

# Prime Capital Commodity Index (PCCI)

Representative and efficient exposure to the commodity market,  
designed for the purpose of financial investing

A decorative background consisting of numerous vertical lines of varying heights and colors, including shades of blue and grey, creating a textured effect.

PCCI

## Why a new commodity index

The Prime Capital Commodity Index (PCCI) seeks to fill a market void in efficient passive commodity investment vehicles. Existing products fall in either one of two categories: (i) traditional index trackers which try to replicate commodity benchmarks, but are not designed nor particularly suitable for investment purposes and (ii) enhanced types which try to beat the benchmarks by applying systematic trading strategies that always add manager risk but rarely add value.

Of all issues that plague enhanced commodity indices, the majority only address the roll yield problem of the traditional indices, which suffer from significant negative roll yield in contango due to front end bias. The range of methods to address the negative roll yield in contango is overwhelming, ranging from defining alternative roll dates, taking exposure across the curve, to selecting the exposure along the curve using complex but unstable quantitative models. Such methods often resemble half-active trading strategies with all related problems, such as not being robust in dynamically changing markets, liquidity issues and high transaction costs.

### Representativeness for investment purposes

The lack of representativeness for investment purposes is the biggest issue that most existing commodity indices suffer from. This is due to inappropriate weighting methods of the commodities in the index which create various biases.

Currently utilized weighting methods can be summarized into the following categories:

- Production and/or liquidity based weights

Traditional (or benchmark) indices assign weights to underlying components based on total production in the physical commodity market and/or liquidity in the futures market. Such weighting schemes can be useful for certain benchmarking purposes, but they do not lead to an optimal portfolio for financial investors. Using production weights often results in a high concentration in the energy sector, as such making the index less diversified and prone to higher volatility, and at the same time less reflective of the price evolution of the market as a whole. For instance, the energy sector in the S&P GSCI™ (GSCI) has a weight of about 70%.

Liquidity, measured by either trading volume or open interest, is a good indicator of market depth. However, the most liquid commodity is not always the most representative among the whole universe of commodities in terms of their risk/return profile. For example, U.S. natural gas is among the most liquid commodities, and as such has a weight as high as 11% in the Dow Jones – UBS Commodity Index<sup>SM</sup> (DJ UBS). However, this market is heavily influenced by local factors and its idiosyncrasy was further intensified by recent shale gas developments. In 2009 and 2010, almost every commodity in the major indices gained, while the U.S. natural gas market suffered huge losses, i.e. over 50% in 2009 and over 30% in 2010. The above circumstances have made it less representative of the commodity market as a whole and should thus warrant it a smaller weight.

- Equal weights

To avoid the undesired biases described above, some indices are equally weighted. While this successfully removes these biases, it clearly is not the most efficient way to structure any portfolio of heterogeneous and interrelated components. This approach also ignores the fact that the liquidity of the individual commodities varies significantly which may cause serious liquidity issues for tracking vehicles.

- Active strategies

Some enhanced indices apply basic systematic trading strategies borrowed from active commodity management. Typical examples are strategies based on technical signals such as momentum or mean reversion in order to determine weights. Such application of half-active management always adds undesired uncertainty and manager risk but rarely adds value.

- Proper weighting approach for financial investors: maximizing the representativity dimension

The priority of an investable index is to be unambiguous, accountable and representative for investment purposes. An efficient representation of the commodity market with improved performance can be achieved by applying statistical portfolio construction methods without importing the risks related to half-active management like e.g. subjective views on specific commodities.

## PCCI's innovation and advantages

The PCCI endeavors to overcome the weighting issue of existing commodity indices, i.e. the lack of optimal weighting methods, by applying the concept of factor replicating portfolios (common property replication), broadly used in enhanced equity indexing. Its objective is to build an optimal and representative commodity exposure specifically for the benefit of financial investors. When determining the weights of individual commodities in the index, the PCCI applies a portfolio construction method based on a popular statistical procedure, namely the principal component analysis (PCA). This enables it to construct a fairly diversified and balanced portfolio which replicates the common property in the commodity market. As a result the PCCI has the following advantages over traditional and existing enhanced indices:

- Representativeness

PCCI is a representative index, effectively replicating the broader commodity market. The PCCI is the first commodity index which takes a commodity- and sector-neutral approach to gain an unambiguous commodity market exposure. The composition is determined by the factor exposure of individual commodities to the "global commodity market", while filtering out a significant amount of noise. Therefore the PCCI qualifies itself as a representative investable commodity index, optimally designed for the purpose of financial investing.

- Diversification

PCCI's weighting method overcomes the issues of traditional indices which tend to have high concentration in single commodities or sectors, or those of active strategies which are unstable in nature. It results in a fairly balanced portfolio with a stable structure, providing true and reliable diversification from a passive investment point of view, while avoiding the oversimplification of equal weights.

- Higher risk-adjusted returns

The PCCI is an innovative application of well established weighting enhancement methods to commodities. In addition, its robust roll approach mitigates the front-end bias embedded in the traditional commodity indices and avoids the uncertainty associated with semi-active roll methods of many enhanced commodity indices.

Furthermore, the PCCI enjoys structural stability. Even though the index may be rebalanced intra-month, the same index composition may be kept for multiple months since the cross correlations for commodities tend to be stable especially for those commodities that are fundamentally related. The combined benefit is consistently lower volatility and higher risk-adjusted returns.

## Methodology

### PCCI Index Committee

To insure objectivity in the construction and maintenance of the PCCI, Prime Capital AG has formed the "PCCI Index Committee", which formulates and enacts decisions regarding the composition, construction, calculation and management of the index. The PCCI Index Committee shall meet annually in November to review and decide the components of the PCCI in the following year and any proposed modifications to the index methodology. The PCCI Index Committee may also meet at any other time within a year if exceptional circumstances arise. Any material changes to the existing index methodology will be communicated ahead of their implementation.

### Component selection

When selecting individual commodities to be included in the index, the PCCI Index Committee takes into consideration the following criteria: economic significance, continuity, liquidity and diversification. General guidelines are set as follows:

- The commodity must play a significant role in the world economy, measured by production, international trade flow and consumption.
- The commodity futures must trade on a valid U.S. or EU public exchange.
- The commodity futures contracts must be USD-denominated.
- The commodity futures contracts must have been traded for at least three years.

Based on these guidelines, the PCCI is currently composed of 19 commodities as listed in Table 1.

In certain exceptional circumstances, the PCCI Index Committee may replace one commodity with another similar one, for example when the exchange ceases trading of one commodity and

introduces a substitution. Such change will be announced as far in advance as possible.

Table 1: PCCI components – 2010

Commodity	Exchange	Symbol
<b>Energy</b>		
WTI crude oil	NYMEX	CL
RBOB gasoline	NYMEX	XB
Heating oil	NYMEX	HO
Natural gas	NYMEX	NG
<b>Base metals</b>		
Copper	COMEX	HG
Aluminium	LME	LA
Nickel	LME	LN
Zinc	LME	LX
<b>Precious metals</b>		
Gold	COMEX	GC
Silver	COMEX	SI
<b>Grains</b>		
Corn	CBOT	C
Soybeans	CBOT	S
Soybean oil	CBOT	BO
Wheat	CBOT	W
<b>Softs</b>		
Coffee	NYBOT	KC
Sugar	NYBOT	SB
Cotton	NYBOT	CT
<b>Livestock</b>		
Live cattle	CME	LC
Lean hogs	CME	LH

Source: Prime Capital AG

## Weight calculation

The typical objective of a passive investable index is to be representative of an asset class. The PCCI is the first commodity index using the common property replication method, borrowing from an enhanced equity indexing method pioneered by Professor Carol Alexander<sup>1</sup> (Henley Business School, University of Reading).

### Why common property replication weights

The rationale of the PCCI weighting scheme using the common property replication method is straightforward: a representative passive index

replicating an asset class should account for the largest amount of the total joint variation in that asset class. This property makes the index the optimal portfolio capturing only the common property in that asset class, making the PCCI more desirable for a financial investor than indices using production or liquidity based weighting criteria.

### Deriving single commodity weights using PCA and sample results

The PCCI uses a general portfolio construction model based on the principal component analysis (PCA). PCA is a standard statistical procedure for the orthogonal transformation of variables, reducing dimensionality and noise in the data. By convention, the first principal component explains the most variation. The common finding in financial markets is that the first principal component of a group of stocks, or in this case commodities, resembles the "market factor" or, respectively, the implicit "global commodity market". The index is thus constructed to replicate the first principal component, i.e. the "global commodity market". The result is that each commodity's weight is positively correlated to its average correlation to other commodities, but negatively correlated to its volatility.

Chart 1: Relationship between weight and correlation, volatility

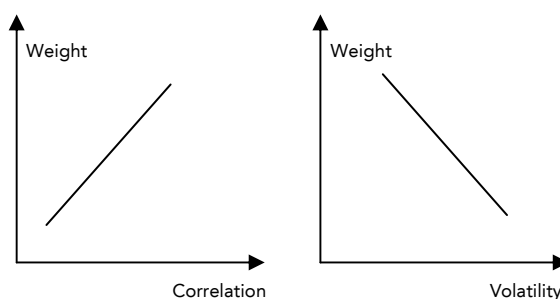
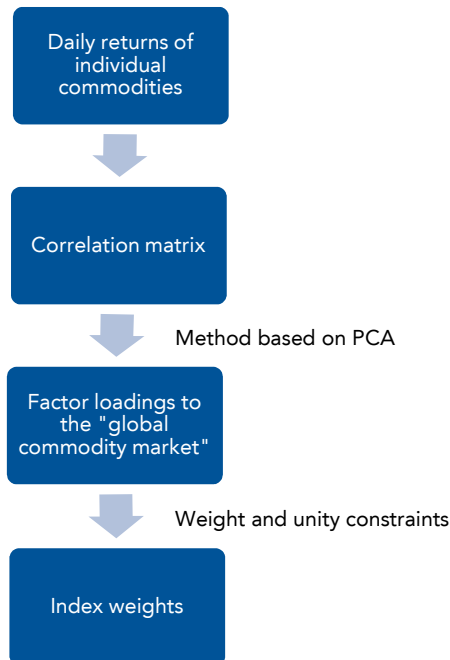


Chart 2 presents an overview of the process. In order to obtain the commodities' weights in the index, daily returns are used to obtain the commodities' correlation matrix. These correlations are then used to calculate the respective commodities' factor loadings to the "global commodity market". These are in turn used to obtain the index weights subject to weight and unity constraints.

<sup>1</sup> Alexander and Dimitriu (2003): Sources of Over-Performance in Equity Markets: Mean Reversion, Common Trends and Herding

Chart 2: Workflow overview



The following is an example of determining the PCCI weights as of 31 May 2011.

Step 1: Calculation of the correlation matrix of the daily returns. For each commodity, daily returns are measured as the excess returns earned from investing in the commodity futures, taking into account the effect of contract changes applying the roll schedule as described in the next section "Roll approach", or in other words, including the roll yield. As Table 2 indicates, the correlation varies across commodities and sectors, but all are positive - a striking phenomenon since 2004. This makes it reasonable to apply the PCA technique in the next step.

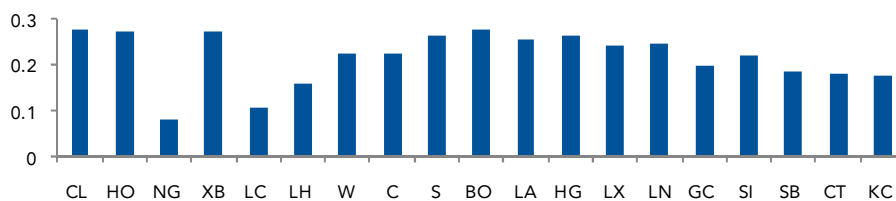
Step 2: Derive factor loadings to the "global commodity market" and the intermediate composition. The factor loadings are calculated from the first principal component or eigenvector based on the PCA and the volatility of each commodity. The intermediate results are presented in Chart 3.

Table 2: Correlation matrix

	CL	HO	NG	XB	LC	LH	W	C	S	BO	LA	HG	LX	LN	GC	SI	SB	CT	KC	
CL	100																			
HO	0.94	100																		
NG	0.13	0.11	100																	
XB	0.94	0.96	0.11	100																
LC	0.25	0.24	0.13	0.26	100															
LH	0.17	0.16	0.09	0.18	0.60	100														
W	0.28	0.27	0.16	0.29	0.34	0.28	100													
C	0.28	0.25	0.15	0.27	0.39	0.32	0.66	100												
S	0.36	0.37	0.09	0.36	0.39	0.36	0.60	0.66	100											
BO	0.47	0.48	0.07	0.47	0.36	0.30	0.55	0.57	0.88	100										
LA	0.47	0.44	0.21	0.46	0.28	0.28	0.31	0.29	0.41	0.44	100									
HG	0.51	0.46	0.15	0.46	0.26	0.24	0.35	0.29	0.42	0.47	0.68	100								
LX	0.41	0.38	0.10	0.38	0.18	0.19	0.26	0.25	0.36	0.42	0.68	0.74	100							
LN	0.49	0.47	0.17	0.47	0.23	0.19	0.31	0.27	0.38	0.42	0.63	0.69	0.68	100						
GC	0.45	0.41	0.17	0.42	0.13	0.07	0.21	0.22	0.29	0.34	0.34	0.35	0.33	0.32	100					
SI	0.53	0.47	0.21	0.48	0.15	0.13	0.22	0.20	0.29	0.33	0.37	0.40	0.37	0.38	0.78	100				
SB	0.30	0.26	0.13	0.25	0.31	0.27	0.32	0.43	0.40	0.41	0.29	0.34	0.23	0.28	0.21	0.25	100			
CT	0.27	0.29	0.03	0.27	0.16	0.17	0.30	0.32	0.40	0.45	0.26	0.31	0.25	0.31	0.24	0.32	0.33	100		
KC	0.24	0.20	0.18	0.22	0.34	0.26	0.25	0.32	0.32	0.27	0.28	0.31	0.25	0.33	0.31	0.30	0.37	0.17	100	

Source: Bloomberg, Prime Capital AG. As of 31 May 2011.

Chart 3: Factor loadings to the "global commodity market"



Source: Bloomberg, Prime Capital AG. As of 31 May 2011.

Step 3: Determine the final index weights. The final index composition is determined by applying weight and unity constraints. Weight constraints are imposed to avoid concentration risk. The unity constraint ensures the sum of the weights is 100%.

The final composition of the PCCI as of 31 May 2011 is shown in Table 4.

Table 4: PCCI weights vs. other indices

	PCCI	S&P GSCI	DJ UBS
<b>Energy</b>			
WTI Crude oil	6.5%	33.0%	15.6%
Brent Crude oil		16.4%	
Heating oil	6.3%	5.0%	4.0%
Natural gas	2.5%	3.0%	11.0%
Gasoline	6.4%	5.0%	4.0%
Gas oil		6.8%	
<b>Base metals</b>			
Aluminium	6.0%	2.5%	5.1%
Copper	6.4%	3.4%	6.7%
Zinc	5.8%	0.5%	2.4%
Nickel	5.9%	0.7%	2.0%
Lead		0.4%	
<b>Precious metals</b>			
Gold	4.6%	2.7%	10.8%
Silver	5.1%	0.6%	4.0%
<b>Grains</b>			
Wheat	5.3%	3.2%	4.2%
Kansas wheat		0.8%	
Corn	5.5%	4.7%	8.0%
Soybeans	6.4%	2.4%	7.3%
Soybean oil	6.6%		2.8%
<b>Softs</b>			
Sugar	4.1%	1.8%	2.4%
Coffee	4.2%	1.0%	2.5%
Cocoa		0.3%	
Cotton	4.3%	1.8%	2.1%
<b>Livestock</b>			
Live cattle	4.3%	2.2%	3.1%
Lean hogs	3.8%	1.4%	2.1%
Feeder cattle		0.4%	

Source: Prime Capital AG and index sponsors. As of 31 May 2011.

As can be seen from Table 4, compared to the S&P GSCI and the DJ UBS, the PCCI is more balanced and diversified across the components. The composition is a natural reflection of the current market structure without any selection bias.

Therefore, it enjoys the property of a fair and true investable index.

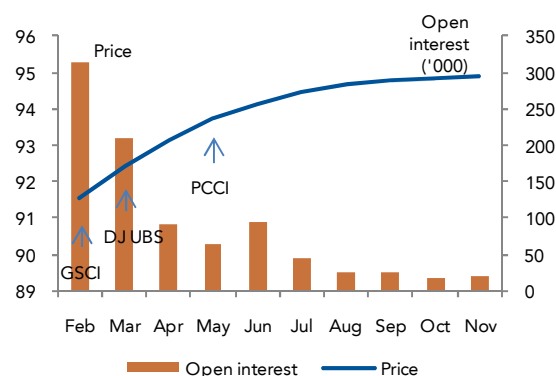
### Roll approach

Unlike most roll yield enhancement methods, which use either simple systematic trading rules that rely on the assumption that the commodity futures curve remains stable, or complex backtested methods that assume the market structure does not change over time, the PCCI takes an unbiased approach, buying deferred contracts along the futures curve, subject to liquidity. We follow a roll cycle of futures contracts which are 4-8 months away from expiration to reduce the volatility associated with front-end contract expiration and to mitigate negative roll yield in contango while at the same time staying in the liquid part of the futures curve and maintaining a close relation to the price development of the underlying commodities. The result is similar to complex methods but more reliable and incurring lower trading costs. Hence it is a superior and robust approach that does not induce unnecessary uncertainty.

Below we exemplify this for WTI crude oil. The full contract roll table can be found in the Annex.

In the beginning of every January, the S&P GSCI contains the February contract (the immediately expiring contract), the DJ UBS contains the March contract (the following expiring contract), while the PCCI holds the May contract. This avoids investing in the front-end of the futures curve, which is typically the steepest and most volatile part, without suffering from a lack of liquidity.

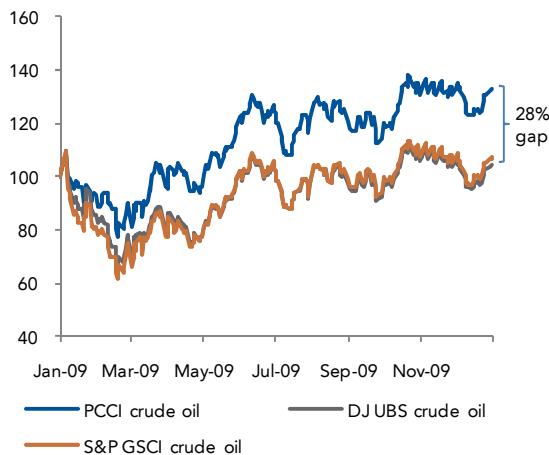
Chart 4: WTI crude oil in PCCI vs. standard indices



Source: Prime Capital AG and index sponsors

This approach has the benefit of reducing the negative roll yield when the futures curve is in contango, which was the case for example in 2009. The crude oil component in the PCCI outperformed its equivalent in the standard indices by a significant amount during that period as illustrated in Chart 5.

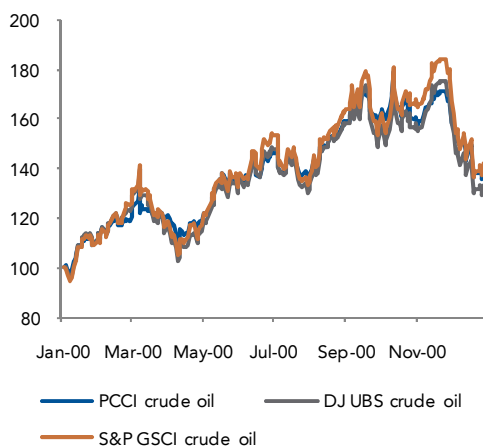
Chart 5: Performance during contango – 2009



Source: Bloomberg, Prime Capital AG

Even in backwardated periods, PCCI’s approach can still capture the steepening of the futures curve and gain similar positive roll yield as traditional indices – as shown for the example of the year 2000 in Chart 6.

Chart 6: Performance during backwardation – 2000



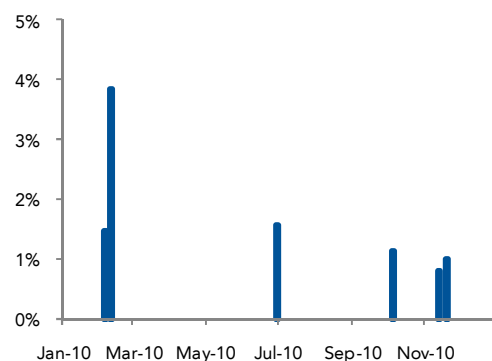
Source: Bloomberg, Prime Capital AG

## Rebalancing

Unlike most benchmark and enhanced indices, which use arbitrary rebalancing cycles, the PCCI lets the market decide when to rebalance. Every day, a target portfolio is constructed by using the described weighting method. The updated risk parameters are then compared with those of the current portfolio. Rebalancing will be triggered if the risk parameters of the target portfolio exceed a certain margin which was chosen to be within 5% of the current portfolio.

Since the PCCI’s weighting method results in a balanced portfolio with a stable structure, the rebalancing does not take place very often if the underlying market structure is relatively stable, which also reduces transaction costs, qualifying it as a passive index. Despite being fairly stable over time, this mechanism ensures that the portfolio is adjusted in a more timely fashion in case there are major intra-month movements in the commodity market. Below is the example of how this played out in 2010, which represents a typical rebalancing pattern in the PCCI. The portfolio reacts to the higher variation and volatility in the beginning of the year, but then remains fairly stable until Q4 2010. The aggregate turnover resulting from rebalancing was about 10% in 2010.

Chart 7: Rebalancing – 2010 (% of portfolio)

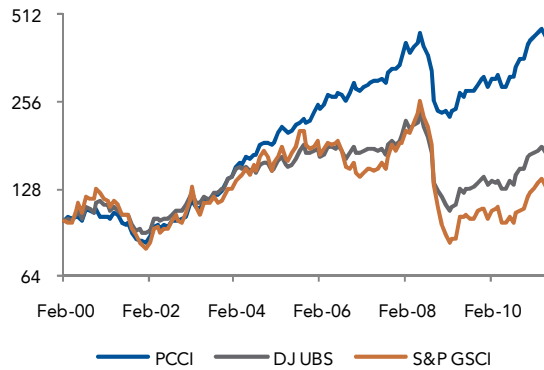


Source: Prime Capital AG

## Performance

With dynamic weighting, a deferred roll schedule and market oriented rebalancing, the PCCI benefits from reduced volatility and higher absolute as well as consequently higher risk-adjusted returns.

Chart 8: PCCI performance vs. standard indices



Source: Bloomberg, Prime Capital AG. Log scale.

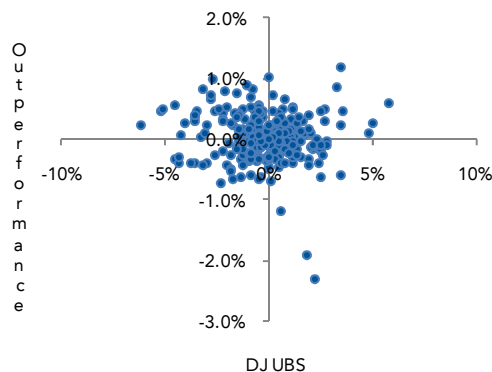
Table 5: PCCI risk/return vs. standard indices

Mar00 - May11	PCCI	DJ UBS	S&P GSCI
Annualized return	13.9%	4.8%	2.3%
Annualized volatility	17.4%	17.4%	24.8%
Sharpe ratio (3%)	0.67	0.19	0.10
Max drawdown	-48.2%	-54.5%	-67.8%

Source: Bloomberg, Prime Capital AG

The outperformance has been consistent and independent of market direction, meaning there is no observable relationship between the daily performance and the outperformance - even in the year of 2008 when the commodity market experienced large swings.

Chart 9: Outperformance vs. DJ UBS (daily returns - 2008)



Source: Bloomberg, Prime Capital AG

## Summary

- The PCCI is a new commodity index specifically designed for the needs of financial investors. It offers a representative and efficient approach to gain exposure to the global commodity market.
- The PCCI applies a well-established portfolio construction method based on a robust statistical technique, namely principal component analysis, to make intelligent allocations. The benefit is the capturing of the common property in the commodity market using an efficient and balanced portfolio.
- The PCCI reduces the negative roll yield in contango by positioning in the deferred part of the commodity futures curve, while still capturing the steepening of the futures curve and enjoying a positive roll yield in backwardation.
- The PCCI rebalances its portfolio based on risk parameters and the market environment, which is more desirable and effective than any arbitrary rebalancing cycle.
- The PCCI has produced annual returns of 13.9% with a volatility of 17.4% since 2000. It results in a Sharpe ratio of 0.67, far superior to the traditional indices, such as the S&P GSCI (0.10) and the DJ UBS (0.19).

## Annex

## Pre-roll contract table

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Gas	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Crude Oil	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Gasoline	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Heating Oil	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Live Cattle	Jun	Jun	Aug	Aug	Oct	Oct	Dec	Dec	Feb	Feb	Apr	Apr
Lean Hogs	Jun	Jun	Jul	Aug	Oct	Oct	Dec	Dec	Feb	Feb	Apr	Apr
Wheat	May	Jul	Jul	Sep	Sep	Dec	Dec	Dec	Mar	Mar	Mar	May
Corn	May	Jul	Jul	Sep	Sep	Dec	Dec	Dec	Mar	Mar	Mar	May
Soybeans	May	Jul	Jul	Nov	Nov	Nov	Nov	Jan	Jan	Mar	Mar	May
Soybean Oil	May	Jul	Jul	Dec	Dec	Dec	Dec	Jan	Jan	Mar	Mar	May
Aluminium	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Copper	May	Jul	Jul	Sep	Sep	Dec	Dec	Dec	Mar	Mar	Mar	May
Zinc	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Nickel	May	Jul	Jul	Sep	Sep	Nov	Nov	Jan	Jan	Mar	Mar	May
Gold	Jun	Jun	Aug	Aug	Dec	Dec	Dec	Dec	Feb	Feb	Apr	Apr
Silver	May	Jul	Jul	Sep	Sep	Dec	Dec	Dec	Mar	Mar	Mar	May
Sugar	May	Jul	Jul	Oct	Oct	Oct	Mar	Mar	Mar	Mar	Mar	May
Cotton	May	Jul	Jul	Dec	Dec	Dec	Dec	Dec	Mar	Mar	Mar	May
Coffee	May	Jul	Jul	Sep	Sep	Dec	Dec	Dec	Mar	Mar	Mar	May

Source: Prime Capital AG. Contract roll typically takes place around the 10th business day in the month.

## Contact Details

Prime Capital AG  
Bockenheimer Landstr. 51-53  
60325 Frankfurt am Main  
GERMANY  
Tel: +49 (0)69 9686 984 0  
Fax: +49 (0)69 9686 984 61

Prime Capital AG  
2 Eaton Gate  
London, SW1W 9BJ  
UNITED KINGDOM  
Tel: +44 (0)203 178 7493  
Fax: +44 (0)203 178 7494

Internet: [www.primecapital-ag.com](http://www.primecapital-ag.com)

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