentum of the residual returns.



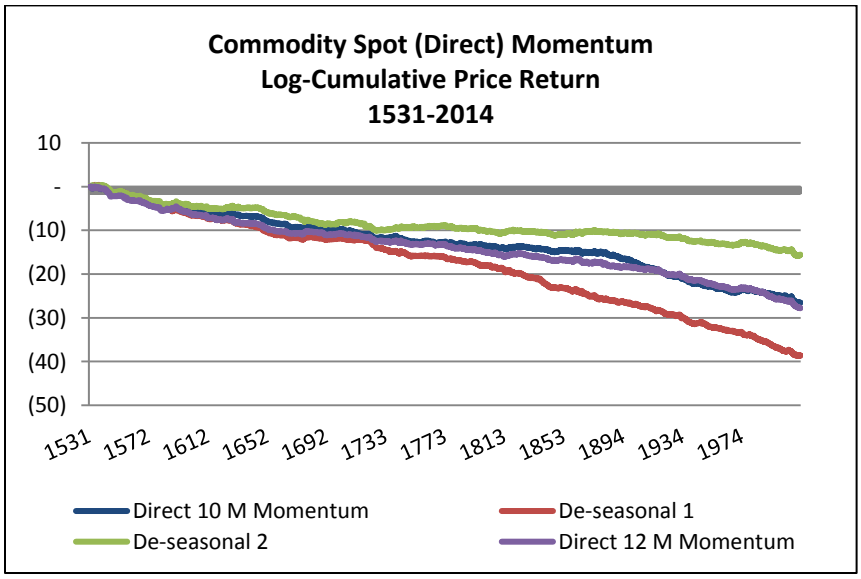
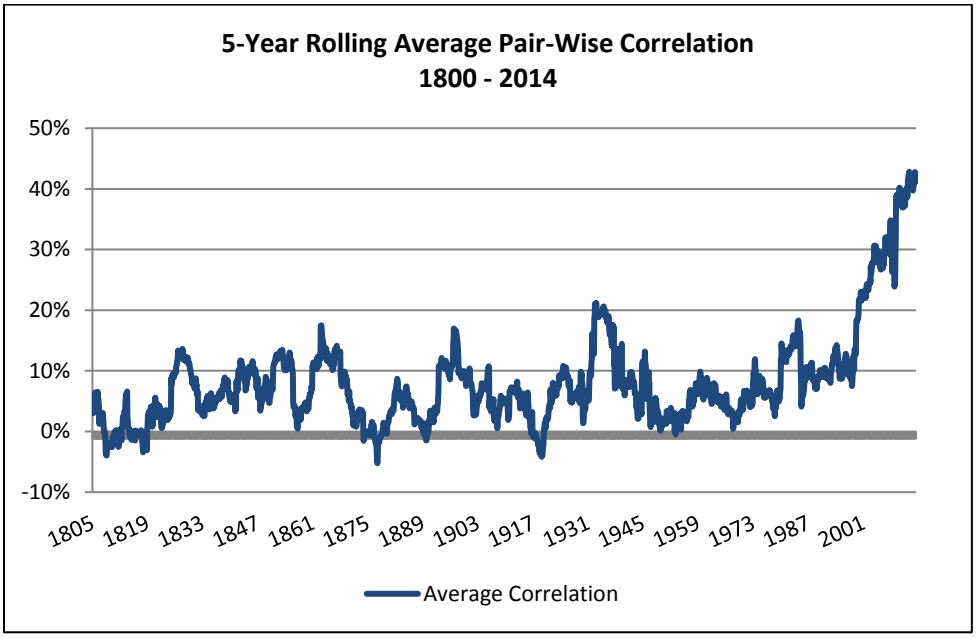


Figure VI

Average Correlations of Momentum Strategies

Figure shows the average 5-year rolling correlation between the seven momentum long-short returns (Equities, Currencies, Bonds, Commodities, Sectors, Stocks and Cross-Asset class).



Appendix A: Data

Country Equity Returns

We download all available data for 47 country equity price and total return indices. During the 19th century, the number of available countries stays under ten, but it rises significantly during the 20th century.

The U.K. has the longest running equity price index starting in 1693. The first stock in the index is the East Indies stock. From 1694 until 1811, the index equally weights three U.K. stocks: Bank of England, East Indies and South Sea. From 1811 to 1867, the index uses Rostow and Hayek's Total Index of Share Prices, which includes U.K. industrial firms. From 1867 to 1904, the index uses the London and Cambridge Economic Service index, the constituents of which grow from 25 to 75 by 1906. From 1906 to 1950, the index uses Banker's Magazine (covering 287 stocks) and *The Economist* data, and from 1950 to present the index uses the Financial Times index (FTSE All-Share Index).

By 1791, the U.S. stock index emerges, creating the first possible cross-sectional pair trade of the UK vs. U.S. From 1791 to 1801, the U.S. index is an equally-weighted average of seven bank companies, three insurance companies and two transport companies. Between 1801 and 1871, the index uses a combination of Smith and Cole, and Macaulay indices; and after 1871 Cowles and S&P Composites are used. The third country is France, which enters the dataset in 1801. The French index consists of Banque de France exclusively from 1801 to 1864. From 1865 to 1978, the INSEE index is used, followed by the CAC General Index from 1979 to 1990, and the CAC-40 index 1991 to present.

In several cases, there is more than one index per country, enabling a creation of a longer history of returns. In these cases, we splice the indices to create the longest possible history. This has occurred for eight countries: Austria, Greece, India, Brazil, Hong Kong, Russia, Malaysia, and Hungary. For example, Greece has Greece Market Index data from 1928 to 1940. From 1940 to 1952, the data are missing as the stock market was closed due to WWII. From 1952 to the present, the Athens SE General Index is used. These extensions have an insignificant effect on the overall results but do increase their time-frame.

In the beginning of some of the country histories, the data frequency is annual for several years until it changes to monthly. We use these annual data to compute the momentum value each month as a 10-month change in the index value that changes once a year and stays constant during the rest of the year. In this case, the full annual return to this country will only be captured once, in January, of every calendar year, and be zero during the other 11 months. Even though this slightly distorts the volatility of the monthly return in the early years, it expands the scope of country indices studied. This choice to include the annual data is an aesthetic one, having little bearing on the results, based upon robustness tests.

Because in early history there are fewer total return indices than price return, we supplement the missing total return data with a combination of price index changes and lagged dividend yield divided by 12. A dividend data map is shown in Appendix A. There are six countries for which dividend yield data start in the 19th century (Australia, Japan, France, Germany, U.K. and the U.S.), with the rest becoming available over the course of the 20th century. We report all results separately in price-only and total return terms.

Using the spot exchange rates of each country's currency to USD, we are able to construct both the local and the USD versions of the equity index histories. Given the wide availability of the currency history, all of the country equity indices have a corresponding currency history. A separate discussion of currency data follows below. As a result, we can measure country equity returns in each of the four following ways: price-only, total return, local currency and USD. Using USD returns allows us to simulate a U.S.-based, unhedged investor. None of these choices changes the conclusions but increases robustness of observations.

Currency Returns

Currency spot exchange rates are widely populated over the full sample. Starting in 1693, data for the UK and U.S. colonies exchange rate become available. In 1757, Canadian Dollar enters the dataset, followed by the Netherlands in 1792. By 1800, there are three additional country currencies for France, Germany, and Portugal. In GFD database all spot rates are quoted in foreign currency / USD. To compute momentum strategies, we first invert the exchange rate to compute strength / weakness of the foreign currency vs. USD. In this way, each currency's momentum is directly derived from the change of its exchange rate vs. the USD. Hence, our

currency mom entum portfolios are buying strengthening currencies and selling weakening currencies vs USD. When showing the results of the currency market / universe returns, we re-invert the returns so that the USD strength / weakness is reflected vs. all other currencies. Hence, for example, a rally in the currency market return corresponds to the rally in the USD vs global currencies. For currency excess return computation, we add the spread between the return of the foreign currency T-bill and the U.S. T-bill. Hence, when we show the price-only results, we use the currency spot changes; and when we show total return results, we use the currency excess returns.

T-bill Returns

The first two T-bill total return indices in our dataset start in 1800 for France and United Kingdom, followed by the U.S. in 1801, the Netherlands in 1813, and Germany in 1814. We have constructed T-bill total returns for each of the 47 countries in our sample in the following way. First, we start by using all the T-bill total return data available in GFD. Total return data are available for 39 of the 47 countries in our sample, but many country time-series do not extend all the way back to 1800, and sometimes they end before 2014. Secondly, we build a set of 3-month T-bill yields, which we lag by 3 months and divide by 3 to compute monthly T-bill total return index. The GFD database has a broad availability of the T-bill yields, which we further extend with country time-deposit rates and the central bank minimum interest rates, preferring the former, but if none be available, using the latter to backfill the remainder of the missing months. We use this method to fill in any missing GFD T-bill total return history, specifically for the following 22 countries: Argentina, Brazil, China, Colombia, Greece, Hungary, Iceland, Indonesia, Israel, Italy, Luxembourg, Norway, New Zealand, Peru, Poland, Russia, South Africa, Spain, Switzerland, Taiwan, Turkey, and the U.K. A few years of recent history were filled in from the FRED database of the St. Louis Fed (specifically, for Brazil, Iceland, and Chile rates). For the U.S. we also use Jeremy Siegel's T-bill data from 1801 to 1835. We fill the most recent data from Bloomberg for countries where GFD data ends before May 2014. Tickers in Appendix A that contain "_Index" refer to these Bloomberg extensions.

Government Bond Returns

Government 10-year bond total return data start in 1788 for the Netherlands and Denmark, in1790 for the U.S., in 1796 for France, and in 1800 for India. Of the 47 countries in the equity universe, we have government bond data for 43. For several countries, we rely on data from Bloomberg for the most recent history. In a similar manner to the country equity, using the currency spot rates we are also able to compute the USD version of the bond returns.

We also obtain the government bond yield data for the same sample of bonds. To extend coverage, we splice the 5- and 10-year bonds for the 23 countries. Our default choice was the 10-year bond, followed by the 5-year bond. Bond yields give us the ability to compute the implied bond price-only movements from $P_t = 1/yield_t$ crude approximation of bond's price. Hence, when we show the price-only results for bonds, we use the changes of the inverse yield; and when we show the total returns results, we use the bonds' total return histories. In this case, the total return momentum results are more meaningful, but we show price-only results for consistency of presenting the results across asset classes.

Commodity Returns

Commodity spot data are widely available for 76 commodities utilized in this study. In the GFD database, the earliest spot price data start in 1000 for rice and silver, and by 1693 data become available for barley, coal, cress, dates, gold, hops, iron, malt, mustard, oats, sesame, rye, tobacco, wheat and wool. By 1800, there are 20 commodity spot time-series available. Often, multiple commodity spot time-series are available for the same commodity, mainly varying by country or exchange city where the commodity was produced or traded. We splice multiple spot time-series to generate the longest uninterrupted history for each commodity. For example, in the case of corn, Pennsylvania corn prices are available from 1784 to 1896. And Chicago Yellow corn prices are available from 1858 to 2013. In this case, we would use the Pennsylvania corn data until 1857 and switch to the Chicago data in 1858. We link the time periods by creating an index of cumulative spot returns.

For the period after 1959, we use 46 commodity futures from Bloomberg. This allows us to compute and compare both the recent futures and spot returns of the momentum strategy and validate our conclusions from earlier spot-only history. We rely on the default Bloomberg continuously rolled data.

Country-Sector Returns

Country-sector data are available starting in 1804 for the U.S. and 1811 for the U.K., followed by France in 1856, Australia in 1875, South Africa in 1887, and Germany in 1903. A total of 301 sectors from 33 countries are built for this study. Countries were selected based on the number of sectors with available data. Only countries that had at least six sectors with available data were chosen. For each country, we assign all industries and sub-industries into one of the following 11 aggregate sectors: consumer discretionary, consumer staples, energy, finance, health care, industrials, information technology, materials, telecommunications, transportation, and utilities. All industries with the exception of transportation are the top-level classifications under the Global Industry Classification Standards. However, we decided to break out the transportation sector from industrials to add more robustness to earlier data, since transportation and industrial companies had a large representation in early history. Each country's sector data series was constructed to incorporate as many top level sector indices as possible and then extend to the earliest records using industry and sub-industry data. In some cases, we averaged two sub-industry indices within a sector group if sector-level data were not available and the monthly dates lined up exactly. No more than four indices were spliced to create any given sector data, with the exception of United Kingdom transportation which used seven indices to create a continuous time-series. For example, to construct Australia's Industrial sector, Sydney SE Industrial and Commercial data was used from 1875 to 1979, Australia S&P/ASX 200 Industrials were used from 1979 to 1992, and S&P/ASX 200 Industrials Accumulation Index was used from 1992 to 2014. The U.S. sector data and methodology from 1800 to 1926 come from Geczy and Samonov (2016), and from CRSP from 1926 to 2013. Each U.S. sector equally weights all the underlying stocks in the sector. For total returns results of sector momentum, we use only the U.S. sector data, as total returns are generally not available for country sectors.

U.S. Stocks

The U.S. stock data come from Geczy and Samonov (2016) from 1800 to 1927, after which CRSP data are used. Pre-1925 U.S. stock-level data was assembled by merging data from the International Center of Finance at Yale (ICF), the Inter-University Consortium for Political and Social Research (ICPSR), and Global Financial Data (GFD). Between 1800 and 1927, the

merged dataset contains price-return data on average for 272 securities per month, making it robust for security-level studies. With over 34 thousand securities in the overall sample, and on average with 301 stocks per long and short portfolio between 1800 and 2014, these data permit creation of a robust stock-level momentum time-series. As a refinement in this paper vs. Geczy and Samonov (2016), we filter the CRSP universe to common share class only (SHRCD equal to 10 or 11), and stock price levels (between $5 and $1000), borrowing this filter from the empirical literature in liquidity (for example, Pastor and Stambaugh (2003)). There is no material impact of these filters.

Appendix B.

Global Assets Mapping: Country Equity

This is the comprehensive list of global assets and indicies used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data.

	Equity Price					Equity Total Return				
Country	**Start**	**End**	**Name**	**ID**	**Extensions**	**Start**	**End**	**Name**	**ID**	**Extensions**
Argentina	12/31/1966	05/31/2014	Buenos Aires SE General Index (IVBNG)	_IBGD		12/31/1987	01/31/2005	Argentina BUSE Inflation Adjusted Stock TR Index	TRARGSBM	
Australia	01/31/1875	05/31/2014	Australia ASX All-Ordinaries (w/GFD extension)	_AORDD		09/30/1882	05/31/2014	Australia ASX Accumulation Index-All Ordinaries	_AORDAD	
Brazil	06/30/1925	05/31/2014	Dow Jones Brazil Stock Index	_BR1	_FGV100D	01/31/1954	05/31/2014	Brazil Bolsa de Valores de Sao Paulo (Bovespa)	_BVSPD	
Canada	01/31/1914	05/31/2014	Canada S&P/TSX 300 Composite (w/GFD extension)	_GSPTSED		12/31/1933	05/31/2014	Canada S&P/TSX-300 Total Return Index	_TRGSPTSE	
Chile	12/31/1894	05/31/2014	Santiago SE Indice General de Precios de Acciones	_IGPAD		12/31/1982	04/30/2014	Santiago SE Return Index	TRCHLSTM	
China	12/31/1990	05/31/2014	Shanghai SE Composite	_SSECD		12/31/1992	04/30/2014	China Stock Return Index	TRCHNSTM	
Colombia	01/31/1927	05/31/2014	Colombia IGBC General Index (w/GFD extension)	_IGBCD		12/31/1987	04/30/2014	Colombia Stock Return Index	TRCOLSTM	
Denmark	12/31/1914	05/31/2014	OMX Copenhagen All-Share Price Index	_OMXCPID		12/31/1969	05/31/2014	OMX Copenhagen All-Share Gross Index	_OMXCGID	
Hong Kong	08/31/1962	05/31/2014	Hong Kong Hang Seng Composite Index	_HSID	HKFEERD	12/31/1969	05/31/2014	Hang Seng Composite Return Index	_HSIDVD	
Hungary	12/31/1924	05/31/2014	Vienna OETEB Hungary Traded Index (Forint)	_HTLD	HUBUDAM	01/31/1991	05/31/2014	Budapest Stock Exchange Index (BUX)	_BUXD	
Iceland	12/31/1992	05/31/2014	OMX Iceland All-Share Price Index	_OMXIPID		06/30/2002	05/31/2014	OMX Iceland All-Share Gross Index	_OMXIGID	
India	12/31/1880	05/31/2014	Bombay SE Sensitive Index (w/GFD extension)	_BSESND	GBBRRINM	12/31/1987	04/30/2014	India Stocks Total Return Index	TRINDSTM	
Indonesia	12/31/1977	05/31/2014	Jakarta SE Composite Index	_JKSED		12/31/1987	04/30/2014	Indonesia Stock Return Index	TRIDNSTM	
Israel	01/31/1949	05/31/2014	Tel Aviv All-Share Index	ILTLVAD		12/31/1992	04/30/2014	Tel Aviv SE Return Index	TRISRSTM	
Japan	07/31/1914	05/31/2014	Tokyo SE Price Index (TOPIX) (w/GFD extension)	_TOPXD		12/31/1920	05/31/2014	Japan Topix Total Return Index	_TOPXDVD	
Malaysia	12/31/1969	05/31/2014	Malaysia KLSE Composite	_KLSED	_KLFID	11/30/1972	04/30/2014	Kuala Lumpur SE Return Index	TRMYSSTM	
Mexico	01/31/1930	05/31/2014	Mexico SE Indice de Precios y Cotizaciones (IPC)	_MXXD		12/31/1987	05/31/2014	Mexico SE Return Index	_IRTD	
New Zealand	12/31/1926	05/31/2014	New Zealand SE All-Share Capital Index	_NZCID		06/30/1986	05/31/2014	New Zealand SE Gross All-Share Index	_NZGID	
Norway	01/31/1914	05/31/2014	Oslo SE OBX-25 Stock Index (w/GFD extension)	_OBXPD		12/31/1969	09/30/2001	Oslo SE Total Return Index	_NTOTD	_OBXD
Pakistan	07/31/1960	05/31/2014	Pakistan Karachi SE-100 Index	_KSED		12/31/1987	04/30/2014	Pakistan Stock Return Index	TRPAKSTM	
Peru	12/31/1926	05/31/2014	Lima SE General Index (w/GFD extension)	_IGRAD		12/31/1992	04/30/2014	Peru Stock Return Index	TRPERSTM	
Philippines	12/31/1952	05/31/2014	Manila SE Composite Index	_PSID		12/31/1981	04/30/2014	Philippines Return Stock Index	TRPHLSTM	
Poland	04/30/1994	05/31/2014	Warsaw SE 20-Share Composite	_WIG20D		04/30/1991	05/31/2014	Warsaw SE General Index (WIG)	_WIGD	
Russian Federation	09/30/1993	05/31/2014	Russia MICEX Composite	_MCXD	_AKMCD	12/31/1994	05/31/2014	Russian Depository Total Return Index	_RDXTRUD	
Singapore	07/31/1965	05/31/2014	Singapore FTSE Straits-Times Index	_FTSTID		12/31/1969	04/30/2014	Singapore SE Return Index	TRSGPSTM	
South Africa	01/31/1910	05/31/2014	FTSE/JSE All-Share Index (w/GFD extension)	_JALSHD		01/31/1960	04/30/2014	Johannesburg SE Return Index	TRZAFSTM	
South Korea	01/31/1962	05/31/2014	Korea SE Stock Price Index (KOSPI)	_KS11D		01/31/1962	04/30/2014	Korea Stocks Total Return Index	TRKORSTM	
Sweden	12/31/1901	05/31/2014	Sweden OMX Affärsvärldens General Index	_OMXAFGX		12/31/1918	05/31/2014	OMX Stockholm Benchmark Gross Index (GFD extension	_OMXSBGI	
Switzerland	12/31/1910	05/31/2014	Switzerland Price Index (w/GFD extension)	_SPIXD		01/31/1966	05/31/2014	Swiss Performance Index	_SSHID	
Taiwan	01/31/1967	05/31/2014	Taiwan SE Capitalization Weighted Index	_TWIID		12/31/1987	04/30/2014	Taiwan FTSE/TSE-50 Return Index	_TSE50TD	
Thailand	04/30/1975	05/31/2014	Thailand SET General Index	_SETID		04/30/1975	04/30/2014	Bangkok SE Return Index	TRTHASTM	
Turkey	01/31/1986	05/31/2014	Istanbul SE IMKB-100 Price Index	_XU100D		01/31/1986	05/31/2014	Turkey ISE-100 Total Return Index	TRRBILED	
United Kingdom	01/31/1693	05/31/2014	UK FTSE All-Share Index (w/GFD extension)	_FTASD		08/31/1694	05/31/2014	UK FTSE All-Share Return Index (w/GFD extension)	_TFTASD	
Venezuela	12/31/1929	05/31/2014	Caracas SE General Index (w/GFD extension)	_IBCD		12/31/1987	01/31/2008	Venezuela Stock Return Index	TRVENSTM	
Austria	01/31/1922	05/31/2014	Austria Wiener Boersekammer Share Index (WBKI)	_WBKID		12/31/1969	05/31/2014	Vienna SE ATX Total Return Index	_ATXTRD	
Belgium	01/31/1897	05/31/2014	Brussels All-Share Price Index (w/GFD extension)	_BSPTD		12/31/1950	05/31/2014	Brussels All-Share Return Index (GFD extension)	_BCSHD	
Finland	10/31/1912	05/31/2014	OMX Helsinki All-Share Price Index	_OMXHPID		10/31/1912	03/31/2013	OMX Helsinki All-Share Gross Index	_OMXHGID	_OMXHCAPGI
France	12/31/1864	05/31/2014	France CAC All-Tradable Index (w/GFD extension)	_CACTD		01/31/1895	03/31/2014	France CAC All-Tradable Total Return Index	TRSBF250D	
Germany	12/31/1840	05/31/2014	Germany CDAX Composite Index (w/GFD extension)	_FWBXXD		12/31/1869	05/31/2014	Germany CDAX Total Return Index (w/GFD extension)	_CDAXD	
Greece	12/31/1928	05/31/2014	Athens SE General Index (w/GFD extension)	_ATGD	GRATHENM	12/31/1976	05/31/2014	ASE Total Return General Index	_RETMD	
Ireland	01/31/1934	05/31/2014	Ireland ISEQ Overall Price Index (w/GFD extension)	_ISEQD		01/31/1988	05/31/2014	ISEQ Overall Total Return Index	_IVRTD	
Italy	09/30/1905	05/31/2014	Banca Commerciale Italiana Index (w/GFD extension)	_BCIID		12/31/1924	05/31/2014	Italy BCI Global Return Index (w/GFD extension)	_BCIPRD	
Netherlands	01/31/1919	05/31/2014	Netherlands All-Share Price Index (w/GFD extension	_AAXD		12/31/1950	04/30/2014	Netherlands Total Return Stock Index	TRNLDSTM	
Portugal	06/30/1931	05/31/2014	Oporto PSI-20 Index	_PSI20D		01/31/1988	05/31/2014	Lisbon BVL General Return Index	_BVLGD	
Spain	12/31/1833	05/31/2014	Madrid SE General Index (w/GFD extension)	_SMSID		03/31/1940	05/31/2014	Barcelona SE-30 Return Index (w/GFD extension)	_BCNPR30	
Luxembourg	12/31/1929	05/31/2014	Luxembourg SE LUXX Index (w/GFD extension)	_LUXXD		12/31/1984	05/31/2014	Luxembourg SE Total Return Index	_LUXXRD	
United States	08/31/1791	05/31/2014	S&P 500 Composite Price Index (w/GFD extension)	_SPXD		01/31/1800	05/31/2014	S&P 500 Total Return Index (w/GFD extension)	_SPXTRD	
EUROPE	01/31/1919	05/31/2014	GFD Europe Price Index	GFEURM		12/31/1925	04/30/2014	GFD Europe Return Index	TREURM	

Appendix B. contd.

Global Assets Mapping: Government Bonds

This is the comprehensive list of global assets and indicies used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data.

	Bond Total Return					Bond Yields				
Country	**Start**	**End**	**Name**	**ID**	**Extensions**	**Start**	**End**	**Name**	**ID**	**Extension**
Australia	05/31/1857	05/31/2014	Australia 10-year Government Bond Return Index	TRAUSGVM	SBAD5L Index	06/30/1857	05/31/2014	Australia 10-year Government Bond Yield	IGAUS10D	GACGB10 Index;GEBR10Y Index
Canada	12/31/1852	05/31/2014	Canada 10-year Total Return Government Bond Index	TRCANGVM	SBCD5L Index	01/31/1853	05/31/2014	Canada 10-year Government Bond Yield	IGCAN10D	GCAN10YR Index;C02010Y Index;COGR10Y Index
China	03/31/2011	05/31/2014	China 5-year Government Bond Return Index		SBCN5PL Index	03/31/2003	05/31/2014			C0205Y Index
Chile	08/31/2011	05/31/2014	Chile 5-year Government Bond Return Index		SBCL5PL Index					
Colombia	08/31/2013	05/31/2014	Colombia 5-year Government Bond Return Index		SBCO5PL Index	12/31/2009	05/31/2014	Colombia 5-Year Government Bond Yield		COGR5Y Index
Denmark	08/31/1788	05/31/2014	Denmark 10-year Total Return Government Bond Index	TRDNKGVM	SBDK5L Index	09/30/1788	05/31/2014	Denmark 10-year Government Bond Yield	IGDNK10D	GDGB10YR Index
Hong Kong	05/31/1993	05/31/2014	Hong Kong 10-year Government Bond Return Index	TRHKGGVM		10/31/1993	05/31/2014	Hong Kong 10-year Government Bond Yield	IGHKG10D	IGHKG3D;HKGG10Y Index;GHGB10YR Index
Hungary	08/31/2011	05/31/2014	Hungary 5-year Government Bond Return Index		SBHU5PL Index	01/31/1999	05/31/2014	Hungary 5-Year Government Bond Yield		GHGB5YR Index
Iceland	12/31/1992	06/30/2004	Iceland Government Bonds Return Index	TRISLGVD		11/30/1993	05/31/2014	Iceland 10-year Government Bond Yield	IGISL10D	IGISL5D
India	01/31/1800	05/31/2014	India 10-year Government Bond Total Return Index	TRINDGVD		01/31/1800	05/31/2014	India 10-Year Government Bond Yield	IGIND10D	GIND10YR Index;GIDN10YR Index;GISR10YR Index
Indonesia	05/31/2008	05/31/2014	Indonesia 5-year Government Bond Return Index		SBID5PL Index	07/31/2003	05/31/2014	Indonesia 5-Year Government Bond Yield		GIDN5YR Index
Israel	08/31/2011	05/31/2014	Israel 5-year Government Bond Return Index		SBIS5PL Index	02/28/2006	05/31/2014	Israel 5-Year Government Bond Yield		GISR5YR Index
Japan	11/30/1870	05/31/2014	Japan GFD/Nikko Government Bond Return Index	JPNBGLM	SBJY5L Index	05/31/1870	05/31/2014	Japan 10-year Government Bond Yield	IGJPN10D	GJGB10 Index
Malaysia	12/31/1960	05/31/2014	Malaysia 10-year Government Bond Return Index	TRMYSGVM	SBMY5MY Index	11/30/1964	05/31/2014	Malaysia 10-year Government Bond Yield	IGMYS10D	MGIY10Y Index
Mexico	12/31/1994	05/31/2014	Mexico 10-year Government Bonds Total Return Index	TRMEXGVM		07/31/2001	05/31/2014	Mexico 10-year Government Bond Yield	IGMEX10D	GMXN10YR Index
New Zealand	09/30/1861	05/31/2014	New Zealand 10-year Government Bond Return Index	TRNZLGVD	SBNZL Index	10/31/1861	05/31/2014	New Zealand 10-year Government Bond Yield	IGNZL10D	GNZGB10 Index
Norway	02/28/1822	05/31/2014	Oslo SE BRIX Government Bond Return Index	TRNORGVD		03/31/1822	05/31/2014	Norway 10-year Government Bond Yield	IGNOR10D	GNOR10YR Index
Pakistan	12/31/1948	05/31/2014	Pakistan Government Bond Total Return Index	TRPAKGVM		01/31/1949	05/31/2014	Pakistan 10-year Government Bond Yield	IGPAK10D	PKIB10YR Index;GRPE10Y Index
Peru	08/31/2013	05/31/2014	Peru 5-year Government Bond Return Index		SBPU57L Index	10/31/2007	05/31/2014	Peru 5-Year Government Bond Yield		GRPE5Y Index
Philippines	08/31/1996	05/31/2014	Philippines 10-year Government Bond Return Index	TRPHLGVM		09/30/1996	05/31/2014	Philippines 10-year Government Bond Auction Result	IGPHL10D	PDSR10YR Index
Poland	04/30/1999	05/31/2014	Poland 10-year Government Bond Return Index	TRPOLGVM	SBPL5PL Index	05/31/1999	05/31/2014	Poland 10-year Government Bond Yield	IGPOL10D	POEU10YR Index;MICXRU10 Index
Russian Federation	11/30/2012	05/31/2014	Russia 5-year Government Bond Return Index		SBRU57L Index	03/31/2010	05/31/2014	Russia 5-Year Government Bond Yield		MICXRU5 Index
Singapore	11/30/1987	05/31/2014	Singapore 10-year Government Bond Total Return Index	TRSGPGVM	SBSG5PL Index	12/31/1987	05/31/2014	Singapore 10-year Government Bond Yield	IGSGP10D	IGSGP5D;MASB10Y Index
South Africa	11/30/1860	05/31/2014	South Africa SARB Government Bond Return Index	TRZAFGVM		11/30/1860	03/31/2014	South Africa 10-Year Bond Yield	IGZAF10D	GSAB10YR Index
South Korea	01/31/1957	05/31/2014	South Korea 10-year Government Bond Return Index	TRKORGVM	SBKR5KR Index	12/31/1957	05/31/2014	Republic of Korea 10-year Government Bond Yield	IGKOR10D	IGKOR5D;GVSK10YR Index
Sweden	07/31/1868	05/31/2014	Sweden Govt Bond Return Index (w/GFD extension)	_RXTBD	SBSK5L Index	09/30/1788	05/31/2014	Sweden 10-year Government Bond Yield	IGSWE10D	GSGB10YR Index
Switzerland	01/31/1915	05/31/2014	Switzerland TR Government Bond Index	_SDGTD	SBSZ5L Index	11/30/1899	05/31/2014	Switzerland 10-year Government Bond	IGCHE10D	GSWISS10 Index
Taiwan	12/31/1994	05/31/2014	Taiwan 10-year Government Bond Return Index	TRTWNGVM		01/31/1995	05/31/2014	Taiwan 10-year Government Bond Yield	IGTWN10D	GVTW10YR Index
Thailand	11/30/1979	05/31/2014	Thailand 10-year Government Bond Return Index	TRTHAGVM		12/31/1979	05/31/2014	Thailand 10-year Government Bond Yield	IGTHA10D	GVTL10YR Index;GTRU10YR Index
Turkey	03/31/2011	05/31/2014	Turkey 5-year Government Bond Return Index		SBTR5PL Index	03/31/2003	05/31/2014	Turkey 5-Year Government Bond Yield		GTRU5YR Index
United Kingdom	12/31/1932	05/31/2014	United Kingdom 10-year Government Bond Total Return Index	TRGBRGVM	SBUK5L Index	07/31/1729	05/31/2014	United Kingdom 10-year Government Bond Yield	IGGBR10D	IGGBRCD;GUKG10 Index
Austria	06/30/1923	05/31/2014	Austria 10-year Total Return Government Bond Index	TRAUTGVM	SBAS5L Index	09/30/1788	05/31/2014	Austria 10-year Government Bond Yield	IGAUT10D	GAGB10YR Index
Belgium	11/30/1831	05/31/2014	Belgium 10-year Total Return Government Bond Index	TRBELGVM	SBBF5L Index	12/31/1831	05/31/2014	Belgium 10-year Government Bond Yield	IGBEL10D	GBGB10YR Index
Finland	12/31/1959	05/31/2014	Finland 10-year Government Bond Total Return Index	TRFINGVM	SBFM5L Index	12/31/1896	05/31/2014	Finland 10-year Government Bonds	IGFIN10D	IGFIN5D;GFIN10YR Index
France	12/31/1796	05/31/2014	France 10-year Total Return Government Bond Index	TRFRAGVM	SBFF5L Index	01/31/1746	05/31/2014	France 10-year Government Bond Yield	IGFRA10D	GFRN10 Index
Germany	12/31/1923	05/31/2014	Germany 10-year Government Bond Return Index	TRDEUGVM	SBDM5L Index	01/31/1807	05/31/2014	Germany 10-year Benchmark Bond	IGDEU10D	GDBR10 Index
Greece	09/30/1992	05/31/2014	Greece 10-year Bond Total Return Index	TRGRCGVM		01/31/1981	05/31/2014	Greece 10-year Government Note Yield	IGGRC10D	GGGB10YR Index
Ireland	02/28/1897	05/31/2014	Ireland 10-year Government Bonds Return Index	TRIRLGVM	SBIR5L Index	03/31/1897	05/31/2014	Ireland 10-year Government Bond Yield	IGIRL10D	GIGB10YR Index
Italy	10/31/1807	05/31/2014	Italy 10-year Total Return Government Bond Index	TRITAGVM	SBIT5L Index	11/30/1807	05/31/2014	Italy 10-year Government Bond Yield	IGITA10D	GBTPGR10 Index
Netherlands	08/31/1788	05/31/2014	Netherlands 10-year Government Bond Return Index	TRNLDGVM	SBDG5L Index	12/31/1517	05/31/2014	Netherlands 10-year Government Bond Yield	IGNLD10D	GNTH10YR Index
Portugal	12/31/1975	05/31/2014	Portugal 10-year Government Bond Return Index	TRPRTGVM	SBPE5L Index	01/31/1806	05/31/2014	Portugal 10-year Government Bond Yield	IGPRT10D	GSPT10YR Index
Spain	08/31/1788	05/31/2014	Spain 10-year Government Bond Total Return Index	TRESPGVD	SBSP5L Index	09/30/1788	05/31/2014	Spain 10-year Government Bond Yield	IGESP10D	GSPG10YR Index
United States	10/31/1790	05/31/2014	USA 10-year Government Bond Total Return Index	TRUSG10M	SBUS10L Index	08/31/1786	05/31/2014	USA 10-year Bond Constant Maturity Yield	IGUSA10D	USGG10YR Index

Appendix B. contd.

Global Assets Mapping: Currency Spots

This is the comprehensive list of global assets and indicies used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data.

	Currency Spots				T-bill Total Return				
Country	Start	End	Name	ID	Start	End	Name	ID	Extensions
Argentina	01/31/1848	05/31/2014	Argentina Peso per US Dollar	USDARS	02/28/1977	05/31/2014	Argentina BUSE Deposits Inflation Adjusted Returns	TRARGBIM	
Australia	07/31/1822	05/31/2014	Australian Dollars per US Dollar	USDAUD	10/31/1834	05/31/2014	Australia Total Return Bills Index	TRAUSBIM	
Brazil	01/31/1812	05/31/2014	Brazil Real per US Dollar	USDBRL	01/31/1948	05/31/2014	Brazil T-bills Return Index	_IRFMD	
Canada	07/31/1757	05/31/2014	Canada Dollar per US Dollar	USDCAD	12/31/1933	05/31/2014	Canada Total Return Bills Index	TRCANBIM	
Chile	01/31/1878	05/31/2014	Chile Peso per US Dollar	USDCLP					
China	08/31/1948	05/31/2014	China Yuan Renmimbi per US Dollar	USDCNY					
Colombia	01/31/1919	05/31/2014	Colombia Peso per US Dollar	USDCOP					
Denmark	01/31/1864	05/31/2014	Denmark Krone per US Dollar	USDDKK	12/31/1863	05/31/2014	Denmark CIBOR/T-bills Total Return Index	TRDNKBIM	
Hong Kong	01/31/1844	05/31/2014	Hong Kong Dollar per US Dollar	USDHKD	12/31/1967	05/31/2014	Hong Kong Bills Total Return	TRHKGBIM	
Hungary	01/31/1900	05/31/2014	Hungary Forint Exchange Rate per US Dollar	USDHUF					
Iceland	01/31/1900	05/31/2014	Iceland Krona per US Dollar	USDISK	01/31/1901	05/31/2014	Iceland Treasury Bill Total Return Index	TRISLBIDD	
India	07/31/1822	05/31/2014	India Rupee per US Dollar	USDINR	12/31/1835	05/31/2014	India Bills Total Return Index	TRINDBID	
Indonesia	12/31/1818	05/31/2014	Indonesia Rupiah per US Dollar	USDIDR					
Israel	01/31/1919	05/31/2014	Israel New Shequel per US Dollar	USDILS	03/31/1982	05/31/2014	Israel Makam Bill Index	TRISRBIM	
Japan	07/31/1862	05/31/2014	Japanese Yen per US Dollar	USDJPY	09/30/1882	05/31/2014	Japan Total Return Bills Index	TRJPNBIM	
Malaysia	05/31/1834	05/31/2014	Malaysia Ringgit per US Dollar	USDMYR	03/31/1959	05/31/2014	Malaysia Bills Total Return Index	TRMYSBIM	
Mexico	01/31/1814	05/31/2014	Mexico New Peso per US Dollar	USDMXN	12/31/1835	05/31/2014	Mexico Bills Total Return Index	_MXFR1D	
New Zealand	11/30/1892	05/31/2014	New Zealand Dollars per US Dollar	USDNZD	01/31/1900	05/31/2014	New Zealand Bills Total Return	TRNZLBID	
Norway	04/30/1819	05/31/2014	Norway Krone per US Dollar	USDNOK	10/31/1818	05/31/2014	Norway Bills Total Return (w/GFD extension)	_ST1XD	
Pakistan	01/31/1900	05/31/2014	Pakistan Rupee per US Dollar	USDPKR	11/30/1873	05/31/2014	Pakistan Bills Total Return Index	TRPAKBIM	
Peru	01/31/1883	05/31/2014	Peru New Sol per US Dollar	USDPEN					
Philippines	09/30/1893	05/31/2014	Philippines Peso per US Dollar	USDPHP	12/31/1949	05/31/2014	Philippine Treasury Bill Return Index	TRPHLBIM	
Poland	01/31/1916	05/31/2014	Poland Zloty per US Dollar	USDPLN	01/31/1919	05/31/2014	Poland Treasury Bill Total Return Index	TRPOLBIM	
Russian Federation	01/31/1814	05/31/2014	Russia Ruble per US Dollar	USDRUB					
Singapore	05/31/1834	05/31/2014	Brunei Darussalem Ringgit per US Dollar	USDBND	3/31/1959	05/31/2014	Singapore Bills Return Index	TRSGPBIM	
South Africa	01/31/1844	05/31/2014	South Africa Rand per US Dollar	USDZAR	01/31/1913	05/31/2014	South Africa 3-month Bills Total Return Index	TRZAFBID	
South Korea	01/31/1905	05/31/2014	Republic of Korea Won per US Dollar	USDKRW	6/30/1950	05/31/2014	South Korea Government Bills Total Return Index	TRKORBIM	
Sweden	11/30/1813	05/31/2014	Sweden Kronor per US Dollar	USDSEK	12/31/1835	05/31/2014	Sweden Bills Return Index (w/GFD extension)	_RXVXD	
Switzerland	07/31/1819	05/31/2014	Switzerland Francs per US Dollar	USDCHF	01/31/1835	05/31/2014	Switzerland Total Return Bills Index	TRCHEBIM	
Taiwan	01/31/1895	05/31/2014	Taiwan Dollar per US Dollar	USDTWD	07/31/1950	05/31/2014	Taiwan Treasury Bills Total Return Index	TRTWNBIM	
Thailand	07/31/1859	05/31/2014	Thailand Baht per US Dollar	USDTHB	1/31/1945	05/31/2014	Thailand Bills Return Index	TRTHABIM	
Turkey	01/31/1919	05/31/2014	Turkey New Lira per US Dollar	USDTRY	01/31/1933	05/31/2014	Istanbul SE 90-day Bills Performance Index	TRTURBIM	
United Kingdom	01/31/1693	05/31/2014	British Pounds per US Dollar	USDGBP	01/31/1800	05/31/2014	United Kingdom Total Return Bills Index	TRGBRBIM	
Venezuela	01/31/1921	05/31/2014	Venezuela Bolivar Fuerte per US Dollar	USDVEF	4/30/1947	05/31/2014	Venezuela Cash Total Return Index	TRVENBIM	
Austria	11/30/1813	05/31/2014	Austria Schilling per US Dollar	USDATS	06/30/1860	05/31/2014	Austria Euribor/T-bill Return Index	TRAUTBIM	
Belgium	01/31/1830	05/31/2014	Belgium Franc per US Dollar	USDBEF	06/30/1848	05/31/2014	Belgium Total Return Bills Index	TRBELBIM	
Finland	04/30/1860	05/31/2014	Finland Markka per US Dollar	USDFIM	12/31/1866	05/31/2014	Finland Bill Return Index	TRFINBIM	
France	01/31/1800	05/31/2014	France Franc per US Dollar	USDFRF	01/31/1800	05/31/2014	France Total Return Bills Index	TRFRABIM	
Germany	10/31/1794	05/31/2014	Germany Deutschemark per US Dollar	USDDEM	12/31/1814	04/30/2014	Germany Total Return Bills Index	TRDEUBIM	
Greece	01/31/1901	05/31/2014	Greece Drachma per US Dollar	USDGRD	01/31/1880	04/30/2014	Greece Treasury Bills Total Return Index	TRGRCBIM	
Ireland	01/31/1900	05/31/2014	Irish Pfund per US Dollar	USDIEP	12/31/1899	04/30/2014	Ireland Bills Total Return	TRIRLBIM	
Italy	11/30/1815	05/31/2014	Italy Lira per US Dollar	USDITL	12/31/1861	04/30/2014	Italy Total Return Bills Index	TRITABIM	
Netherlands	01/31/1792	05/31/2014	Netherlands Guilder per US Dollar	USDNLG	12/31/1813	04/30/2014	Netherlands Bills Total Return Index	TRNLDBIM	
Portugal	01/31/1794	05/31/2014	Portugal Escudo per US Dollar	USDPTE	12/31/1883	04/30/2014	Portugal Bills Total Return	TRPRTBIM	
Spain	11/30/1813	05/31/2014	Spain Peseta per US Dollar	USDESP	01/31/1874	05/31/2014	Spain Treasury Bills Total Return Index	TRESPBIM	
Luxembourg	01/31/1830	05/31/2014	Luxembourg Franc per US Dollar	USDLUF					
United States	01/31/1693	05/31/2014	US Dollar	USDUSD	12/31/1835	05/31/2014	USA Total Return T-Bill Index	TRUSABIM	
EUROPE	01/31/1950	05/31/2014	Euros per US Dollar	USDEUR	12/31/1949	05/31/2014	Europe Euro-17 Bills Return Index	TREUROBM	

Appendix B. contd.

Global Assets Mapping: T-bill Yields

This is the comprehensive list of global assets and indicies used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data.

	T-bill Yields					Dividend Yield				
Country	Start	End	Name	ID	Extensions	Start	End	Name	ID	Extension
Argentina	09/30/2002	05/31/2014	Argentina 3-month BCRA Treasury Auction Yield	ITARG3D	2136601 Index	01/31/1988	05/31/2014	Buenos Aires SE Dividend Yield	SYARGYM	
Australia	07/31/1928	05/31/2014	Australia 3-month Treasury Bill Yield	ITAUS3D	1936591 Index	10/31/1882	05/31/2014	Australia ASX Dividend Yield	SYAUSYM	
Brazil	07/31/1965	05/31/2014	Brazil 3-month Treasury Bill Yield	ITBRA3D	BZAD3M Index	01/31/1988	05/31/2014	Brazil Dividend Yield	SYBRAYM	
Canada	03/31/1934	05/31/2014	Canada 3-month Treasury Bill Yield	ITCAN3D	1566591 Index	01/31/1934	05/31/2014	S&P/TSX-300 Dividend Yield	SYCANYTM	
Chile	07/31/1997	09/30/2012	Chile 3-month Nominal T-bill Auction Yield	ITCHL3D	CHDRCU CMPN Curncy	01/31/1983	05/31/2014	Chile Dividend Yield	SYCHLYM	
China	01/31/2002	05/31/2014	China 3 Month Repo on Treasury Bills	ITCHN3W	CNBI3MO ICBB Index	01/31/1995	05/31/2014	China Dividend Yield	SYCHNYM	
Colombia	01/31/1998	05/31/2014	Colombia 3-month Treasury Bill Yield	ITCOL3W	2336601 Index	01/31/1988	05/31/2014	Colombia Dividend Yield	SYCOLYM	
Denmark	01/31/1976	05/31/2014	Denmark 3-month Treasury Bill Yield	ITDNK3D	1286591 Index	07/31/1969	05/31/2014	Copenhagen SE Dividend Yield	SYDNKYM	
Hong Kong	06/30/1991	05/31/2014	Hong Kong 3-month Treasury Bill Yield	ITHKG3D	HKGG3M Index	12/31/1972	05/31/2014	Hang Seng Index Dividend Yield	SYHKGYM	
Hungary	12/31/1988	05/31/2014	Hungary 3-month Treasury Bill Yield	ITHUN3D	GHTB3M Index	11/30/1993	05/31/2014	Hungary Dividend Yield	SYHUNYM	
Iceland	06/30/1987	01/31/2013	Iceland 3-month Treasury Bill Yield	ITISL3D	IRLTMT01ISM156N;GRIC2Y Index	07/31/2002	12/31/2006	Iceland Dividend Yield	SYISLYM	ICEXI_DL Index
India	01/31/1931	05/31/2014	India 3-month Treasury Bill Yield	ITIND3D	GINTB3MO Index	01/31/1988	05/31/2014	India Nifty Dividend Yield	SYINDYD	
Indonesia	02/29/2000	12/31/2003	Indonesia Treasury Bill Yield	ITIDN3M	5366601 Index	11/30/1990	05/31/2014	Indonesia Dividend Yield	SYIDNYM	
Israel	01/31/1992	11/30/2013	Israel 3-month Treasury Bill Yield	ITISR3D	GISR2YR Index	12/31/1993	05/31/2014	Israel Dividend Yields	SYISRYM	
Japan	01/31/1960	05/31/2014	Japan 3-month Treasury Bill Yield	ITJPN3D	GJTB3MO Index	12/31/1886	05/31/2014	Tokyo SE Dividend Yield	SYJPNYM	
Malaysia	01/31/1961	05/31/2014	Malaysia 3-month T-bill Discount Rate	ITMYS3D	5486591 Index	12/31/1972	05/31/2014	Malaysia Dividend Yield	SYMYSYM	
Mexico	01/31/1978	03/31/2014	Mexico 3-month Cetes Yield	ITMEX3D	INTGSTMXM193N;MPTBC CMPN Curncy	01/31/1988	05/31/2014	Mexico SE Dividend Yield	SYMEXYM	
New Zealand	03/31/1978	01/31/2014	New Zealand 3-month Treasury Bill Yield	ITNZL3D	NDTB3M Curncy	12/31/1984	05/31/2014	New Zealand Dividend Yield	SYNZLYM	
Norway	01/31/1984	02/28/2014	Norway 3-month Treasury Bill Yield	ITNOR3D	GNGT3M Index	07/31/1969	05/31/2014	Oslo SE Dividend Yield	SYNORYM	
Pakistan	03/31/1991	03/31/2014	Pakistan 3-month Treasury Bill Rate	ITPAK3D	PKIB090D Index;2936601 Index	01/31/1988	05/31/2014	Pakistan Dividend Yield	SYPAKYM	
Philippines	01/31/1976	05/31/2014	Philippines 3-month Treasury Bill Yield	ITPHL3D	5666591 Index	01/31/1982	05/31/2014	Philippines Dividend Yield	SYPHLYM	
Poland	05/31/1991	05/31/2014	Poland 3-month Treasury Bill yield	ITPOL3D	9646591 Index	11/30/1993	05/31/2014	Poland Dividend Yield	SYPOLYM	
Russian Federation	07/31/1994	05/31/2014	Russia 3-month Treasury Bill Yield	ITRUS3D	9226591 Index	12/31/1996	05/31/2014	Russia Dividend Yield	SYRUSYM	
Singapore	12/31/1987	05/31/2014	Singapore 3-month Treasury Yield	ITSGP3D	MASB3M Index	12/31/1972	05/31/2014	Singapore SE Dividend Yield	SYSGPYM	
South Africa	01/31/1936	05/31/2014	South Africa 3-month Treasury Bill Yield	ITZAF3D	GSAB2YR Index	01/31/1954	05/31/2014	Johannesburg SE Dividend Yield	SYZAFYM	
South Korea	01/31/1987	05/31/2014	Korea 12-month Monetary Stabilization Bill	ITKOR12D	GVSK3MON Index	01/31/1963	05/31/2014	Korea SE Dividend Yield	SYKORYM	
Sweden	01/31/1955	05/31/2014	Sweden 3-month Treasury Bill Yield	ITSWE3D	1446591 Index	12/31/1915	05/31/2014	Stockholm SE Dividend Yield	SYSWEYM	
Switzerland	01/31/1980	05/31/2014	Switzerland 3-month Secondary Market T-Bill Yield	ITCHE3D	1466591 Index	12/31/1918	05/31/2014	Switzerland Dividend Yield	SYCHEYM	
Taiwan	03/31/1974	03/31/2014	Taiwan 3-month T-bill Yield	ITTWN3D	GVTWTL2 Index	01/31/1988	05/31/2014	Taiwan SE Dividend Yield	SYTWNYM	
Thailand	01/31/1977	05/31/2014	Thailand 3-month Treasury Bill Yield	ITTHA3D	TBDC3M Index	12/31/1975	05/31/2014	Thailand Dividend Yield	SYTHAYM	
Turkey	09/30/1985	05/31/2014	Turkey 3-6 month Treasury Bill Yield	ITTUR3M	1866601 Index	01/31/1986	05/31/2014	Istanbul SE Dividend Yield	SYTURYM	
United Kingdom	01/31/1900	05/31/2014	UK 3-month Treasury Bill Yield	ITGBR3D	1126593 Index	01/31/1909	12/31/1990	UK FT/Actuaries Preference Yield	GBFPREYM	UKX_DL Index
Venezuela	12/31/1996	12/31/2003	Venezuela 3-month Treasury Bill Yields	ITVEN3D	2996601 Index	01/31/1988	05/31/2014	Venezuela Dividend Yield	SYVENYM	
Austria	01/31/1960	12/31/1990	Austria 3-month Treasury Bill Rate	ITAUT3M	C9083M Index	01/31/1925	05/31/2014	Vienna SE Dividend Yield	SYAUTYM	
Belgium	01/31/1948	05/31/2014	Belgium 3-month Treasury Bill Yield	ITBEL3D	1246591 Index	12/31/1927	05/31/2014	Belgium SE Dividend Yield	SYBELYM	
Finland	02/29/2012	05/31/2013	Finland 3-month Treasury Bond Yield	ITFIN3D	GFIN12M Index	01/31/1962	05/31/2014	Helsinki SE Dividend Yield	SYFINYM	
France	01/31/1931	05/31/2014	France 3-month Treasury Bill Yield	ITFRA3D	1326591 Index	12/31/1860	05/31/2014	France Dividend Yield	SYFRAYM	
Germany	01/31/1953	05/31/2014	Germany 3-month Treasury Bill Yield	ITDEU3D	1346591 Index	12/31/1869	05/31/2014	Germany Dividend Yield	SYDEUYM	
Greece	01/31/1980	05/31/2014	Greece 3-month Treasury Bill Yield	ITGRC3M	GGGB3M Index	01/31/1977	05/31/2014	Athens SE Dividend Yield	SYGRCYM	
Ireland	12/31/1969	05/31/2014	Ireland 3-month Treasury Bill Yield	ITIRL3M	GIGB3M Index	05/31/1990	05/31/2014	Ireland Dividend Yield	SYIRLYM	
Italy	01/31/1940	05/31/2014	Italy 3-month Treasury Bill Yield	ITITA3D	1366591 Index	01/31/1925	05/31/2014	Italy Dividend Yield	SYITAYM	
Netherlands	01/31/1941	05/31/2014	Netherlands 3-month Treasury Bill Yield	ITNLD3D	1386591 Index	01/31/1951	07/31/1995	Netherlands Local Corporations' Dividend Yield	SYNLDYLM	AEX_DL Index
Portugal	08/31/1985	05/31/2014	Portugal 3-month Treasury Bill Yield	ITPRT3M	GSPT2YR Index	01/31/1988	05/31/2014	Portugal Dividend Yield	SYPRTYM	
Spain	07/31/1982	05/31/2014	Spain 3-month T-Bill Yield	ITESP3M	1846591 Index	12/31/1875	05/31/2014	Madrid SE Dividend Yield	SYESPYM	
United States	01/31/1801	05/31/2014	USA Government 90-day T-Bills Secondary Market	ITUSA3D	USGG3M Index	01/31/1871	05/31/2014	S&P 500 Monthly Dividend Yield	SYUSAYM	
EUROPE	01/31/1984	10/31/2010	Europe 3-month Euro Treasury Bill Yield	ITEUR3D	GECU3M Index	12/31/1925	05/31/2014	Europe Dividend Yield	SYEURYM	

Appendix B. contd.

Global Assets Mapping: Time Deposit Rates

This is the comprehensive list of global assets and indicies used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data.

	Time Deposit Rates				Central bank Rates			
Country	**Start**	**End**	**Name**	**ID**	**Start**	**End**	**Name**	**ID**
Argentina	03/31/1977	04/30/2014	Argentina Time Deposit Rate	ICARGTD	12/31/1891	12/31/2009	Argentina Reserve Bank Discount Rate	IDARGD
Australia	11/30/1834	04/30/2014	Australia Savings Deposit Rate	ICAUSSM	07/31/1920	05/31/2014	Australia Reserve Bank Overnight Cash Rate	IDAUSD
Brazil	12/31/1982	01/31/2014	Brazil 3-month Time Deposit Rate	ICBRATM	01/31/1948	02/29/2004	Brazil Central Bank Discount Rate	IDBRAD
Canada	01/31/1961	01/31/2014	Canada Individual 3-month CD Rate	ICCANT3M	03/31/1935	05/31/2014	Bank of Canada Discount Rate	IDCAND
Chile	01/31/1977	04/30/2014	Chile Time Deposit Rate	ICCHLTD	06/30/1908	04/30/2014	Chile Central Bank Minimum Interest Rate	IDCHLM
China	01/31/1980	04/30/2014	China Time Deposit Rate	ICCHNTM	07/31/1950	04/30/2014	Bank of China (Taiwan) Discount Rate	IDTWNM
Colombia	01/31/1923	04/30/2014	Colombia 3-month Time Deposit Rate	ICCOL3D	07/31/1923	12/31/2013	Colombia Bank of the Republic Discount Rate	IDCOLM
Denmark	01/31/1948	10/31/2013	Denmark Current Account Deposit Rate	ICDNKDM	01/31/1864	05/31/2014	Denmark National Bank Discount Rate	IDDNKD
Hong Kong	05/31/1971	04/30/2014	Hong Kong 3-month Time Deposits	ICHKGTM	06/30/1992	04/30/2014	Bank of Hong Kong Best Lending Rate	IDHKGD
Hungary	01/31/1995	04/30/2014	Hungary Sight Deposit Yield	ICHUNCM	06/30/1921	10/31/2013	Bank of Hungary Base Rate	IDHUNM
Iceland	01/31/1901	04/30/2012	Iceland Savings Deposits	ICISLSW	01/31/1903	05/31/2014	Bank of Iceland Required Reserve Interest Rate	IDISLD
India	04/30/1995	08/31/2011	India Low Yield on CDs	ICINDTM	12/31/1873	03/31/2013	India Reserve Bank Discount Rate	IDINDW
Indonesia	04/30/1974	04/30/2014	Indonesia 3-month Time Deposits	ICIDNTM	01/31/1913	12/31/1975	Indonesia/Netherlands Indies Discount Rate	IDIDNM
Israel	12/31/1983	03/31/2013	Israel 3-month Time Deposit Rate	ICISRTM	03/31/1982	11/30/2013	Bank of Israel Discount Rate	IDISRM
Japan	01/31/1957	05/31/2014	Japan 3-month Time Deposits 3-10M Yen	ICJPN3W	10/31/1882	05/31/2014	Bank of Japan Discount Rate	IDJPND
Malaysia	01/31/1976	03/31/2014	Malaysia 3-month Time Deposits	ICMYSTM	04/30/1959	05/31/2014	Malaysia Bank Negara Discount Rate	IDMYSM
Mexico	01/31/1962	03/31/2014	Mexico 3-month Deposit Rate	ICMEXTM	01/31/2008	05/31/2014	Mexico Central Bank Target Rate	IDMEXD
New Zealand	01/31/1965	04/30/2014	New Zealand 6-month Time Deposit Rate	ICNZLTM	12/31/1899	05/31/2014	New Zealand Reserve Bank Official Cash Rate	IDNZLD
Norway	01/31/1915	12/31/2013	Norway Deposits Average Yield	ICNORM	10/31/1818	06/30/1984	Bank of Norway Discount Rate	IDNORD
Pakistan	06/30/1997	02/28/2014	Pakistan Fresh Deposits All Banks	ICPAKM	07/31/1948	04/30/2014	Pakistan State Bank Discount Rate	IDPAKM
Peru	01/31/1976	05/31/2014	Peru Time Deposit Rate (CD del BCRP)	ICPERTD	01/31/1923	04/30/2014	Central Bank of Peru Discount Rate	IDPERD
Philippines	01/31/1976	03/31/2014	Philippines 1-3 month Time Deposit Rate	ICPHLTM	01/31/1950	03/31/2014	Philippines Central Bank Discount Rate	IDPHLM
Poland	01/31/1993	03/31/2014	Poland 3-month Time Deposits	ICPOL3M	01/31/1919	10/31/2013	Poland Central Bank Refinancing Rate	IDPOLM
Russian Federation	01/31/1992	03/31/2014	Russia Time Deposit Rate	ICRUSTM	07/31/1860	05/31/2014	Russia Central Bank Refinancing Rate	IDRUSD
Singapore	01/31/1977	04/30/2014	Singapore Demand Deposit Rate	ICSGPDM	12/31/1997	01/31/2000	Singapore Monetary Authority Rediscount Rate	IDSGPM
South Africa	01/31/1945	10/31/2012	South Africa 3-month Time Deposit Rate	ICZAF3W	01/31/1913	06/30/2003	South Africa Reserve Bank Discount Rate	IDZAFLW
South Korea	01/31/1969	03/31/2014	South Korea 1-month Time Deposit Rate	ICKORT1M	07/31/1950	04/30/2014	Bank of Korea Discount Rate	IDKORM
Sweden	01/31/1933	03/31/2014	Sweden Demand Deposit Rate	ICSWEDM	11/30/1856	05/31/2014	Sweden Riksbank Reference Rate	IDSWED
Switzerland	12/31/1830	02/28/2014	Switzerland Savings Accounts Yield	ICCHESM	12/31/1838	04/30/2014	Switzerland National Bank Lombard Rate	IDCHELD
Taiwan	07/31/1961	04/30/2014	Taiwan 30-day CD Yields	ICTWN1M	07/31/1950	04/30/2014	Bank of China (Taiwan) Discount Rate	IDTWNM
Thailand	01/31/1977	04/30/2014	Thailand 3-month Demand Deposit Rate	ICTHADM	02/28/1945	08/31/2012	Bank of Thailand 1-day Repurchase Rate	IDTHAD
Turkey	01/31/1973	04/30/2014	Turkey 1-month Time Deposits	ICTURTM	01/31/1933	04/30/2014	Turkey Central Bank Discount Rate	IDTURM
United Kingdom	01/31/1870	05/31/2014	UK 3-month Sterling Time Deposit Rate	ICGBR3D	08/31/1694	05/31/2014	Bank of England Base Lending Rate	IDGBRD
Venezuela	12/31/1982	01/31/2011	Venezuela 1-month Time Deposit Rate	ICVENTD	05/31/1947	10/31/2013	Venezuela Central Bank Discount Rate	IDVENM
Austria	01/31/1960	08/31/2013	Austria 3-month Time Deposit Rate	ICAUTDM	07/31/1860	12/31/2005	Austria Central Bank Discount Rate	IDAUTD
Belgium	01/31/1948	08/31/2013	Belgium 3-month Time Deposit Rate	ICBELTM	06/30/1858	12/31/1998	Belgium Central Bank Discount Rate	IDBELD
Finland	01/31/1980	08/31/2013	Finland Current Account Deposit Rate	ICFINDM	01/31/1867	12/31/2001	Finland Central Bank Discount Rate	IDFIND
France	01/31/1966	01/31/2014	France Corporate Deposit Rate	ICFRACM	02/28/1800	12/31/1991	Bank of France Discount Rate	IDFRAW
Germany	11/30/1968	08/31/2013	Germany 3-month Time Deposit Rate	ICDEUTM	01/31/1854	12/31/2005	Germany Bundesbank Discount Rate	IDDEUD
Greece	11/30/1960	04/30/2011	Greece Corporate Deposit Rate	ICGRCCM	01/31/1880	12/31/2000	Bank of Greece Discount Rate	IDGRCD
Ireland	01/31/1962	08/31/2013	Ireland Current Account Rate	ICIRLDM	01/31/1922	12/31/1990	Bank of Ireland Discount Rate	IDIRLM
Italy	12/31/1861	12/31/1972	Italy Cassa di Risparmio Deposits	ICITACRM	12/31/1861	12/31/2001	Bank of Italy Discount Rate	IDITAD
Netherlands	01/31/1951	01/31/2013	Netherlands Savings Accounts Rate	ICNLDSM	01/31/1814	12/31/1993	Netherlands Bank Discount Rate on Bills of Exchange	IDNLDBD
Portugal	12/31/1975	08/31/2005	Portugal 3-month Time Deposit Rate	ICPRTTM	01/31/1885	12/31/2001	Bank of Portugal Discount Rate	IDPRTD
Spain	01/31/1939	04/30/2011	Spain Corporate Deposit Rate	ICESPCM	01/31/1874	12/31/2001	Bank of Spain Discount Rate	IDESPD
Luxembourg	04/30/1985	08/31/2013	Luxembourg Sight Deposit Rate	ICLUXDM				
United States					11/30/1914	01/31/2003	USA Federal Reserve Bank Discount Rate	IDUSAD

Appendix C
Global Country Sectors

This is a comprehensive list of global sectors used in the study. These are sector price indicies. Main ticker has most recent history.
Extension indicies are used to splice/extend main index data and are denoted by ",". When several industry indicies that are averaged together to represent the sector are denoted by ";".

Country	Sector	Start	End	Name	Main Ticker	Extensions(,) Averages (;)
Australia	Consumer Discretionary	07/31/1928	05/31/2014	S&P/ASX 200 Consumer Discretionary Index	_AXDJD	_AXRTJD;AUAUTOSM, AUELECTM;AUNRETM
Australia	Consumer Staples	07/31/1928	05/31/2014	S&P/ASX 200 Consumer Staples Index	_AXSJD	_AFHID;AUPASNEM;AUNPAFM
Australia	Energy	01/31/1961	05/31/2014	S&P/ASX 200 Energy Index	_AXEJD	
Australia	Finance	01/31/1875	05/31/2014	S&P/ASX 200 Financials Index	_AXFJD	_AXXJD
Australia	Health Care	12/31/1990	05/31/2014	S&P/ASX 200 Health Care Index	_AXHJD	
Australia	Industrials	01/31/1875	05/31/2014	S&P/ASX 200 Industrials Accumulation Index	_AXJIAD	_AXJID;AUINCM
Australia	Information Technology	03/31/2000	05/31/2014	S&P/ASX 200 Information Technology Index	_AXIJD	
Australia	Materials	01/31/1875	05/31/2014	S&P/ASX 200 Materials Index	_AXMJD	AUMSILM;AUMINEM
Australia	Telecommunications	12/31/1995	05/31/2014	S&P/ASX 200 Telecommunications Index	_AXTJD	
Australia	Transportation	07/31/1936	05/31/2014	S&P/ASX 200 Transportation Index	_AXTRJD	
Australia	Utilities	07/31/1928	05/31/2014	S&P/ASX 200 Utilities Index	_AXUJD	AUFUELM;AUNUTILM
Austria	Consumer Discretionary	01/31/1928	04/30/1998	Vienna WBKI Trade and Services	ATHANVD	ATTEXTM
Austria	Consumer Staples	01/31/1922	04/30/1998	Vienna WBKI Breweries Index	ATTRIVD	ATBREWM
Austria	Energy	10/31/1994	04/30/1998	Vienna WBKI Energy Index	ATENGVD	
Austria	Finance	12/31/1991	05/31/2014	Austria ATX Real Estate Index	_IATXD	ATIMMVD
Austria	Industrials	01/31/1921	04/30/1998	Vienna WBKI Machinery, Transportation, Technology	ATMTTVD	ATAUT36W;ATINDUM
Austria	Information Technology	03/31/2000	06/30/2009	Vienna Dynamic Index	_VIDXD	
Austria	Materials	01/31/1922	04/30/1998	Vienna WBKI Chemicals and Paper Index	ATCHMVM, ATPAPVD	ATMINEM
Austria	Transportation	01/31/1922	10/31/1934	Austria National Bank Transportation	ATBTRANM	
Austria	Utilities	01/31/1922	04/30/1998	Vienna SE Electric and Gas Utilities	ATELGASM	
Belgium	Consumer Discretionary	01/31/1934	05/31/2014	Euronext Brussels ICB Consumer Services 5000	_BECSD	BETEXTM
Belgium	Consumer Staples	04/30/1955	05/31/2014	Euronext Brussels ICB Food Producers 3570	_BEFPRD	BEFOODSM
Belgium	Energy	01/31/1934	05/31/2001	Belgium CBB Oil Companies TR Index	_BSOILD	BECOALM
Belgium	Finance	01/31/1934	05/31/2014	Euronext Brussels ICB Financials 8000	_BEFIND	_BEBD;BEFININM
Belgium	Health Care	08/31/2001	05/31/2014	Euronext Brussels ICB Health Care 4000	_BEHCD	
Belgium	Industrials	01/31/1941	05/31/2014	Euronext Brussels ICB Industrials 2000	_BEIND	_BECMD;BEINDUSM;BECONSTM
Belgium	Information Technology	04/30/1983	05/31/2014	Euronext Brussels ICB Technology 9000	_BETECD	BEBSINRD
Belgium	Materials	01/31/1934	05/31/2014	Euronext Brussels ICB Basic Materials 1000	_BEBMD	BEFERMEM, BENOFMEM
Belgium	Telecommunications	02/29/2000	05/31/2014	Euronext Brussels ICB Telecommunications 6000	_BETELD	
Belgium	Utilities	01/31/1934	05/31/2014	Euronext Brussels ICB Utilities 7000	_BEUTD	BEGASELM
Canada	Consumer Discretionary	01/31/1919	05/31/2014	S&P/TSX Consumer Discretionary Index	GSPTTCDD	_TSCD;_TCPD;CAITEXTM
Canada	Consumer Staples	01/31/1919	05/31/2014	S&P/TSX Consumer Staples Index	GSPTTCSD	_GT3010D;_GT3022D
Canada	Energy	01/31/1927	05/31/2014	S&P/TSX Capped Energy Index (w/GFD extension)	_SPTTEND	
Canada	Finance	07/31/1914	05/31/2014	Canada S&P/TSX Banks	_GT4010D	
Canada	Health Care	12/31/1987	05/31/2014	Canada S&P/TSX Health Care Equipment and Services	_GT3510D	
Canada	Industrials	01/31/1914	05/31/2014	S&P/TSX Capped Industrials Index	_GSPTTID	_TIPD;CAIINDUM
Canada	Information Technology	08/31/1957	05/31/2014	S&P/TSX Capped Information Technology Index	_SPTTTKD	_TIPED
Canada	Materials	01/31/1919	05/31/2014	S&P/TSXCapped Materials Index	_GSPTTMD	GT1552D, CAIPULPM;_TPFD
Canada	Telecommunications	01/31/1919	05/31/2014	S&P/TSX Capped Telecommunication Services Index (w/GFD extension)	_GSPTTTD	
Canada	Transportation	01/31/1919	05/31/2014	Toronto SE-300 Transportation and Environmental	_TTRD	
Canada	Utilities	07/31/1914	05/31/2014	S&P/TSX Capped Utilities Index (w/GFD extension)	_GSPTTUD	
Chile	Consumer Discretionary	12/31/1947	10/31/2003	Santiago SE Other Services	CLBSOSM	CLBSTXM
Chile	Consumer Staples	01/31/1927	05/31/2014	Chile BEC Services Index	_TELECOD	CLBSAGM
Chile	Energy	01/31/1927	02/28/1969	Santiago SE Coal Index	CLCOALM	
Chile	Finance	01/31/1927	05/31/2014	Chile BEC Finance Index	_FINANCD	
Chile	Industrials	01/31/1927	07/31/2009	Chile BEC Industrials Index (w/GFD extension)	_INDUSTD	
Chile	Materials	01/31/1927	05/31/2014	Chile BEC Natural Resources Index (w/GFD extension	_MATERID	
Chile	Transportation	01/31/1927	12/31/1993	Santiago SE Shipping	CLBSSHM	
Chile	Utilities	01/31/1927	12/31/1993	Santiago SE Public Utilities and Services	CLBSUTM	
China	Consumer Discretionary	04/30/1993	05/31/2014	Shanghai SE Commercial Shares	_SSEMD	
China	Finance	01/31/1995	03/31/2013	Shenzhen SE Financial	_SZFID	
China	Industrials	04/30/1993	05/31/2014	Shanghai SE Industrials	_SSEID	
China	Materials	07/31/2001	03/31/2013	Shenzhen SE Timber Index	_SZMTFD	
China	Transportation	07/31/2001	03/31/2013	Shenzhen SE Transports Index	_SZTPD	
China	Utilities	04/30/1993	05/31/2014	Shanghai SE Utilities	_SSEUD	
Columbia	Consumer Discretionary	01/31/1933	06/30/2001	Colombia IBB Services	COIBBSM	COMSERVM;COBMILLM
Columbia	Consumer Staples	01/31/1933	09/30/2010	Colombia Agriculture Index	_IABCD	COBCHOCM, COBBEERM
Columbia	Energy	01/31/1937	05/31/1971	Bogota SE Oil Shares	COBOILM	
Columbia	Finance	01/31/1927	06/30/2001	Colombia IBOMED Financial Sector	_IBMFD	COBBANKM
Columbia	Industrials	01/31/1927	06/30/2001	Colombia IBOMED Industrials	_IBMID	COBOINDD;COBINDUM
Columbia	Materials	01/31/1933	05/31/1971	Bogota SE Leather and Tanning and Cement Index	COBCEMM, COBLEATM	
Columbia	Transportation	01/31/1933	01/31/1990	Colombia Medellin SE Transportation, Communication	COMTRANM	COBTRANM
Columbia	Utilities	01/31/1933	09/30/1962	Bogota SE Electric Utilities	COBUTILM	

Appendix C.2 Contd.
Global Country Sectors

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Extension indicies are used to splice/extend main index data and are denoted by ",". When several industry indicies that are averaged together to represent the sector are denoted by ";".

Country	Sector	Start	End	Name	Main Ticker	Extensions(,) Averages (;)
Denmark	Consumer Discretionary	01/31/1955	01/31/2012	Copenhagen SE Consumer Discretionary Index	_CX25PID	_CX2020D
Denmark	Consumer Staples	12/31/1995	01/31/2012	Copenhagen SE Consumer Staples Index	_CX30PID	
Denmark	Energy	03/31/2004	01/31/2012	OMX Copenhagen Energy Index	_CX10PID	
Denmark	Finance	12/31/1914	01/31/2012	Copenhagen SE Banks Index (w/GFD extension)	_CX4010D	
Denmark	Health Care	12/31/1995	05/31/2014	Copenhagen OMX Health Care Gross Index	_CX4000D	_CX3520D
Denmark	Industrials	12/31/1914	01/31/2012	Copenhagen SE Industrials Index (w/GFD extension)	_CX20PID	
Denmark	Information Technology	12/31/1995	01/31/2012	Copenhagen SE Information Technology Index	_CX45PID	
Denmark	Materials	12/31/1995	01/31/2012	Copenhagen SE Materals and Resources Index	_CX15PID	
Denmark	Telecommunications	12/31/1995	01/31/2012	Copenhagen SE Telecommunications Index	_CX50PID	
Denmark	Transportation	12/31/1914	06/30/2001	Copenhagen SE Shipping Index (w/GFD extension)	_SHP_COD	
Denmark	Utilities	12/31/1995	01/31/2012	Copenhagen SE Utilities Index	_CX55PID	
Finland	Consumer Discretionary	05/31/1975	01/31/2012	OMX Helsinki Consumer Discretionary Price Index	_HX25PID	_HEMED;FIHESD;FIUTEXTM
Finland	Consumer Staples	07/31/1996	01/31/2012	OMX Helsinki Consumer Staples Price Index (30)	_HX30PID	_HEFOD
Finland	Energy	07/31/1996	01/31/2012	OMX Helsinki Energy Price Index (10)	_HX10PID	
Finland	Finance	10/31/1930	01/31/2012	OMX Helsinki Banks Price Index (4010)	_HX4010D	FIUBANKM
Finland	Health Care	06/30/2000	01/31/2012	OMX Helsinki Health Care Price Index (35)	_HX35PID	
Finland	Industrials	10/31/1930	01/31/2012	OMX Helsinki Industrials Price Index (20)	_HX20PID	_HET1D;FIUINDUD
Finland	Information Technology	06/30/2000	01/31/2012	OMX Helsinki Information Technology Price Index	_HX45PID	
Finland	Materials	05/31/1975	01/31/2012	OMX Helsinki Materials Price Index (15)	_HX15PID	_HEF1D
Finland	Telecommunications	07/31/1996	01/31/2012	OMX Telecommunication Services Price Index (50)	_HX50PID	
Finland	Transportation	05/31/1975	09/30/2005	Finland HEX Transports	_HETRD	FIUTRADM
Finland	Utilities	06/30/2000	01/31/2012	OMX Utilities Price Index (55)	_HX55PID	
France	Consumer Discretionary	12/31/1856	05/31/2014	Euronext Paris CAC Consumer Services 5000	_FRCSD	_2BCMED;FRNFCONM;FRTEXTM
France	Consumer Staples	01/31/1928	05/31/2014	Euronext Paris CAC Food Producers	_FRFPRD	
France	Energy	12/31/1857	05/31/2014	Euronext Paris CAC Oil and Gas 0001	_FROGD	_FPOID;FRCOALCM
France	Finance	12/31/1857	05/31/2014	Euronext Paris CAC Financials 8000	_FRFIND	_FRRED;FRBANKCM
France	Health Care	12/31/1990	05/31/2014	Euronext Paris CAC Pharmaceuticals & Biotechnology	_FRPBD	
France	Industrials	12/31/1856	05/31/2014	Euronext Paris CAC Industrials 2000	_FRIND	_FISID;_FREID;FRINDUSA
France	Information Technology	01/31/1961	05/31/2014	Euronext Paris CAC Technology 9000	_FRTECD	_BE2D
France	Materials	12/31/1862	05/31/2014	Euronext Paris CAC Basic Materials 1000	_FRBMD	_2BABTD;FRSTIRM
France	Telecommunications	12/31/1990	05/31/2014	Euronext Paris CAC Telecommunications 6000	_FRTELD	_AS1D
France	Transportation	12/31/1856	12/31/2005	Euronext Paris Transports (59)	_2SCTSD	FRRAILSM
France	Utilities	12/31/1856	08/31/2013	Euronext Paris CAC Utilities 7000	_FRUTD	FRCUTILD;FRGASUTM
Germany	Consumer Discretionary	12/31/1903	05/31/2014	Germany CDAX Consumer Goods Price Index	_CXKYXD	DEFWBTD;DECTEXTM
Germany	Consumer Staples	12/31/1903	05/31/2014	Germany CDAX Food and Beverages Price Index	_CXKFXD	DEFWBFD;DECFOODM
Germany	Energy	01/31/1928	06/30/1943	Germany Reichsamt Lignite and Coal	DERLIGNM, DERCOALM	
Germany	Finance	12/31/1903	05/31/2014	Germany CDAX Banks Price Index	_CXKBXD	DECBGERM
Germany	Health Care	12/31/1987	05/31/2014	Germany CDAX Pharmaceuticals Price Index	_CXKPXD	
Germany	Industrials	12/31/1903	05/31/2014	Germany CDAX Industrials Price Index	_CXKNXD	DEBMACHM;DERCONSM;DECONSTM
Germany	Information Technology	01/31/1924	05/31/2014	Germany CDAX Technology Price Index	_CXKHXD	DERELECM
Germany	Materials	12/31/1903	05/31/2014	Germany CDAX Chemicals Price Index	_CXKCXD	DERCHEMM;DECCHEMM
Germany	Telecommunications	12/31/1987	05/31/2014	Germany CDAX Telecommunications Price Index	_CXKTXD	
Germany	Transportation	12/31/1903	05/31/2014	Germany CDAX Transportation Price Index	_CXKLXD	DECTRANM
Germany	Utilities	12/31/1924	05/31/2014	Germany CDAX Public Utilities Price Index	_CXKUXD	
Greece	Consumer Discretionary	01/31/1952	12/31/2005	Athens SE Textiles Index	_ATTED	GRTEXTM
Greece	Consumer Staples	01/31/1952	12/31/2005	Athens SE Food Index	_ATFOD	GRFOODM
Greece	Finance	01/31/1952	05/31/2014	FTSE/Athex Banks Index	_FTATBNK	GRFINANM
Greece	Industrials	12/31/1952	05/31/2014	FTSE/Athex Construction and Materials Index	_FTATCON	_ATIDD
Greece	Information Technology	03/31/2001	12/31/2005	Athens SE Information Technology	_ATIFD	
Greece	Materials	01/31/1952	12/31/2005	Athens SE Basic Metal	_ATBMD	GRCHEMM
Greece	Telecommunications	03/31/2001	12/31/2005	Athens SE Telecommunications Index	_ATTCD	
Greece	Transportation	01/31/1952	12/31/1996	Greece National Bank Transportation Index	GRTRANSM	
Iceland	Consumer Discretionary	12/31/1992	03/31/2005	Reykjavik SE Services	_ICEXSED	
Iceland	Consumer Staples	12/31/1992	10/31/2009	OMX Iceland Fishing and Fisheries	_OMXIFID	
Iceland	Energy	12/31/1992	08/31/2003	Reykjavik SE Oil Refining and Distribution	_ICEXOID	
Iceland	Finance	12/31/1992	03/31/2005	Reykjavik SE Finance and Insurance	ICEXFIND	
Iceland	Health Care	12/31/1998	03/31/2005	Iceland Pharmaceuticals Index	_ICEXPHD	
Iceland	Industrials	12/31/1992	03/31/2005	Reykjavik SE Industrials and Manufacturing	_ICEXIND	
Iceland	Information Technology	12/31/1998	03/31/2005	Iceland Information Technology Index	_ICEXITD	
Iceland	Telecommunications	04/30/2005	10/31/2008	OMX Iceland Telecommunications Price Index	_IX50PID	
Iceland	Transportation	12/31/1992	03/31/2005	Reykjavik SE Transportation	_ICEXTRD	
Indonesia	Consumer Discretionary	01/31/1989	05/31/2014	Jakarta SE Consumer Index	_JKCONSD	
Indonesia	Consumer Staples	12/31/1995	05/31/2014	Jakarta SE Agriculture Index	_JKAGRID	
Indonesia	Finance	01/31/1989	05/31/2014	Jakarta SE Finance Index	_JKFINAD	
Indonesia	Industrials	12/31/1995	05/31/2014	Jakarta SE Manufacturing Index	_JKMNFGD	
Indonesia	Materials	05/31/1990	05/31/2014	Jakarta SE Mining Index	_JKMINGD	
Indonesia	Transportation	04/30/1990	04/30/1999	Indonesia PT Jardine Shipping Index	IDJFSHD	

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Country	Sector	Start	End	Name	Main Ticker	Extensions(,) Averages (;)
Italy	Consumer Discretionary	01/31/1985	05/31/2014	FTSE Italia All-Share Media Index	_FTIT5500	
Italy	Energy	06/30/2009	05/31/2014	FTSE Italia All-Share Oil and Gas Index	_FTIT0001	
Italy	Finance	01/31/1985	05/31/2014	FTSE Italia All-Share Financial Index	_FTIT8000	
Italy	Health Care	06/30/2009	05/31/2014	FTSE Italia All-Share Health Care Index	_FTIT4000	
Italy	Industrials	01/31/1961	05/31/2014	FTSE Italia All-Share Industrials Index	_FTIT2000	ITMILAND
Italy	Information Technology	12/31/2004	05/31/2014	FTSE Italia All-Share Technology Index	_FTIT9000	_TSTARD
Italy	Materials	12/31/1989	05/31/2014	FTSE Italia All-Share Chemicals Index	_FTIT13D	
Italy	Telecommunications	06/30/1999	05/31/2014	FTSE Italia All-Share Telecommunications Index	_FTIT6000	_NUMTELD
Italy	Utilities	12/31/1989	05/31/2014	FTSE Italia All-Share Utilities Index	_FTIT7000	
Japan	Consumer Discretionary	01/31/1933	05/31/2014	Japan TOPIX Services	_ISVCS_D	_ITXTL_D;JPORAYOM
Japan	Consumer Staples	09/30/1946	05/31/2014	Japan TOPIX Foods (w/GFD extension)	_IFOOD_D	JPOFOODM
Japan	Energy	01/31/1957	05/31/2014	Japan TOPIX Oil and Coal	_IPETE_D	
Japan	Finance	01/31/1983	05/31/2014	Japan TOPIX Insurance Index	_IINSU_D	JPFININM;JPOINSUM
Japan	Health Care	01/31/1983	05/31/2014	Japan TOPIX Pharmaceuticals	_IPHAM_D	
Japan	Industrials	09/30/1946	05/31/2014	Japan TOPIX Machinery (w/GFD extension)	_IMCHN_D	JPOMACHM
Japan	Materials	09/30/1946	05/31/2014	Japan TOPIX Mining (w/GFD extension)	_IMING_D	JPOMINIM
Japan	Telecommunications	01/31/1968	05/31/2014	Japan TOPIX Communications	_ICOMS_D	
Japan	Transportation	09/30/1946	05/31/2014	Japan TOPIX Land Transportation (w/GFD extension)	_IRAIL_D	JPORAILM
Japan	Utilities	09/30/1946	05/31/2014	Japan TOPIX Electricity and Gas (w/GFD extension)	_IEPNG_D	JPOELEPM
Netherlands	Consumer Discretionary	01/31/1931	05/31/2014	Euroenxt Amsterdam ICB Consumer Goods 3000	_NLCGD	NLDCONSM
Netherlands	Consumer Staples	01/31/1980	10/31/2012	Euronext Amsterdam ICB Food and Drug Retailers	_NLFDRD	
Netherlands	Energy	01/31/1928	05/31/2014	Euronext Amsterdam ICB Oil and Gas 0001	_NLOGD	NLDOILM
Netherlands	Finance	01/31/1928	05/31/2014	Euronext Amsterdam ICB Financials 4000	_NLFIND	NLBNKPRD;NLDBKINM
Netherlands	Health Care	12/31/1994	05/31/2014	Euronext Amsterdam ICB Health Care 4000	_NLHCD	
Netherlands	Industrials	01/31/1928	05/31/2014	Euronext Amsterdam ICB Industrials 2000	_NLIND	NLINDD;NLDPRODM;NLDOTHIM
Netherlands	Information Technology	12/31/1994	05/31/2014	Euronext Amsterdam ICB Technology 9000	_NLTECD	
Netherlands	Materials	01/31/1980	05/31/2014	Euronext Amsterdam ICB Basic Materials 1000	_NLBMD	
Netherlands	Telecommunications	12/31/1994	05/31/2014	Euronext Amsterdam ICB Telecommunications 6000	_NLTELD	
Netherlands	Transportation	01/31/1928	12/31/2005	AEX Transportation Index	_AEXSTPD	
New Zealand	Consumer Discretionary	11/30/1991	09/30/1997	New Zealand SE Automobiles	NZNZAUD	
New Zealand	Consumer Staples	11/30/1991	09/30/1997	New Zealand SE Liquor and Tobacco	NZNZLTM	
New Zealand	Health Care	11/30/1991	09/30/1997	New Zealand SE Medical Supplies	NZNZMESD	
New Zealand	Industrials	11/30/1991	09/30/1997	New Zealand SE Engineering	NZNZEND	
New Zealand	Information Technology	03/31/2006	03/31/2013	NZX SciTech Capital Index	_NZTSD	
New Zealand	Materials	11/30/1991	09/30/1997	New Zealand SE Chemicals	NZNZCHD	
New Zealand	Utilities	11/30/1991	09/30/1997	New Zealand SE Electricity	NZNZELD	
Norway	Consumer Discretionary	12/31/1995	05/31/2014	Oslo SE Consumer Discretionary	_OSE25GI	
Norway	Consumer Staples	01/31/1914	05/31/2014	Oslo SE Consumer Staples	_OSE30GI	NOWHALEM
Norway	Energy	12/31/1995	05/31/2014	Oslo SE Energy	_OSE10GI	
Norway	Finance	12/31/1982	05/31/2014	Oslo SE Finance (w/GFD extension)	_OSE40GI	
Norway	Health Care	12/31/1995	05/31/2014	Oslo SE Health Care	_OSE35GI	
Norway	Industrials	11/30/1979	05/31/2014	Oslo SE Industrials (w/GFD extension)	_OSE20GI	NOOSLOD
Norway	Information Technology	12/31/1995	05/31/2014	Oslo SE Information Technology	_OSE45GI	
Norway	Materials	12/31/1995	05/31/2014	Oslo SE Materials	_OSE15GI	
Norway	Telecommunications	12/31/1995	05/31/2014	Oslo SE Telecommunication Services	_OSE50GI	
Norway	Transportation	01/31/1914	01/31/1969	Oslo SE Water Transportation	NOWATERM	
Norway	Utilities	12/31/1995	05/31/2014	Oslo SE Utilities	_OSE55GI	
Pakistan	Consumer Discretionary	07/31/1960	06/30/2008	Pakistan Cotton and Other Textiles	PKTEXTM	
Pakistan	Consumer Staples	07/31/1960	06/30/2008	Pakistan Food and Allied	PKFOODM	PKTOBACM
Pakistan	Finance	07/31/1960	06/30/2008	Pakistan Banks and Other Financial Institutions	PKFINANM	
Pakistan	Industrials	07/31/1960	06/30/2008	Pakistan Engineering	PKENGINM	
Pakistan	Materials	07/31/1960	06/30/2008	Pakistan Paper and Board	PKPAPERM	
Pakistan	Transportation	07/31/1960	06/30/2008	Pakistan Transportation and Communication	PKTRANSM	
Pakistan	Utilities	07/31/1960	06/30/2008	Pakistan Fuel and Energy	PKPOWERM	
Peru	Consumer Discretionary	01/31/1990	05/31/2014	Lima SE Services Index	_LMSERD	
Peru	Consumer Staples	12/31/1926	05/31/2014	Lima SE Food and Beverage	_LMALBD	PEAGRICM
Peru	Finance	12/31/1926	05/31/2014	Lima SE Banks and Finance (w/GFD extension)	_LMBFND	
Peru	Industrials	12/31/1937	05/31/2014	Lima SE Industrials (w/GFD extension)	_LMINDD	
Peru	Materials	12/31/1938	05/31/2014	Pakistan Glass and Ceramics	_LMMIND	
Peru	Telecommunications	10/31/1998	12/31/2012	Lima SE Telecommunications Index	_LMTELD	
Peru	Utilities	12/31/1981	05/31/2014	Lima SE Electric Utilities	_LMELED	
Philippines	Consumer Discretionary	03/31/1981	11/30/2010	Philippine SE Services Index	_PSSED	PHSERVEM
Philippines	Consumer Staples	01/31/1952	01/31/1982	Philippines Sugar Index	PHSUGARM	
Philippines	Energy	01/31/1985	12/31/2005	Manila SE Oil Index	_PSOID	
Philippines	Finance	01/31/1952	05/31/2014	Manila SE Finance Index	_PSFID	PHFINM;PHBANKM
Philippines	Industrials	12/31/1952	05/31/2014	Philippine SE Industrial Index	_PSIND	
Philippines	Materials	12/31/1952	08/31/1997	Manila SE Mining Index	PHPSEMD	_PSMID
Philippines	Transportation	03/31/1981	12/31/1989	Philippines Transportation and Communication	PHTRANSM	

Appendix C.2 Contd.
Global Country Sectors

This is a comprehensive list of global sectors used in the study. These are sector price indicies. Main ticker has most recent history.
Extension indicies are used to splice/extend main index data and are denoted by ",". When several industry indicies that are averaged together to represent the sector are denoted by ";".

Country	Sector	Start	End	Name	Main Ticker	Extensions(,) Averages (;)
Portugal	Consumer Discretionary	12/31/1999	05/31/2014	Euronext Lisbon PSI Consumer Services 5000	_PTCSD	
Portugal	Consumer Staples	12/31/1987	12/31/2005	Euronext Lisbon Non-Cyclical Consumer Goods	_PSI205D	PTBVFDM
Portugal	Finance	01/31/1938	05/31/2014	Euronext Lisbon PSI Financials 4000	_PTFIND	PTBVBKM;PTBANKSM
Portugal	Industrials	01/31/1953	05/31/2014	Euronext Lisbon PSI Industrials 2000	_PTIND	PTBVBLM;PTINDUSM
Portugal	Information Technology	12/31/1999	05/31/2014	Euronext Lisbon PSI Technology 9000	_PTTECD	
Portugal	Materials	12/31/1987	05/31/2014	Euronext Lisbon PSI Basic Materials 1000	_PTBMD	PTBVPAM
Portugal	Telecommunications	12/31/1990	05/31/2014	Euronext Lisbon PSI Telecommunications 6000	_PTTELD	_BVL64D
Portugal	Transportation	01/31/1938	04/30/1974	Portugal Transportation	PTTRANSM	PTRAILSM
Portugal	Utilities	01/31/1949	05/31/2014	Euronext Lisbon PSI Utilities 7000	_PTUTD	PTUTILM;PTHYDROM
Russia	Energy	09/30/1994	02/28/2013	Russia AK&M Energy	RUAKMEND	
Russia	Finance	09/30/1993	03/31/2010	Russia RTS-Interfax Investment Stock Index	_RUIXD	RUAKMBD
Russia	Industrials	09/30/1993	02/28/2013	Russia AK&M Industrials (30 shares)	_AKMED	
Russia	Materials	09/30/1994	02/28/2013	Russia AKM Metallurgy Index	RUAKMETD	RUAKMNFD, RUAKMFMD
Russia	Telecommunications	09/30/1994	02/28/2013	Russia AK&M Telecommunications	RUAKMTED	
Russia	Transportation	09/30/1994	10/31/1998	Russia AK&M Transportation	RUAKMTRD	
Singapore	Consumer Discretionary	01/31/1970	01/31/2008	Singapore SES Hotel Index	_HLRSD	
Singapore	Consumer Staples	01/31/1970	12/31/1989	Singapore SES Plantations	SGSINPLD	
Singapore	Finance	01/31/1970	01/31/2008	Singapore SES Finance Index	_FIAND	
Singapore	Industrials	10/31/1962	01/31/2008	Singapore SES Miscellaneous Multi-industry Index	_MLTID	SGSS1D
Singapore	Information Technology	07/31/1996	01/31/2008	Singapore SES Electronics	_ELCTD	
Singapore	Materials	10/31/1962	12/31/1989	Singapore Straits-Times Mining Index	SGSTMIND	
Singapore	Transportation	02/28/1997	02/29/2008	Singapore SES Transportation Index	_TSCMD	
South Africa	Consumer Discretionary	01/31/1925	05/31/2014	FTSE/JSE Africa Household Goods	_JHOUSD	_JSRVD;ZAJCONM;ZACONSUW
South Africa	Consumer Staples	7/31/1949	05/31/2014	FTSE/JSE Africa Beverages	_JBEVRD	ZAJLIQUM;ZAJLIQTM
South Africa	Energy	07/31/1952	05/31/2014	FTSE/JSE Africa Oil and Gas	_JOILGD	_JCOLD;ZAJCOALM
South Africa	Finance	06/30/1953	05/31/2014	FTSE/JSE Africa Financials	_JFINAD	_JFIND;ZAJMFID
South Africa	Health Care	12/31/1979	05/31/2014	FTSE/JSE Africa Health Care Equipment and Services	_JHEESD	
South Africa	Industrials	01/31/1910	05/31/2014	FTSE/JSE All-Share Industrials Index	_JASIND	_JIAID
South Africa	Information Technology	12/31/1979	12/31/2005	FTSE/JSE Information Technology	_JITCHD	_JELED
South Africa	Materials	07/31/1887	05/31/2014	FTSE/JSE Gold Mining (w/GFD extension)	_JGLDXD	
South Africa	Telecommunications	01/31/1993	12/31/2005	FTSE/JSE Telecommunication Services	_JTLSVD	
South Africa	Transportation	12/31/1979	05/31/2014	FTSE/JSE Africa Industrial Transportation	_JINDTD	
South Korea	Consumer Discretionary	01/31/1975	05/31/2014	Korea SE Textiles and Wearing Apparel	_KS23D	
South Korea	Consumer Staples	01/31/1975	05/31/2014	Korea SE Foods and Beverages	_KS19D	
South Korea	Finance	01/31/1975	05/31/2014	Korea SE Banks	_KS51D	_KS49D
South Korea	Health Care	01/31/1975	05/31/2014	Korea SE Medicine	_KS32D	
South Korea	Industrials	01/31/1975	05/31/2014	Korea SE Transportation Equipment	_KS42D	
South Korea	Information Technology	03/31/2000	05/31/2006	Korea SE Information Technology (KOSPI-IT) Index	_KSITD	
South Korea	Materials	01/31/1975	05/31/2014	Korea SE Chemicals and Paper Products	_KS29D,_KS27D	
South Korea	Transportation	01/31/1976	05/31/2014	Korea SE Transportation and Storage	_KS46D	
Spain	Consumer Discretionary	03/31/1940	05/31/2014	Madrid Services	_ISRV_MD	
Spain	Consumer Staples	12/31/2000	05/31/2014	Madrid Consumer Goods	_IBDC_MD	
Spain	Energy	03/31/1940	05/31/2014	Madrid Energy	_IENE_MD	
Spain	Finance	03/31/1940	05/31/2014	Madrid Financial Services	_IFNC_MD	_FINAD;_IBAN_MD
Spain	Industrials	03/31/1940	05/31/2014	Madrid Construction (new)	_ICNS_MD	_ISER_MD
Spain	Information Technology	12/31/1999	12/31/2001	Madrid SE Technology Index	_ITEC_MD	
Spain	Materials	03/31/1940	12/31/2001	Madrid SE Chemicals and Petroleum	_IQUI_MD	
Spain	Telecommunications	01/31/1984	05/31/2014	Madrid Communications (new)	_ICMS_MD	
Spain	Transportation	03/31/1940	12/31/1973	Madrid SE Transportation Shares	ESTRANSM	
Spain	Utilities	03/31/1940	06/30/2005	Madrid IBEX Utilities Index	_UTILD	_IELC_MD
Sweden	Consumer Discretionary	10/31/1991	05/31/2014	Stockholm SX Consumer Discretionary Price Index	_SX25PID	_STJSD
Sweden	Consumer Staples	01/31/1982	01/31/2012	Stockholm SX Consumer Staples Price Index	_SX30PID	_SWHAD
Sweden	Energy	12/31/1995	01/31/2012	Stockholm SX Energy Price Index	_SX10PID	
Sweden	Finance	01/31/1906	01/31/2012	Stockholm SX Finance Price Index	_SX40PID	_SX4010D
Sweden	Health Care	12/31/1995	01/31/2012	Stockholm SX Health Care Price Index	_SX35PID	
Sweden	Industrials	01/31/1906	01/31/2012	Stockholm SX Industrials Price Index	_SX20PID	
Sweden	Information Technology	12/31/1995	01/31/2012	Stockholm SX Information Technology Price Index	_SX45PID	
Sweden	Materials	12/31/1927	01/31/2012	Stockholm SX Materials Price Index	_SX15PID	_AFRASKD
Sweden	Telecommunications	12/31/1995	01/31/2012	Stockholm SX Telecommunication Services Price Inde	_SX50PID	
Sweden	Transportation	01/31/1935	03/31/2009	Sweden Affarsvarlden Transportation	_AFINTRD	SEAFSHPM
Sweden	Utilities	12/31/1995	02/29/2004	Stockholm SX Utilities Price Index	_SX55PID	
Switzerland	Consumer Discretionary	11/30/1935	05/31/2014	SWX ICB Consumer Services Price Index	_C5000PD	CHCONSUW
Switzerland	Consumer Staples	11/30/1965	12/31/2005	Switzerland SPI Food Price Index	_SFOXD	CHSSBFD
Switzerland	Finance	01/31/1930	05/31/2014	SWX ICB Banks Price Index	_C8300PD	
Switzerland	Health Care	12/31/1999	05/31/2014	SWX ICB Health Care Price Index	_C4000PD	
Switzerland	Industrials	01/31/1925	05/31/2014	SWX ICB Industrials Price Index	_C2000PD	
Switzerland	Information Technology	10/31/1995	05/31/2014	SWX ICB Technology Price Index	_C9000PD	
Switzerland	Materials	11/30/1935	05/31/2014	SWX ICB Basic Materials Price Index	_C1000PD	_SCHXD
Switzerland	Telecommunications	12/31/1999	05/31/2014	SWX ICB Telecommunications Price Index	_C6000PD	
Switzerland	Transportation	09/30/1968	12/31/2005	Switzerland SPI Transports Price Index	_STRXD	CHTRANSW
Switzerland	Utilities	10/31/1995	05/31/2014	SWX ICB Utilities Price Index	_C7000PD	

Appendix C.2 Contd.
Global Country Sectors

This is a comprehensive list of global sectors used in the study. These are sector price indicies. Main ticker has most recent history.
Extension indicies are used to splice/extend main index data and are denoted by ",". When several industry indicies that are averaged together to represent the sector are denoted by ";".

Country	Sector	Start	End	Name	Main Ticker	Extensions(,) Averages (;)
Thailand	Consumer Discretionary	12/31/1975	05/31/2014	Thailand SET Automobiles	_SETAUD	
Thailand	Consumer Staples	06/30/1975	05/31/2014	Thailand SET Foods and Beverages	_SETFBD	
Thailand	Energy	04/30/1979	05/31/2014	Thailand SET Energy	_SETEND	
Thailand	Finance	04/30/1975	05/31/2014	Thailand SET Finance	_SETFD	
Thailand	Health Care	12/31/1982	05/31/2014	Thailand SET Healthcare	_SETHCD	
Thailand	Industrials	08/31/1988	05/31/2014	Thailand SET Electrical Components	_SETECD	
Thailand	Information Technology	12/31/1975	05/31/2006	Thailand SET Electrical Products and Computers	_SETED	
Thailand	Materials	04/30/1975	05/31/2014	Thailand SET Packaging	_SETPKD	
Thailand	Telecommunications	03/31/1991	05/31/2006	Thailand SET Communication	_SETCMD	
Thailand	Transportation	12/31/1988	05/31/2014	Thailand SET Transportation	_SETTPD	
United Kingdom	Consumer Discretionary	07/31/1867	05/31/2014	FTSE All-Share Services (5000)	_FTASX5000	GBFTTXD;GBACOTTW;GBLTEXTM
United Kingdom	Consumer Staples	01/31/1879	05/31/2014	FTSE All-Share Food Producers	_FTA357D	_FTBRD;GBLDRINM
United Kingdom	Energy	07/31/1867	05/31/2014	FTSE All-Share Oil and Gas Producers	_FTA053D	GBBCOALM;GBLCOALM
United Kingdom	Finance	02/28/1811	05/31/2014	FTSE All-Share Financials (8000)	_FTASX8000	GBBAFINM;GBRBANKM;GBRINSUM
United Kingdom	Health Care	06/30/1952	05/31/2014	FTSE All-Share Health Care (4000)	_FTASX4000	
United Kingdom	Industrials	01/31/1820	05/31/2014	UK Financial Times 30 Industrials	_FTIID	GBLINDUM;GBHAYEKM
United Kingdom	Information Technology	04/30/1962	05/31/2014	FTSE TechMark All-Share Index	_FTTASXD	_FTITD;GBFELECM
United Kingdom	Materials	10/31/1824	05/31/2014	FTSE All-Share Basic Materials (1000)	_FTASX1000	GBLCHEMM;GBRMINEM
United Kingdom	Telecommunications	12/31/1880	05/31/2014	FTSE All-Share Telecommunications (6000)	_FTASX6000	_LCTND;GBBTELEM
United Kingdom	Transportation	02/28/1811	05/31/2014	FTSE All-Share Industrial Transportation	_FTA277D	GBFTRANM;GBFTRRSD;GBBRAILM;GBLTRANM;GBRRAILM;GBRDOCKM
United Kingdom	Utilities	07/31/1867	05/31/2014	FTSE All-Share Utilities (7000)	_FTASX7000	GBBUTILM;GBLIGHTM
United States	Consumer Discretionary	01/31/1800	05/31/2014	From Geczy / Samonov (2013)		
United States	Consumer Staples	01/31/1801	05/31/2014	From Geczy / Samonov (2013)		
United States	Energy	01/31/1802	05/31/2014	From Geczy / Samonov (2013)		
United States	Finance	01/31/1803	05/31/2014	From Geczy / Samonov (2013)		
United States	Health Care	01/31/1804	05/31/2014	From Geczy / Samonov (2013)		
United States	Industrials	01/31/1805	05/31/2014	From Geczy / Samonov (2013)		
United States	Information Technology	01/31/1806	05/31/2014	From Geczy / Samonov (2013)		
United States	Materials	01/31/1807	05/31/2014	From Geczy / Samonov (2013)		
United States	Telecommunications	01/31/1808	05/31/2014	From Geczy / Samonov (2013)		
United States	Transportation	01/31/1809	05/31/2014	From Geczy / Samonov (2013)		
United States	Utilities	01/31/1810	05/31/2014	From Geczy / Samonov (2013)		

Appendix D
Global Commodity Spots

This is the comprehensive list of global commodity spot prices used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data and are denoted by ",".

Commodity	Start	End	Name	Main Ticker	Extensions
Aliminum	01/31/1900	05/31/2014	Aluminum Spot Price (USD/Ton)	CMALSD	
Antinomy	12/31/1900	05/31/2014	Antimony (Cents/Pound)	CMSBM	
Apples	01/31/1947	05/31/2014	Apples, Average Price to Farmers (Cents/Pound)	CMAPPLEM	
Bananas	12/31/1900	05/31/2014	Bananas US Ports (USD/Metric Ton)	CMBANANM	
Barley	11/30/1348	07/31/2010	Barley ($/Ton)	CMBARLEYM	BAR_US2D,CMKBARW,CMBEBBAR
Beef	12/31/1900	05/31/2014	Beef, c/kg	CMWBEEFM	
BlackPepper	12/31/1919	10/31/2013	Black Pepper in New York (USD/Pound)	CMPEPNYM	
Butter	11/30/1348	11/30/2013	Butter, Average Price (Cents/Pound)	CMBUTD	CMBEBBUT
Cadium	12/31/1900	09/30/2008	Cadmium (USD/Pound)	CMCDM	
Cattle	01/31/1858	05/31/2014	Live Cattle Spot Price (US Cents/Pound)	_ICXD	
Celery	01/31/1970	05/31/2014	Celery, Average Price to Farmers (USD/CWT)	CMCELERM	
Cheese	11/30/1348	11/30/2013	Cheese, 40-lb. Blocks (Cents/Pound)	CMCHEESM	CMBEBCHS
Chicken	01/31/1960	05/31/2014	Chicken Meat (Cents/KG)	CMCHICKM	
Coal	12/31/1585	05/31/2014	Coal Spot Price (US $/Metric Ton)	CMCOALM	CMCOALETA
Cocoa	01/31/1784	05/31/2014	Cocoa Spot Price (USD/Metric Ton)	_CO1599D	
CoconutOil	01/31/1945	05/31/2014	Philippines Coconut Oil Price in NY (Cents/pound)	CNUT_PHD	
Coffee	07/31/1812	05/31/2014	Brazil Santos Arabicas Spot Price (Cents/Pound)	__COFSAD	CMCOFM
Copper	01/31/1800	05/31/2014	High Grade Copper (US Cents/Pound)	__CU_NYD	
Corn	01/31/1784	05/31/2014	Chicago Yellow Corn No. 2 Spot Price (US$/Bushel)	__C_US2D	CMCSPM
Cotton	01/31/1784	05/31/2014	Cotton Spot Price (Cents/Pound)	COT_AFRD	
CottonSeadOil	08/31/1909	05/31/2014	Cottonseed Oil Price, PBSY, MS (Cents/Pound)	COT_USCD	
Cress	05/31/1617	01/31/1923	Babylon Cress Price (Grams of Silver per 1000 kg Cress)	BABCRESS	
Dates	12/31/1615	11/30/1939	Babylon Date Price (Grams of Silver per 1000 kg Dates)	BABDATE	
DiammoniumPhosphate	01/31/1967	01/31/2014	Diammonium Phosphate US Gulf Cost (USD/MT)	CMDAPM	
Eggs	01/31/1890	05/31/2014	Eggs, Lage (Cents/Dozen)	CMEGGSM	
Flaxseed	01/31/1901	05/31/2014	Flaxseed, Average Price to Farmers (USD/Bushel)	CMFLAXM	
Gasoline	04/30/1860	05/31/2014	Regular Unleaded Gasoline Gulf Coast (Cents/Gallon)	RU_USGD	CMGASM
Gold	12/31/1257	05/31/2014	Gold Bullion Price-New York (US$/Ounce)	__XAU_D	
Hay	01/31/1913	05/31/2014	Hay (Baled), Average Price to Farmers (USD/Ton)	CMHAYM	
Hides	01/31/1890	11/30/2008	Hides, Heavy Native Steers (Cents/Pound)	CMHIDEHM	
HOIL	01/31/1967	05/31/2014	Heating Oil No. 2 Gulf Coast FOB (Cents/Gallon)	HO_USGD	
Hops	12/31/1535	12/31/1829	Hops (Eton College)	CMHOPSETA	
Iron	12/31/1268	11/30/1986	Iron Ore (Germany)	CMIRNDESM	CMFEMAM
Jute	12/31/1900	03/31/2014	Jute (United Kingdom)	CMJUTGBBM	CMJUTEM
Lambs	12/31/1900	05/31/2014	Lamb, c/kg	CMWLMBM	CMLAMBSM
Lard	01/31/1859	04/30/2014	Lard, Average Wholesale Price, (Cents/Pound)	CMLARDD	
Lead	01/31/1800	05/31/2014	Lead Bar Spot Price (LME USD/Ton)	CMPBSD	

Appendix D contd.
Global Commodity Spots

This is the comprehensive list of global commodity spot prices used in the study. Main ticker has most recent history.
Extension tickers are used to splice/extend main index data and are denoted by ",".

Commodity	Start	End	Name	Main Ticker	Extensions
LiveHog	01/31/1858	05/31/2014	Live Hog Prices (US Cents/Pound)	_IHXD	
Lumber	01/31/1891	11/30/2008	Lumber (USD per 1000 Board Feet)	CMLBM	
Malt	12/31/1595	12/31/1831	Malt Prices (Eton College)	CMMALTETA	
Mercury	12/31/1910	09/30/2008	Mercury (Cents/Pound)	CMHGM	
Milk	01/31/1890	05/31/2014	Milk, Average Price to Farmers (USD/CWT)	CMMILKM	
Mustard	05/31/1617	04/30/1937	Babylon Mustard Price (Grams Silver per 1000 kg Mustard)	BABMUSTARD	
NaturalGas	12/31/1930	05/31/2014	Natural Gas LNG ($/MMBTU)	CMLNGM	CMNGSNLM,NG_P_WTD
Nickel	12/31/1913	05/31/2014	Nickel Spot Price (US Dollars/Ton)	CMNISD	
OATS	11/30/1348	04/30/2014	Oat Spot Price (US$/Bushel)	OATS_RAD	CMBEBHOAT
Oil	09/30/1859	05/31/2014	West Texas Intermediate Oil Price (US$/Barrel)	__WTC_D	
Onion	01/31/1948	05/31/2014	Onions, Average Price to Farmers (USD/CWT)	CMONIONM	
Oranges	01/31/1914	05/31/2014	Oranges, Average Price to Farmers (USD/Box)	CMORANGM	
Palladium	12/31/1911	05/31/2014	Palladium (USD per Troy Ounce)	XPD_D	
Peanuts	09/30/1930	05/31/2014	Peanuts, Average Price to Farmers (Cents/Pound)	CMPNUTM	
PenutOil	10/31/1970	05/31/2014	Crude Peanut Oil FOB Southeast Mills (Cents/Pound)	PNUT_USD	
Platinum	01/31/1910	05/31/2014	Platinum Cash Price (US$/Ounce)	__PL_NYD	
Plywood	01/31/1963	05/31/2014	Plywood, c/sheets	CMWPLYM	CMPWM
Pork	01/31/1859	11/30/1986	Pork (Germany) - Import price from Belgium-Luxembourg, free at border.	CMPRKDEM	CMPRKDKM,CMMPORKD
Potatoes	01/31/1911	05/31/2014	Potatoes, Average Price to Farmers (USD/CWT)	CMPOTATM	
Rice	12/31/1000	05/31/2014	Rice Spot Price, Bangkok (US $/Metric Ton)	CMRICEM	
Rubber	01/31/1890	05/31/2014	Rubber Spot Price (US Cents/Pound)	CMRUBSD	
Sesame	05/31/1617	11/30/1922	Babylon Sesame Price (Grams of Silver per 1000 kg Sesame)	BABSESAME	
Sheep	01/31/1874	10/31/2011	Sheep, Average Price (USD/CWT)	CMSHEEPM	
ShortRib	01/31/1885	09/30/1932	Short Ribs ($/100 Pounds)	CMSHRIBD	
Silver	12/31/1000	05/31/2014	Silver Cash Price (US$/Ounce)	__XAG_HD	
Soy	11/30/1913	05/31/2014	Soybeans Cash Price (US Dollars/Bushel)	__SYB_TD	
SoybeanOil	01/31/1911	05/31/2014	Soybean Oil Cash Price (Cents/Pound)	_BO1599D	
Soybean Meal	10/31/1929	05/31/2014	Soybean Meal Cash Price (USD/Short Ton - Bulk)	__SYM_4D	
SteelScrap	09/30/1894	10/31/2009	Heavy Melting Steel Scrap in Chicago Price (USD/Metric Ton)	CMSTEELD	
Sugar	01/31/1784	05/31/2014	Sugar, US, c/kg	CMWSUUM	_SU1599D
RYE	11/30/1348	12/31/2005	Rye, No. 2, Minneapolis (Cents/Bushel)	CMRYED	CMRYEM,CMKRYEW,CMBEBRYE
Tallow	01/31/1910	05/31/2014	Tallow, Wholesale Price (Cents/Pound)	CMTALLWM	
Tea	01/31/1890	05/31/2014	Tea Spot Prices (US Cents/Pound)	CMTEAM	
Tobacco	12/31/1618	05/31/2014	Tobacco, Burley Average Price (USD/Metric Ton)	CMTOBACM	CMTOBUSM,CMTOBACMA
Tomatoes	01/31/1919	05/31/2013	Tomatoes, Average Price to Farmers (Cents/CWT)	CMTOMATM	
Uranium	08/31/1968	05/31/2014	Uranium (USD/Pound)	CMU3O8M	
Wheat	11/30/1348	05/31/2014	Wheat #2 Cash Price (US Dollars/Bushel)	__W_USSD	CMWSPM,BABWHEAT,CMBEBWHT
Whool	06/30/1618	03/31/2014	Wool, 64s, Staple 2 3/4 and Up US (Cents/Pound)	CMWOOLM	BABWOOL
Zinc	01/31/1840	05/31/2014	Zinc Special High Grade ($/Ton)	__MZN2MD	

Appendix D
Global Commodity Futures

This is the comprehensive list of global commodity futrures used in the study. Main ticker is from Bloomberg

Commodity	Start	End	Main Ticker
Aluminum	07/31/1997	05/31/2014	LA1 Comdty
Appalachian Coal	07/31/2001	05/31/2014	QZ1 Comdty
Brent Crude Oil	06/30/1988	05/31/2014	CO1 Comdty
Butter	09/30/2005	05/31/2014	V61 Comdty
Cheese	06/30/2010	05/31/2014	CHE1 Comdty
Chicago Wheat	07/31/1959	05/31/2014	W 1 Comdty
Cocoa	07/31/1959	05/31/2014	CC1 Comdty
Coffee	08/31/1972	05/31/2014	KC1 Comdty
Copper	12/31/1988	05/31/2014	HG1 Comdty
Copper	06/30/1997	05/31/2014	LP1 Comdty
Corn	07/31/1959	05/31/2014	C 1 Comdty
Cotton #2	07/31/1959	05/31/2014	CT1 Comdty
CottonSeadOil	04/30/2005	05/31/2014	C71 Comdty
Crude Oil	03/31/1983	05/31/2014	CL1 Comdty
Feeder Cattle	11/30/1971	05/31/2014	FC1 Comdty
Gas oil	07/31/1989	05/31/2014	QS1 Comdty
Gold	01/31/1975	05/31/2014	GC1 Comdty
Hard Red Winter Wheet	01/31/1970	05/31/2014	KW1 Comdty
Heating Oil	07/31/1986	05/31/2014	HO1 Comdty
Iron	10/31/2013	05/31/2014	IOE1 Comdty
Lead	07/31/1997	05/31/2014	LL1 Comdty
Lean Hogs	04/30/1986	05/31/2014	LH1 Comdty
Live Cattle	11/30/1964	05/31/2014	LC1 Comdty
Lumber	04/30/1986	05/31/2014	LB1 Comdty
Malt	05/31/2010	05/31/2014	BRL1 Comdty
Milk	01/31/1996	05/31/2014	DA1 Comdty
Mustard	12/31/2003	05/31/2014	M11 Comdty
Natural Gas	04/30/1990	05/31/2014	NG1 Comdty
Newcastle Coal	12/31/2008	05/31/2014	XW1 Comdty
Nickel	07/31/1997	05/31/2014	LN1 Comdty
Oats	07/31/1959	05/31/2014	O 1 Comdty
Orange Juice	02/28/1967	05/31/2014	JO1 Comdty
Palladium	04/30/1986	05/31/2014	PA1 Comdty
Platinum	04/30/1986	05/31/2014	PL1 Comdty
Potatoes	07/31/2006	05/31/2014	ZQ1 Comdty
Propane	08/31/2009	05/31/2014	BAP1 Comdty
RBOB Gasoline	10/31/2005	05/31/2014	XB1 Comdty
Rough Rice	12/31/1988	05/31/2014	RR1 Comdty
Rubber	05/31/1988	05/31/2014	JN1 Comdty
Silver	01/31/1975	05/31/2014	SI1 Comdty
Soybean Meal	05/31/1973	05/31/2014	SM1 Comdty
Soybean Oil	05/31/1973	05/31/2014	BO1 Comdty
Soybeans	07/31/1959	05/31/2014	S 1 Comdty
Sugar #11	01/31/1961	05/31/2014	SB1 Comdty
Tin	07/31/1997	05/31/2014	LT1 Comdty