Joseph Gruber
June 14, 2011

Modeling Commodity Prices

The staff forecasts for oil and non-fuel commodity prices have been based on quotes from futures markets. In recent years, however, futures-based commodity price forecasts have been subject to large and, at times, persistent errors.[1] Given the disappointing performance of futures-based forecasts, this note examines a number of alternative reduced-form models for commodity prices. First, we review a range of commonly cited determinants of commodity prices and then we assess the in-sample predictive content of these different determinants. Our goal is to identify those variables that hold the greatest promise both for explaining observed movements in commodity prices and potentially for improving on our futures-based forecasts of commodity prices.

We find that a simple model that incorporates world GDP and the broad nominal dollar does a fairly good job of fitting movements both in the IMF's index of non-fuel commodity prices as well as the price of West Texas Intermediate crude oil. In addition, we find that futures prices appear to provide explanatory power for commodities as well. Most of the other determinants we consider either are not significant or don't provide much explanatory power.

Possible Determinants of Commodity Prices

In this section we briefly review frequently cited determinants of commodity prices. It is important to acknowledge that the channels listed here do not work in isolation; rather, all the determinants interact in general equilibrium, affecting commodity

---

[1] See the memo "Evaluating the Forecasting Performance of Commodity Futures Prices" for a discussion of futures-based forecasts.

prices and one another while commodity prices simultaneously feedback onto the determinants. Our focus in this note is on reduced-form, partial equilibrium models of commodity prices with an emphasis on identifying empirical correlations rather than structural relationships.

The determinants we consider include:

Demand: Strong demand for commodities, particularly from fast growing emerging market economies, is perhaps the most widely cited explanation for the run-up in commodity prices over the last decade. Likewise, a sharp fall off in commodity demand and subsequent recovery coincided with the plunge in commodity prices in late 2008 and the upswing in prices over the past two years. In our analysis, we use measures of global economic activity as a proxy for demand.

The Dollar: All else equal, a depreciation of the dollar should boost dollar-denominated commodity prices by lowering the foreign currency price of commodities, and thereby increasing foreign demand. In response to a depreciation of the dollar, foreign commodity producers could also increase dollar prices for commodities to maintain either a non-dollar revenue target or their margins in relation to their non-dollar production costs.

Interest Rates and Liquidity: In theory, low interest rates can push up prices by decreasing the cost of holding inventories, thereby boosting demand. Additionally, it is often asserted that low interest rates drive investors into commodities in a search for yield, thereby driving up prices.

Risk Aversion: Over the past few years, daily movements in commodity prices have often been attributed to changes in the willingness of market participants to bear risk. A reduction in risk aversion is thought to raise commodity prices.

Financialization of Commodities Markets: It is commonly argued that commodity prices are being driven upward the increasing presence of financial investors in these markets. Common proxies for investor flows are open interest in futures markets as well as the net long positions of non-commercial traders.[2]

Inflation Expectations: Commodities are often portrayed as a real hedge against inflation risk. Thus, higher inflation or expected inflation could increase demand for commodities and boost their prices.

Supply: Shortfalls in supply have also been an important factor in explaining the run-up in commodity prices. While shifts in global demand conditions may have broad effects across a range of commodities, individual commodities often tend to have their own idiosyncratic supply stories. As such, finding appropriate empirical proxies for evolving supply conditions is a challenging task.

Futures: Commodity prices are forward-looking and therefore should react to expectations of future supply and demand as well as current conditions. Given that expectations are difficult to assess, we attempt to capture some information regarding supply and demand prospects from the futures market. In particular, after examining the ability of the factors described above to explain commodity prices, this note also assesses

---

[2] Open interest is the total number of outstanding futures contracts traded on an exchange. Contracts are either to buy the commodity (long) or sell the commodity (short) at some time in the future. The net long position of non-commercial traders is the total number of long contracts minus the number of short contracts for traders that do not have business exposures to hedge through commodity futures positions, as classified by the CFTC.

whether, once these factors are taken into account, futures prices provide additional explanatory power.

Results

Demand and the Dollar

Of all the possible determinants of commodity prices considered, demand growth and the dollar appear to be the most important over the 1991 to 2010 sample considered in this note. A simple model that regresses the change in commodity prices on world GDP growth and changes in the broad nominal index of the dollar does quite well at explaining commodity price movements.[3] As shown in the first regression in Table 1, world GDP growth and the dollar explain a little over half of the variation in the IMF non-fuel commodity price index. For disaggregated commodities the model explains a smaller fraction of price variation, as might be expected given that the idiosyncratic shocks that move individual commodity prices may average out to some degree in aggregate indexes. The model does better for oil and industrial metals and relatively poorly for crops, perhaps reflecting the disproportionate importance of supply shocks in agricultural markets. The coefficients are largest on oil and industrial metals, where a 1 percent increase in world GDP is associated with an increase in prices of about 10 percent.

For all the commodities considered in Table 1, an increase in the foreign exchange value of the dollar is associated with a decline in the price of the commodity. The dollar has a significant effect for the non-fuel index, oil, copper, and zinc, but not for

---

[3] The model is similar to that discussed in Higgins (2011), "Why Have Global Commodity Prices Risen So Sharply?", memorandum, Federal Reserve Bank of New York, March 17.

agricultural commodities or aluminum and nickel. The coefficients are generally close to one, suggesting an essentially complete pass-through of dollar changes into prices. For oil and copper the coefficient is closer to 2, a magnitude which is difficult to interpret in terms of the standard theoretical connection between the dollar and commodity prices; these large coefficients could instead reflect the comovement of prices and the dollar in response to some common, unidentified third factor.

The fourth regression in Table 1 replaces world GDP with a measure of world industrial production (IP). Given that IP is more commodity intensive than overall GDP, it could be a better proxy for commodity demand. As shown in the table, the model with IP does explain a slightly higher fraction of variation in the IMF non-fuel index, oil, and the metals; however, IP is not a significant determinant of crop prices.

Considering advanced and emerging market economic growth separately does not noticeably improve the performance of the model either when using GDP (regression 2) or IP (regression 5). However, just looking at growth in emerging Asia alone explains a fair amount of the variation in prices, thus confirming the important role of activity in the region in influencing commodity prices (regressions 3 and 6).

Regression 7 includes a measure of the world output gap as an indicator of demand. The output gap may be a useful predictor if cyclical factors have played an important role in amplifying the swings in commodity prices. Although the gap is significant for a number of commodities, the R-squared of the regressions is lower than when actual GDP is included in the regressions. If we include both the output gap and GDP growth (regression 8), the output gap often appears with the wrong sign.

Interest Rates

Table 2 examines the relationship between commodity prices and interest rates. In addition to world GDP growth and the dollar, the first regression includes an aggregate of advanced economy 10-year sovereign yields. The interest rate is significant in many cases (though not for the crops). However, the sign runs contrary to the conjecture that low rates are associated with high commodity prices. Instead, higher interest rates have historically been associated with increasing commodity prices. This likely reflects the fact that interest rates are high when growth is strong, a spurious correlation apparently not controlled for by world GDP. The results are not much different when we consider the real interest rate (adjusted by CPI inflation) as shown in regression 3.

We also consider the possibility that low interest rates in times of financial stress may not boost prices by the same degree as low rates in more normal times. In order to capture financial conditions we include in the regression a measure of the level financial stress produced by the Board's R&S Division.[4] Interacting the interest rate with the level of financial stress leads to a large and significant negative coefficient on interest rates in the equation for oil, but has little impact on the other commodities (regressions 2 and 4).

Risk Aversion and Financial Flows

Table 3 considers the effect of various financial factors on commodity prices. As shown in the first regression, changes in the MSCI Global equity index are not significantly associated with changes in the price of most commodities, at least once economic growth is accounted for. Changes in risk aversion, however, do have a significant effect, with increases in both the VIX and R&S's financial stress index

---

[4] This index includes corporate bond spreads, implied volatilities for the equity prices and long-term interest rates, the spread between the Fed Funds rate and two-year Treasuries, Treasury on-the-run premiums, and a measure of the equity risk premium.

depressing prices (regressions 2 and 4). The effect of risk is most pronounced in regard to the IMF non-fuel index and the industrial metals. For oil, the coefficient on the VIX is insignificant, while the coefficient on the R&S financial stress measure is significant.

The significance of financial stress in explaining commodity price movements appears to primarily reflect a tight correlation during the recent financial crisis. Removing the financial crisis from the sample and estimating the equation only through the second quarter of 2007 eliminates the significance of financial stress in determining the IMF non-fuel index and the price of oil (as shown in regressions 3 and 5).

As commodity futures markets have attracted increased investor interest over the past decade, many commentators have attributed movements in commodity prices to financial speculation. In regression 6 on Table 3, we examine the effect of changes in total open interest (expressed in number of contracts) in the futures market on price movements for those commodities for which there are data. Open interest is not a significant determinant of commodity prices. In contrast, the net long position of non-commercial traders appears to be significantly correlated with the price of many commodities (Regression 7). However, other empirical work that we (and others) have done indicates that the correlation of net long positions and commodity prices does not necessarily reflect causality. High-frequency Granger causality tests tend to indicate that high prices precede rises in non-commercial net long positions, rather than vice versa.

Inflation and Inflation Expectations

As shown in Regression 1 on Table 4, inflation (as measured by an aggregate world CPI) is significantly correlated with the IMF non-fuel index. Of course there is a considerable endogenity problem in assessing the relationship between inflation and

commodity prices. In Regression 2, we include one-quarter lagged inflation in order to control for the endogenity issue, but lagged inflation is not significantly correlated with commodity prices.

Regressions 3 and 4 include inflation compensation as implied by TIPS yields, over 10 years and 5-to-10 years ahead, respectively. Both measures are weakly correlated with oil prices, but not with the other commodities. Regressions 5 and 7 include median inflation expectations from the Michigan Survey for 1-year ahead and 5-to-10 years ahead respectively. Unsurprisingly, near-term inflation expectations are significantly correlated with oil prices, although once we consider lagged expectations, the significance disappears (regression 6). Longer-term inflation expectations are generally not significant (regression 7).

Supply

Table 5 looks at the impact of supply on select commodity prices. In equilibrium supply tracks demand, so entering commodity supply measures into our models outright results in a classic identification problem. Instead, our empirical work requires variables that track exogenous movements in supply independent of changes in demand. For agricultural commodities, a natural supply proxy is the crop yield, which often moves in response to weather conditions, thus affecting supply in a manner independent of demand. For oil, the production of non-OPEC producers is relatively price inelastic in the short run and is therefore thought to be relatively independent of the contemporaneous level of demand. It is also conceivable that changes in OPEC oil production capacity, rather than output, affect supply conditions but are relatively

exogenous to changes in demand over short horizons. For the industrial metals, suitable proxies are more difficult to identify.

As shown in Regressions 1 and 2 on Table 5, although the signs are negative as expected, neither OPEC capacity nor non-OPEC supply are significant determinants of oil prices. For the agricultural commodities, neither U.S. yields nor global yields are significantly correlated with prices. The insignificance of supply variables in our regressions is hard to reconcile with our understanding of commodity markets, where supply conditions appear to be a major determinant of price dynamics. It is possible that the proxies considered here are not the most suitable for capturing exogenous supply shocks, or it is possible that expected supply is a more important driver than realized supply.

The Slope of the Futures Curve

As mentioned earlier, commodity prices are forward-looking and prices should reflect not only current developments but also expectations of future developments. One potential proxy for expected developments is the slope of the futures curve. A downward sloped curve could suggest that the market expects demand for commodities to loosen relative to supply. Building off work in the memo "Evaluating the Forecasting Performance of Commodity Futures Prices," we examine the informational content of the time slope of futures prices. In particular, we look at the ratio of the spot price to the one-year ahead futures price. As this ratio increases, the spot price rises further above the futures price and prices may be expected to decrease over time. As shown in Table 6, lagging the slope by two quarters results in a coefficient with the right sign for most commodities: For example, prices tend to fall when the futures price was below the spot

price two quarters previously. This effect is statistically significant for corn and soybeans.

Although the evidence is strongest for corn and soybeans, the effectiveness of the slope of the futures curve in predicting prices suggests that there is valuable information in the futures curves that should be incorporated into any model forecast.

Conclusion

In exploring alternative modeling approaches, we have found that a simple model that relates commodity prices to world GDP growth and movements in the broad nominal dollar appears to offer the most promise. Futures prices appear to offer additional explanatory power for some commodities. Most other variables considered provide little additional explanatory power.

Although the simple model presented here with world GDP and the dollar appears to perform quite well, it is important to note that this assessment is based on the in-sample fit of the model, and hence is conditional on realized values of GDP growth and the dollar, which, clearly, are not known ex ante.

Table 1: Commodity Prices and Demand (1991Q2 to 2010Q4)

Regression		IMF Non-Fuel Index	WTI Oil	Alum.	Copper	Nickel	Zinc	Corn	Wheat	Soybeans
1	World GDP	5.72	13.14	11.67	10.83	16.11	8.79	3.46	4.06	3.83
	Broad Dollar	-0.81	-2.03	-0.59	-2.07	-0.83	-1.32	-0.82	-0.90	-1.03
	R^2	0.54	0.48	0.48	0.43	0.32	0.25	0.06	0.08	0.10
2	Advanced GDP	2.55	6.05	6.50	5.49	7.31	5.84	2.93	4.54	0.90
	Emerging GDP	2.60	6.54	4.33	4.59	7.50	2.51	0.01	-0.65	2.51
	Broad Dollar	-0.84	-2.02	-0.74	-2.15	-0.91	-1.49	-0.99	-1.13	-0.99
	R^2	0.51	0.48	0.45	0.42	0.30	0.24	0.04	0.08	0.09
3	Emerging Asian GDP	2.37	5.03	4.44	4.54	7.25	2.87	0.23	0.49	1.96
	Broad Dollar	-1.09	-2.73	-1.22	-2.61	-1.58	-1.85	-1.13	-1.24	-1.18
	R^2	0.43	0.38	0.30	0.37	0.22	0.19	0.04	0.06	0.10
4	World IP	2.41	5.43	4.74	4.69	5.85	3.55	1.25	1.17	1.44
	Broad Dollar	-0.77	-1.97	-0.56	-1.97	-0.96	-1.31	-0.85	-1.00	-1.04
	R^2	0.58	0.51	0.51	0.46	0.30	0.26	0.05	0.07	0.10
5	Advanced IP	0.84	2.40	2.48	1.71	1.81	1.35	-0.12	-0.29	-0.75
	Emerging IP	1.78	3.23	2.18	3.29	4.79	2.29	1.80	2.11	3.17
	Broad Dollar	-0.66	-1.86	-0.58	-1.80	-0.60	-1.22	-0.64	-0.71	-0.59
	R^2	0.58	0.50	0.50	0.46	0.30	0.25	0.05	0.07	0.14
6	Emerging Asia IP	1.87	3.65	3.55	4.14	5.47	3.09	1.20	2.22	1.73
	Broad Dollar	-0.79	-2.19	-0.64	-1.86	-0.73	-1.23	-0.79	-0.62	-0.87
	R^2	0.47	0.40	0.35	0.42	0.26	0.23	0.05	0.10	0.11
7	World Output Gap	2.97	7.51	5.80	5.04	10.98	5.54	1.95	1.52	0.81
	Broad Dollar	-1.12	-2.69	-1.25	-2.71	-1.50	-1.73	-1.00	-1.17	-1.33
	R^2	0.44	0.42	0.32	0.36	0.29	0.23	0.05	0.06	0.08
8	World GDP	6.26	12.69	13.42	13.28	11.21	7.21	3.42	5.88	7.09
	World Output Gap	-0.52	0.44	-1.69	-2.36	4.73	1.52	0.05	-1.76	-3.15
	Broad Dollar	-0.80	-2.03	-0.56	-2.03	-0.92	-1.35	-0.83	-0.86	-0.96
	R^2	0.53	0.47	0.47	0.43	0.32	0.24	0.04	0.07	0.10

Dark blue represents significance at the 5 percent level.
Light blue represents significance at the 10 percent level.

Table 2: Commodity Prices and Interest Rates (1991Q2 to 2010Q4)

Regression		IMF Non-Fuel Index	WTI Oil	Alum.	Copper	Nickel	Zinc	Corn	Wheat	Soybeans
1	10 Year Rate	0.21	0.53	0.30	0.61	0.54	0.35	-0.18	-0.31	-0.09
	World GDP	4.48	10.03	9.90	7.23	12.91	6.74	4.52	5.89	4.34
	Broad Dollar	-0.88	-2.21	-0.70	-2.29	-1.02	-1.45	-0.76	-0.79	-1.00
	R^2	0.58	0.52	0.50	0.49	0.35	0.27	0.05	0.09	0.09
2	10 Year Rate	1.34	-10.82	-1.51	-1.57	5.13	2.90	-0.68	4.70	-1.23
	Financial Stress Index	-0.12	0.45	-0.10	-0.22	0.01	-0.55	0.05	0.00	0.24
	Financial Stress * 10 Year Rate	-0.01	0.11	0.02	0.02	-0.04	-0.02	0.00	-0.05	0.01
	World GDP	4.13	7.29	8.11	4.27	15.53	3.82	4.65	8.68	5.58
	Broad Dollar	-0.95	-2.00	-0.77	-2.44	-0.99	-1.78	-0.73	-0.76	-0.85
	R^2	0.57	0.56	0.50	0.49	0.34	0.27	0.03	0.09	0.07
3	Real 10-Year Rate	0.20	0.50	0.30	0.59	0.52	0.35	-0.19	-0.32	-0.10
	World GDP	4.52	10.19	9.93	7.35	13.03	6.76	4.56	5.93	4.40
	Broad Dollar	-0.88	-2.21	-0.70	-2.29	-1.03	-1.45	-0.75	-0.78	-0.99
	R^2	0.57	0.52	0.50	0.49	0.34	0.27	0.05	0.09	0.09
4	Real 10 Year Rate	1.83	-10.12	-1.19	-0.46	6.19	3.60	0.33	5.59	-0.07
	Financial Stress Index	-0.14	0.40	-0.12	-0.27	-0.03	-0.57	0.01	-0.02	0.19
	Financial Stress * Real 10 Year Rate	-0.02	0.10	0.01	0.01	-0.05	-0.03	-0.01	-0.06	0.00
	World GDP	4.29	7.60	8.20	4.64	15.90	3.98	4.93	8.96	5.91
	Broad Dollar	-0.96	-2.07	-0.79	-2.48	-0.99	-1.79	-0.74	-0.73	-0.87
	R^2	0.57	0.55	0.50	0.48	0.34	0.27	0.03	0.10	0.07

Dark blue represents significance at the 5 percent level.

Light blue represents significance at the 10 percent level.

Table 3: Commodity Prices and Financial Variables (1991Q2 to 2010Q4)

Regression		IMF Non-Fuel Index	WTI Oil	Alum.	Copper	Nickel	Zinc	Corn	Wheat	Soybeans
1	MSCI Equity Index	-0.02	-0.25	0.03	0.15	0.19	0.27	-0.01	-0.01	-0.05
	World GDP	5.86	14.67	11.48	9.95	14.94	7.17	3.50	4.11	4.16
	Broad Dollar	-0.81	-2.11	-0.58	-2.02	-0.77	-1.24	-0.83	-0.90	-1.04
	R^2	0.53	0.49	0.47	0.43	0.32	0.27	0.04	0.07	0.09
2	VIX	-0.07	-0.08	-0.11	-0.20	-0.27	-0.17	-0.04	0.09	-0.02
	World GDP	5.57	12.99	11.44	10.43	15.55	8.43	3.37	4.24	3.79
	Broad Dollar	-0.65	-1.85	-0.34	-1.63	-0.22	-0.94	-0.73	-1.10	-0.98
	R^2	0.58	0.48	0.52	0.49	0.40	0.30	0.05	0.09	0.09
3	VIX (1991Q2 - 2007Q2)	-0.01	0.04	-0.06	-0.08	-0.13	-0.07	0.11	0.15	0.08
	World GDP	5.48	10.35	10.08	10.25	21.29	12.72	1.06	2.21	3.67
	Broad Dollar	-0.45	-1.03	-0.12	-1.24	-0.76	-1.16	0.20	-0.20	0.02
	R^2	0.30	0.15	0.19	0.17	0.31	0.20	-0.02	0.02	-0.02
4	R&S Financial Stress	-0.64	-1.37	-0.96	-1.79	-2.56	-1.87	-0.25	1.23	-0.22
	World GDP	4.96	11.53	10.54	8.72	13.08	6.58	3.16	5.52	3.57
	Broad Dollar	-0.70	-1.80	-0.44	-1.78	-0.41	-1.02	-0.78	-1.10	-0.99
	R^2	0.59	0.52	0.52	0.51	0.43	0.35	0.05	0.12	0.09
5	R&S Financial Stress (1991Q2 - 2007Q2)	-0.29	-0.75	-0.64	-0.65	-2.42	-1.33	0.51	2.03	0.27
	World GDP	5.36	10.29	9.65	9.72	20.04	12.02	1.66	3.45	4.08
	Broad Dollar	-0.47	-1.06	-0.20	-1.34	-1.00	-1.29	0.30	0.02	0.09
	R^2	0.32	0.16	0.19	0.17	0.36	0.23	-0.04	0.07	-0.03
6	Open Interest		0.13		-1.03			0.14	0.33	0.33
	World GDP		12.81		10.77			2.00	3.14	2.61
	Broad Dollar		-2.03		-2.18			-0.72	-0.77	-0.82
	R^2		0.48		0.43			0.12	0.09	0.17
7	Net Long Positions		0.84		3.31			0.59	1.46	1.01
	World GDP		12.87		9.78			2.92	4.83	3.42
	Broad Dollar		-1.94		-1.93			-0.33	-0.55	-0.95
	R^2		0.50		0.47			0.36	0.18	0.41

Dark blue represents significance at the 5 percent level.
Light blue represents significance at the 10 percent level.

Table 4: Commodity Prices and Inflation (1991Q2 to 2010Q4)

Regression		IMF Non-Fuel Index	WTI Oil	Alum.	Copper	Nickel	Zinc	Corn	Wheat	Soybeans
1	World Inflation	0.57	0.39	0.74	0.57	-0.74	-0.44	0.76	0.70	0.76
	World GDP	5.46	12.97	11.34	10.58	16.44	8.98	3.12	3.75	3.49
	Broad Dollar	-0.88	-2.08	-0.69	-2.15	-0.73	-1.26	-0.93	-0.99	-1.13
	R^2	0.55	0.48	0.48	0.43	0.31	0.25	0.05	0.08	0.10
2	Lagged World Inflation	0.36	-0.29	0.72	0.25	-0.65	-0.29	0.48	0.58	0.10
	World GDP	5.56	13.27	11.37	10.72	16.39	8.91	3.26	3.81	3.79
	Broad Dollar	-0.87	-1.97	-0.73	-2.12	-0.71	-1.27	-0.91	-1.01	-1.04
	R^2	0.54	0.48	0.48	0.42	0.31	0.24	0.05	0.07	0.09
3	10 - Year Inflation Compensation	0.03	0.13	0.02	0.08	-0.08	-0.01	0.08	0.03	0.00
	World GDP	3.72	1.55	8.99	2.68	15.00	7.08	-1.59	1.41	0.86
	Broad Dollar	-1.27	-3.93	-1.53	-4.01	-2.17	-2.13	-2.14	-1.89	-2.52
	R^2	0.64	0.66	0.70	0.58	0.32	0.24	0.20	0.17	0.17
4	5 Year Forward Inflation Compensation	0.07	0.20	0.08	0.11	-0.15	-0.06	0.15	0.06	0.00
	World GDP	3.06	2.42	7.77	3.38	15.43	8.30	-2.06	1.52	1.02
	Broad Dollar	-1.39	-4.20	-1.68	-4.15	-1.94	-2.00	-2.38	-1.97	-2.51
	R^2	0.65	0.65	0.71	0.58	0.32	0.24	0.21	0.17	0.17
5	Inflation Expectations 1-Year Ahead	0.01	0.07	0.01	0.02	-0.06	-0.03	0.03	-0.01	0.02
	World GDP	5.59	12.40	11.55	10.67	16.78	9.12	3.18	4.20	3.63
	Broad Dollar	-0.81	-2.03	-0.59	-2.07	-0.83	-1.32	-0.83	-0.90	-1.03
	R^2	0.54	0.53	0.47	0.43	0.35	0.26	0.06	0.07	0.10
6	Lagged Inflation Expectations 1-Year Ahead	-0.01	-0.03	-0.01	-0.04	-0.09	-0.03	-0.01	-0.01	-0.03
	World GDP	5.38	12.36	11.48	9.91	14.05	8.05	3.20	3.90	3.12
	Broad Dollar	-0.76	-1.93	-0.57	-1.95	-0.57	-1.23	-0.79	-0.88	-0.94
	R^2	0.55	0.49	0.47	0.44	0.38	0.26	0.05	0.07	0.11
7	Inflation Expectations 5 to 10 Years Ahead	0.01	0.03	-0.01	0.01	-0.05	-0.01	0.03	0.03	0.03
	World GDP	5.65	12.94	11.74	10.75	16.46	8.83	3.23	3.81	3.61
	Broad Dollar	-0.84	-2.14	-0.56	-2.12	-0.63	-1.30	-0.95	-1.03	-1.15
	R^2	0.53	0.48	0.47	0.42	0.32	0.24	0.05	0.08	0.10

Dark blue represents significance at the 5 percent level.
Light blue represents significance at the 10 percent level.
Range for Inflation Compensation Regressions 2003Q1 to 2010Q4

Table 5: Commodity Prices and Supply

Regression	Range		WTI Oil	Corn	Wheat	Soybeans
1	2000Q2-2010Q4	OPEC Capacity	-1.72			
		World GDP	10.15			
		Broad Dollar	-3.22			
		R^2	0.57			
2	1991Q2-2010Q4	Non OPEC Oil Supply	-0.98			
		World GDP	12.82			
		Broad Dollar	-2.06			
		R^2	0.48			
3	1981-2010	US Crop Yield		-0.24	-0.31	-0.48
		World GDP		4.64	4.43	2.80
		Broad Dollar		-0.22	-0.51	-0.67
		R^2		0.09	0.16	0.20
4	1981-2010	Global Crop Yield		-0.34	-0.01	-0.95
		World GDP		4.72	4.70	2.67
		Broad Dollar		-0.25	-0.50	-0.53
		R^2		0.07	0.15	0.27

Dark blue represents significance at the 5 percent level.
Light blue represents significance at the 10 percent level.

Table 6: Commodity Prices and Supply

Regression	Range		WTI Oil	Copper	Corn	Wheat	Soybeans
1	1991Q2 -2010Q4	Spot / 1-Year Ahead Futures (-2)	-0.08				
		World GDP	13.32				
		Broad Dollar	-1.95				
		R^2	0.48				
2	2003Q1-2010Q4	Spot / 1-Year Ahead Futures (-2)			-0.85		
		World GDP			-6.07		
		Broad Dollar			-4.06		
		R^2			0.56		
3	2004Q3 - 2010Q4	Spot / 1-Year Ahead Futures (-2)		0.36		-0.04	-0.61
		World GDP		2.96		0.34	-2.17
		Broad Dollar		-4.91		-2.70	-3.27
		R^2		0.62		0.22	0.77

Dark blue represents significance at the 5 percent level.
Light blue represents significance at the 10 percent level.