What can we learn from the price of Gold?

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Based on

“Is Gold Overpriced?”

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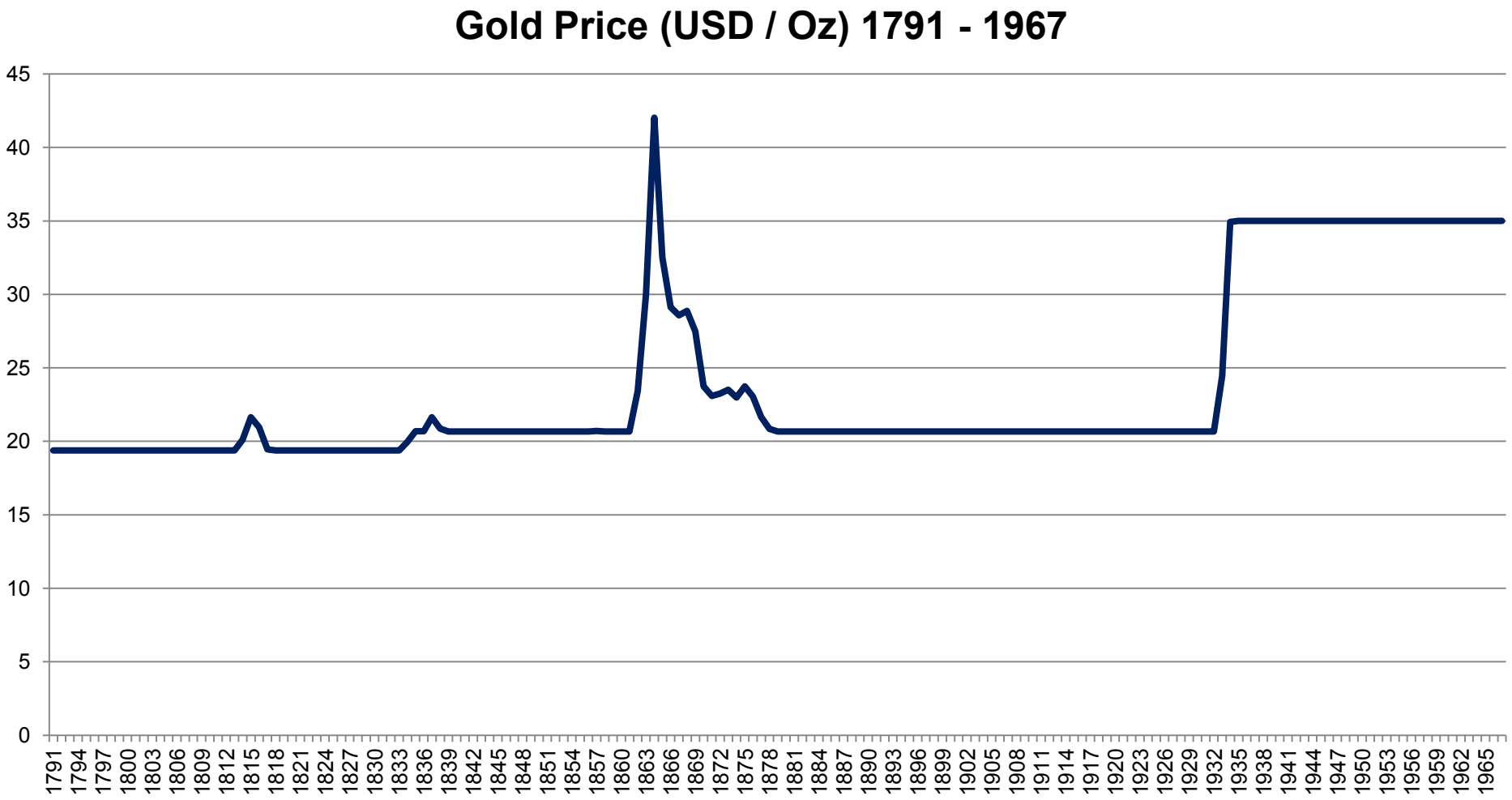
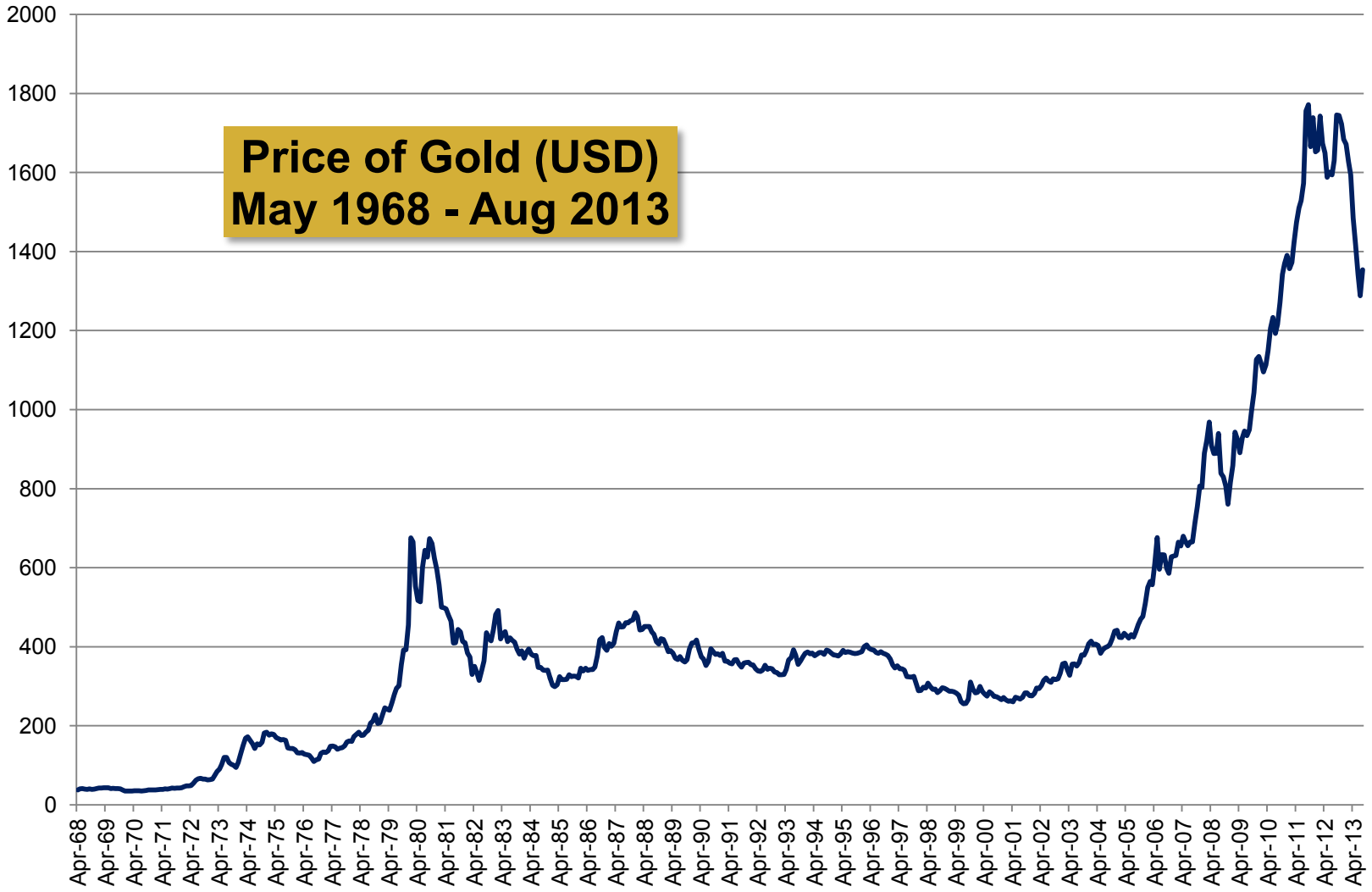
Gold -- A truly unique asset

- Unlike other assets, gold truly is scarce.
- Unique supply & demand features due to hoarding & disposal.
  - Demand
    - Few industrial uses even today.
    - Most of the gold ever mined still exists in use today, in the form of jewelry or bullion.
    - Investments such as ETF
  - Supply
    - Jewelry can re-enter the market at the right price.
    - Getting more difficult to find.
    - Significant lead time to bring on new supply.
- *Historical* cornerstone of Central Bank reserves.
- Historical precedents in the manner in which it has been “used”.

We have gone from this…



To This…


Price of Gold (USD)
May 1968 - Aug 2013
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Apr-68
Apr-69
Apr-70
Apr-71
Apr-72
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Apr-13

Understanding the pricing of this asset

- Supply & Demand
- Identify key underlying drivers:
  - Macroeconomy
  - Monetary System
  - Financial markets
  - Other significant commodities – primarily Oil.
- Employ proxies for these variables that:
  - Have the longest and most consistent time series.
  - Accurately capture the drivers that we consider.
- Use quantile regression to identify the relationships
  - Robust results
  - Distributional view

Key Findings

- Gold is not over priced in the recent period, except for a few months at the end of 2011.
- Very different result than if you apply a traditional ordinary least squares technique (OLS), which implies that gold has been over priced in recent years.
- Strongest explanatory variables include:
  - Oil Price
  - US Dollar Index Strength
  - US Unemployment Rate
- Evidence of gold being an inflation hedge is limited to a very specific time period.

Easy reserves have been mined…

← We have gone from this approach

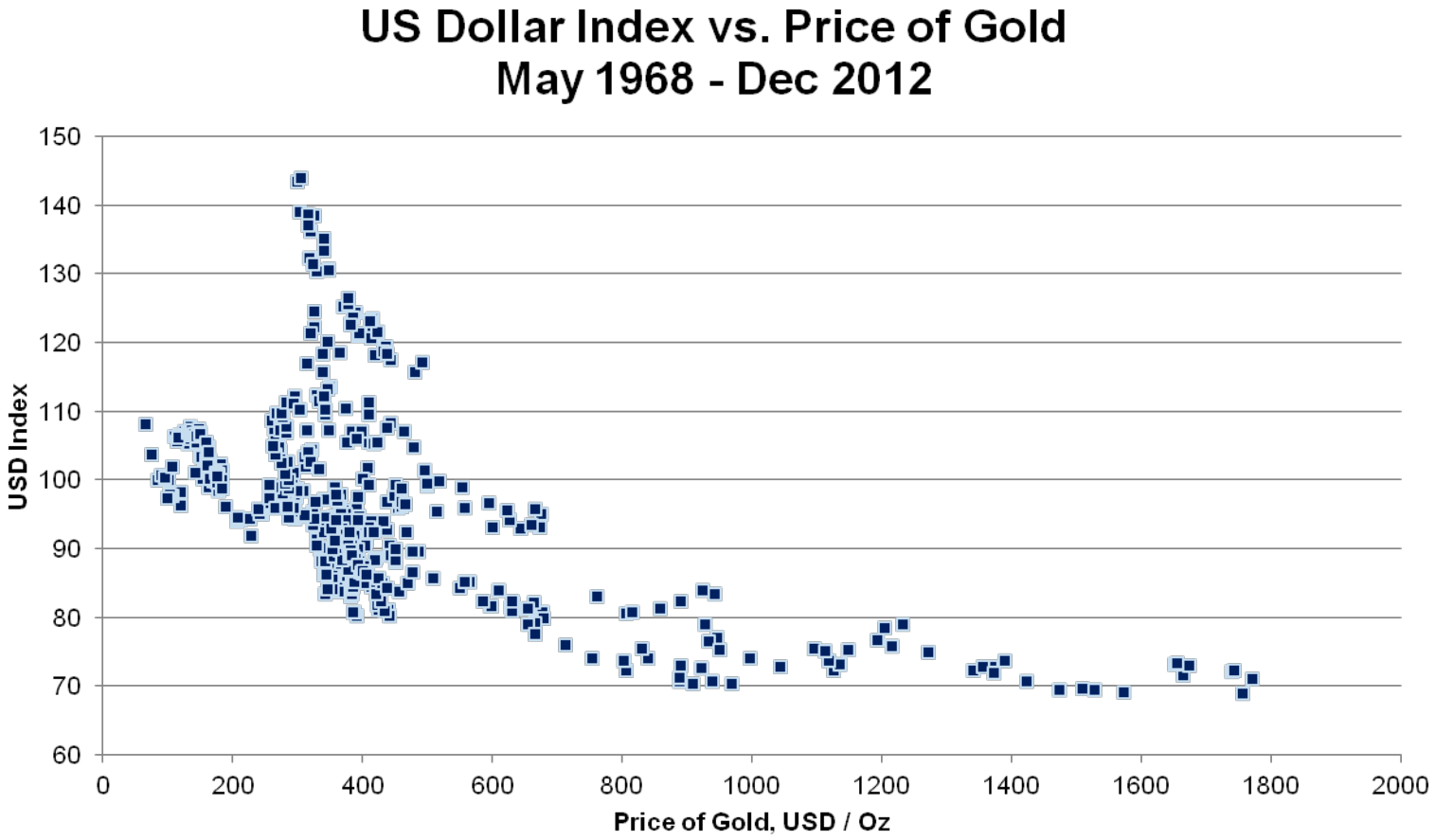
To this approach… →

Key drivers / correlations

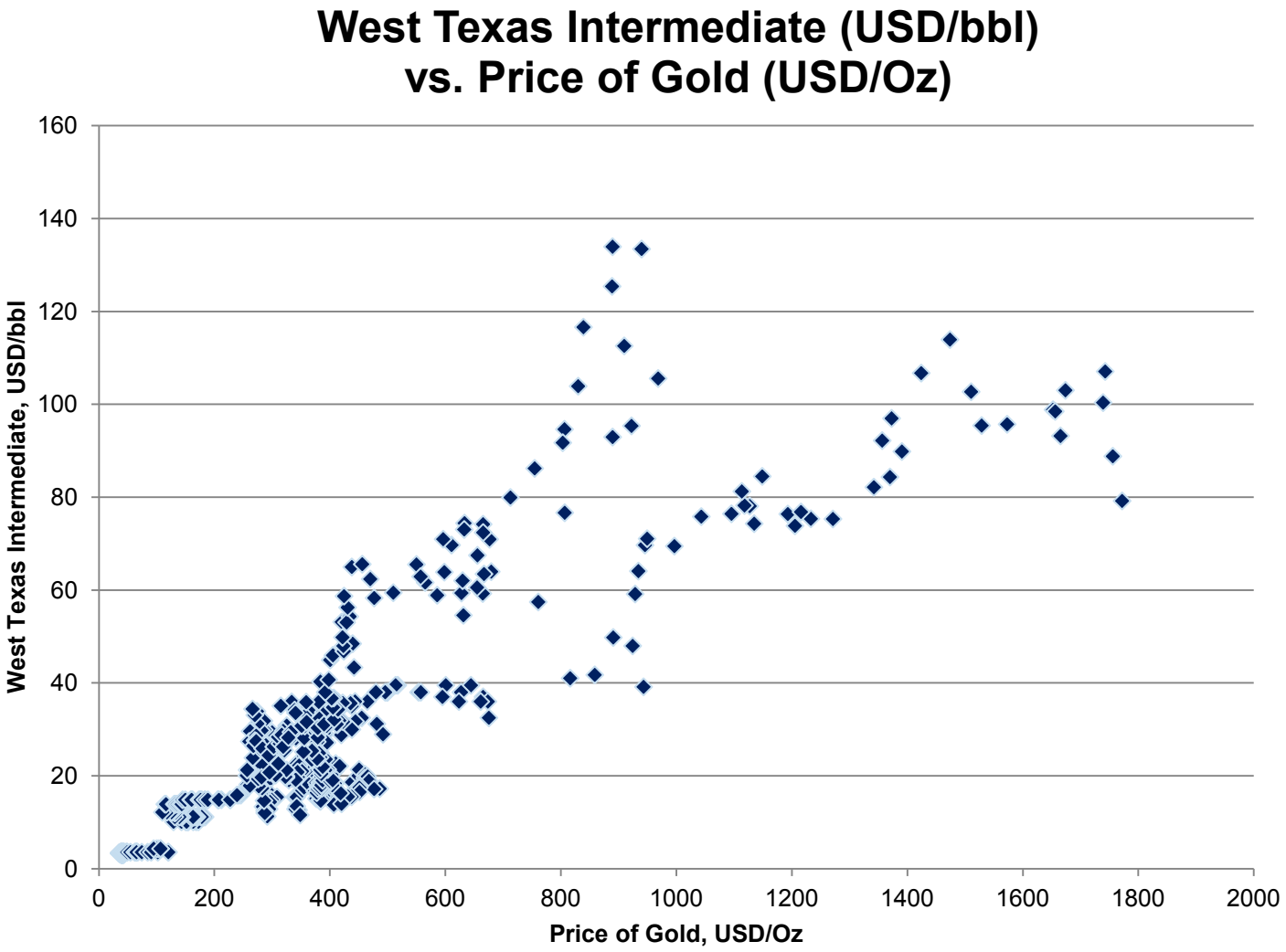
Pooled correlations between the price of gold & key variables in this study
April 1968 – March 2012

Variable	Correlation with the Price of Gold
Oil	0.876
Unemployment	0.462
DJIA	-0.021
TBILL	-0.196
Inflation	-0.235
GDP	-0.364
USD Index	-0.587

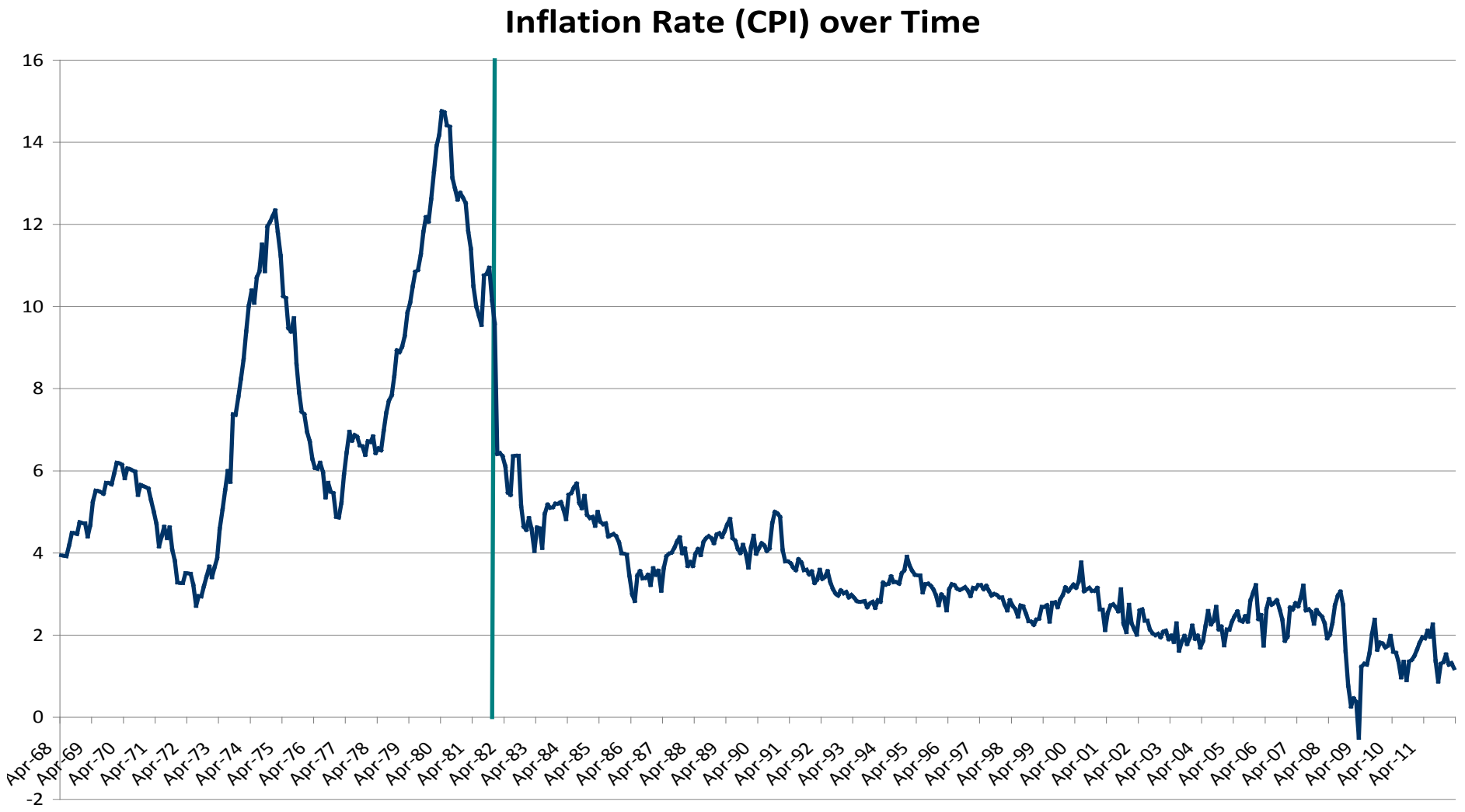
Hedge against a weak dollar? Yes!



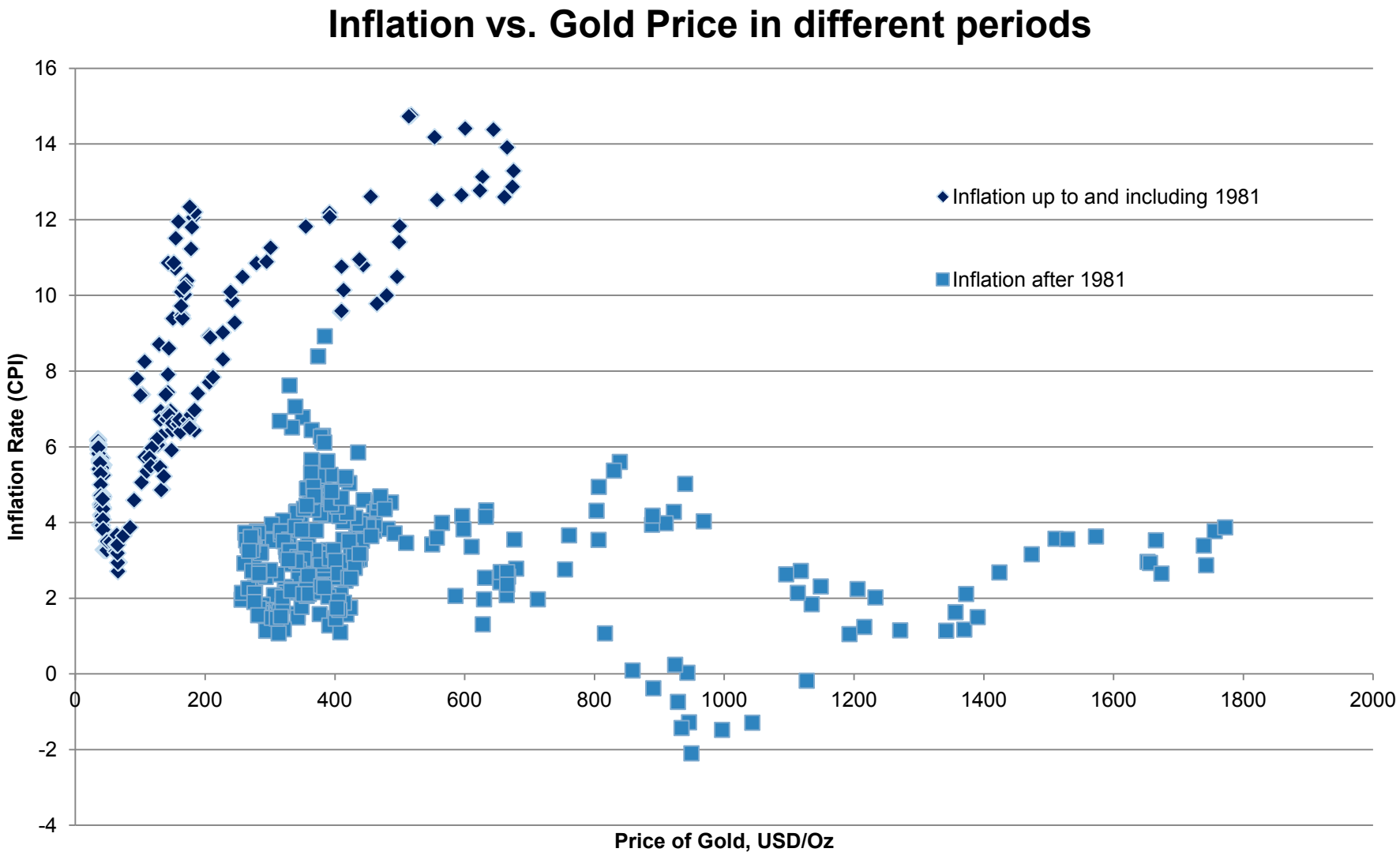
Correlated with oil? Yes!



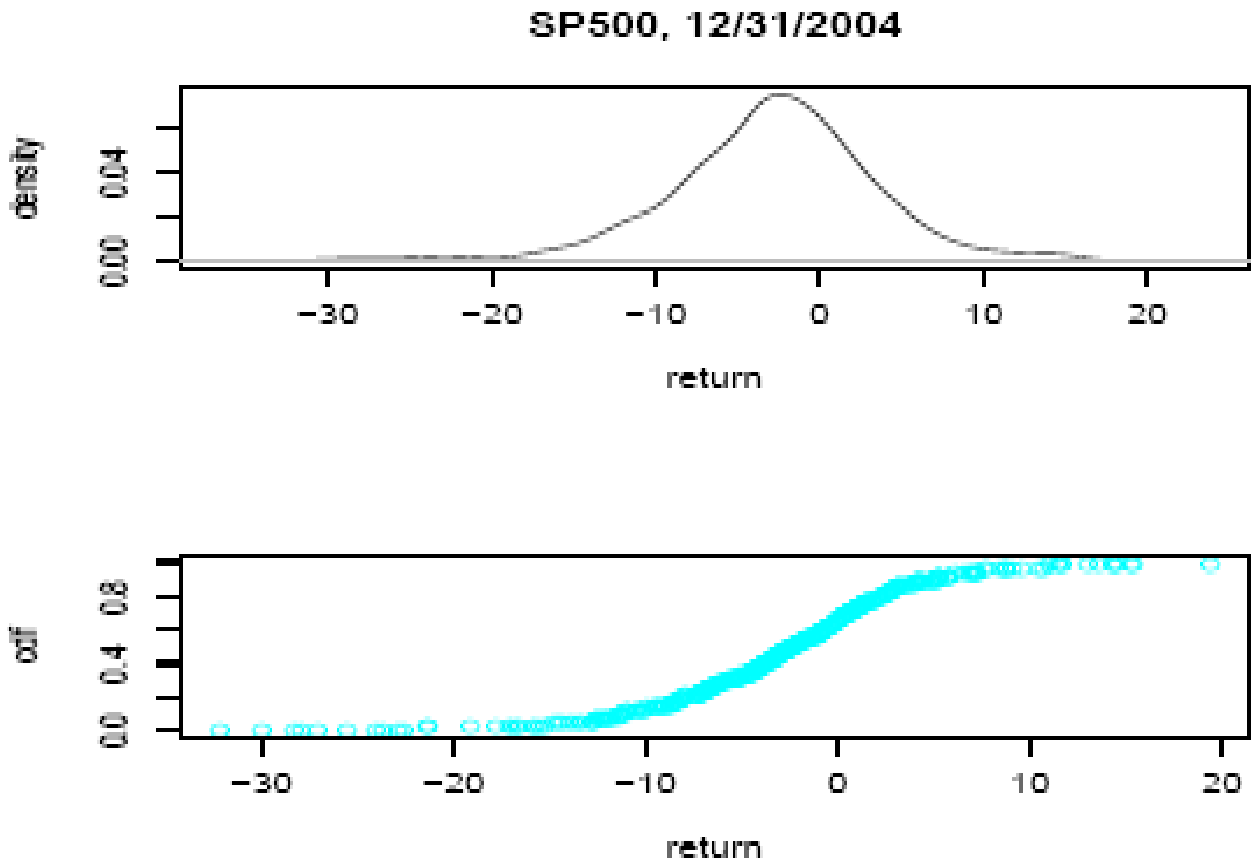
Inflation – The need for structural breaks



Inflation hedge? Not recently…



What does QR do?



- Sample Quantile:

$$F_y = \text{Prob}(\text{Y} \le \text{y}),$$
$$Q(\text{T}) = f\{y : F_y \ge \text{T}\},\ \text{T} \in (0,1)$$

What does QR do?

- Conditional Quantile:

$$y = x^T \beta + (x^T \delta)u$$
$$F_y^{-1}(\mathrm{T}|x) = x^T \beta + x^T \delta F_u^{-1}(\mathrm{T})$$
$$Q_y(\mathrm{T}|x) = x^T(\beta + \delta F_u^{-1}(\mathrm{T})) = x^T \beta(\mathrm{T})$$

- General methodology
  - Linear v.s. Nonlinear
  - Parametric v.s. nonparametric
  - Single equation v.s. Structural equations

Quantile Regression: math and code

- A Parametric Linear Model

$$y = Xb + u$$

- OLS Estimation

$$\hat{\beta}_{OLS} = \min_{b \in \mathrm{B}} \left[\sum (y_i - x_i^T b)^2 \right]$$

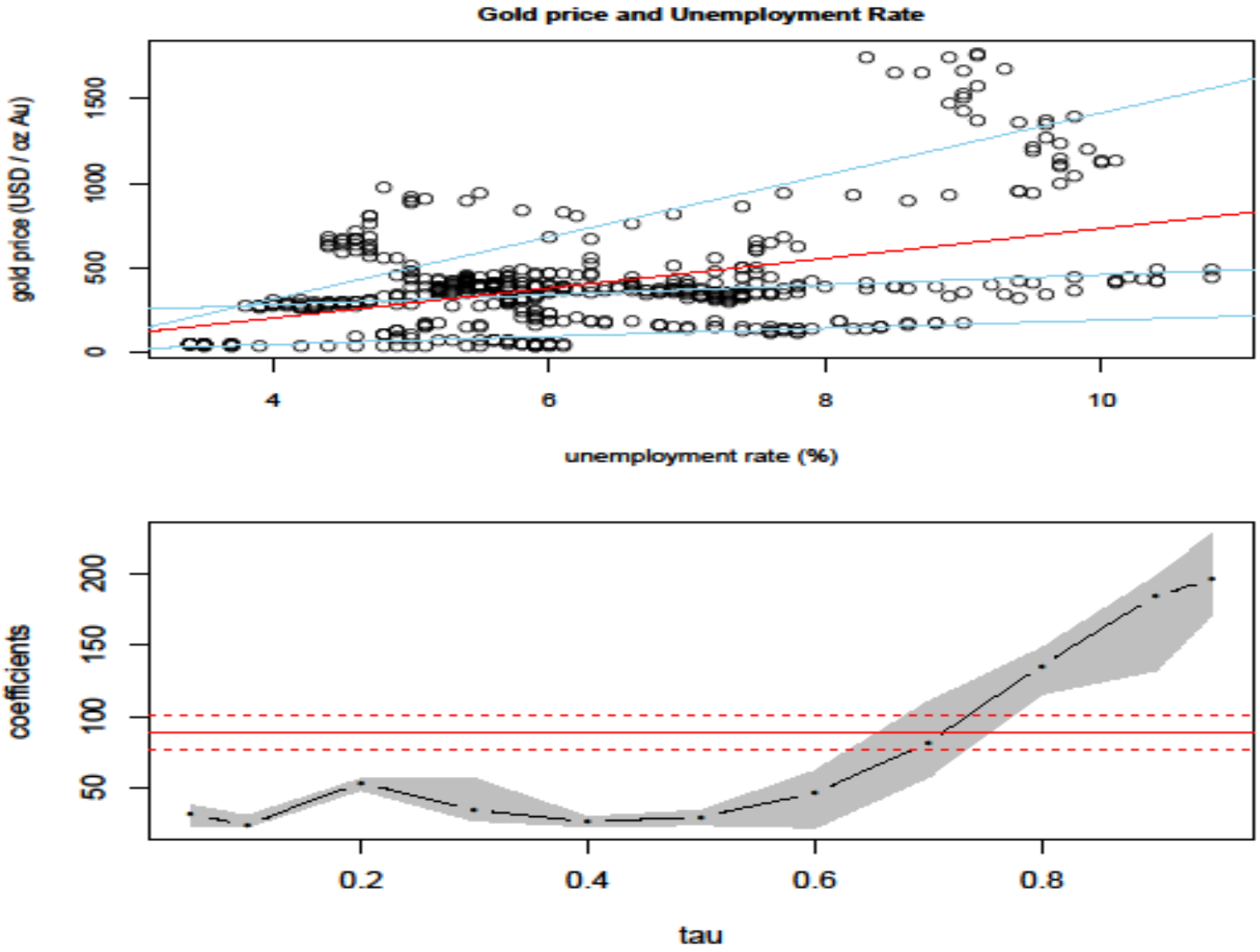
- QR Estimation

$$\hat{\beta}_{QR}(\tau) = \min_b \left[\sum_{y_i \geq x_i^T \beta} \tau (y_i - x_i^T b) + \sum_{y_i < x_i^T b} (\tau - 1)(y_i - x_i^T b) \right]$$

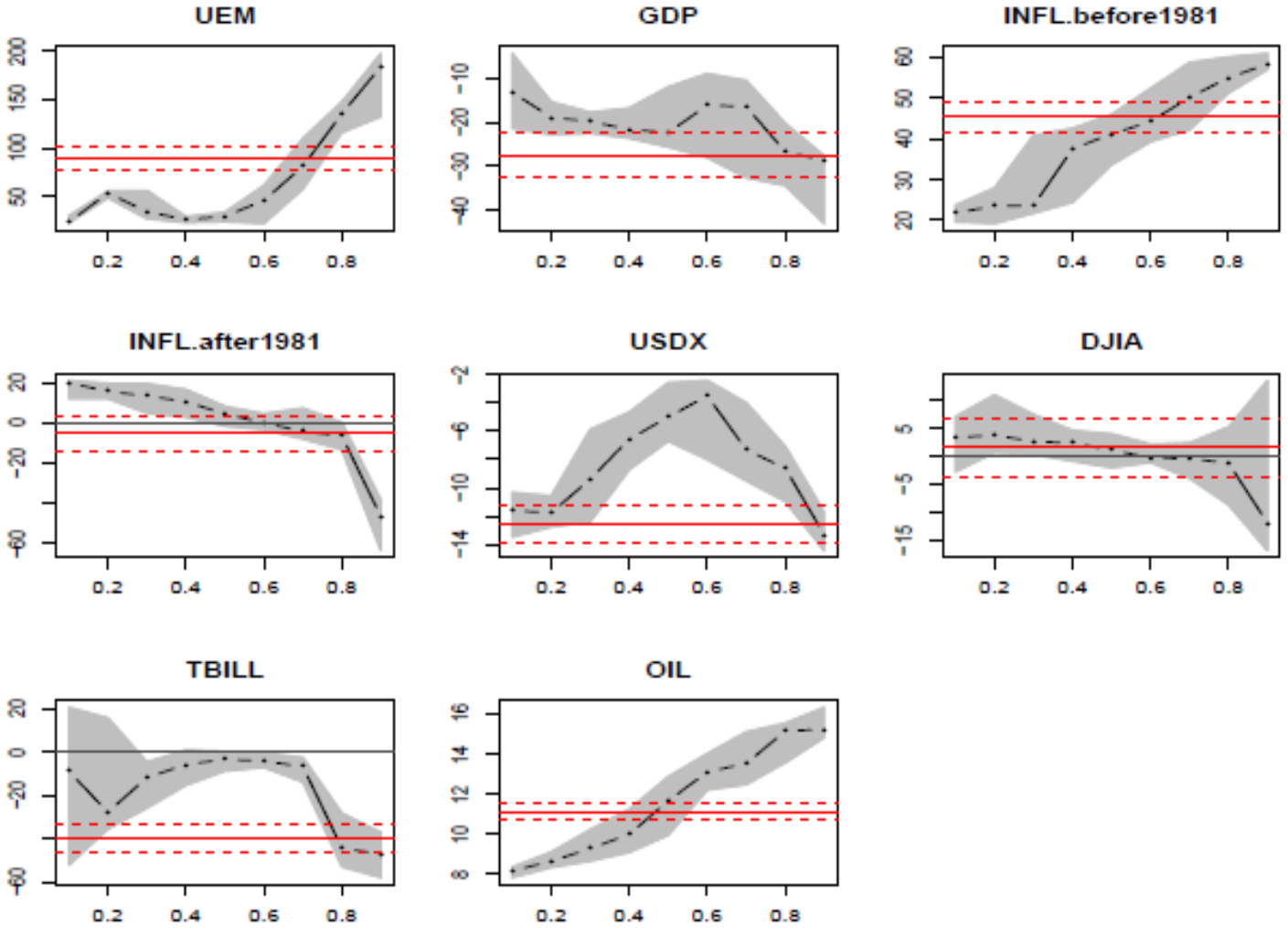
- Statistical packages for QR

  R, S+, Stata, SAS

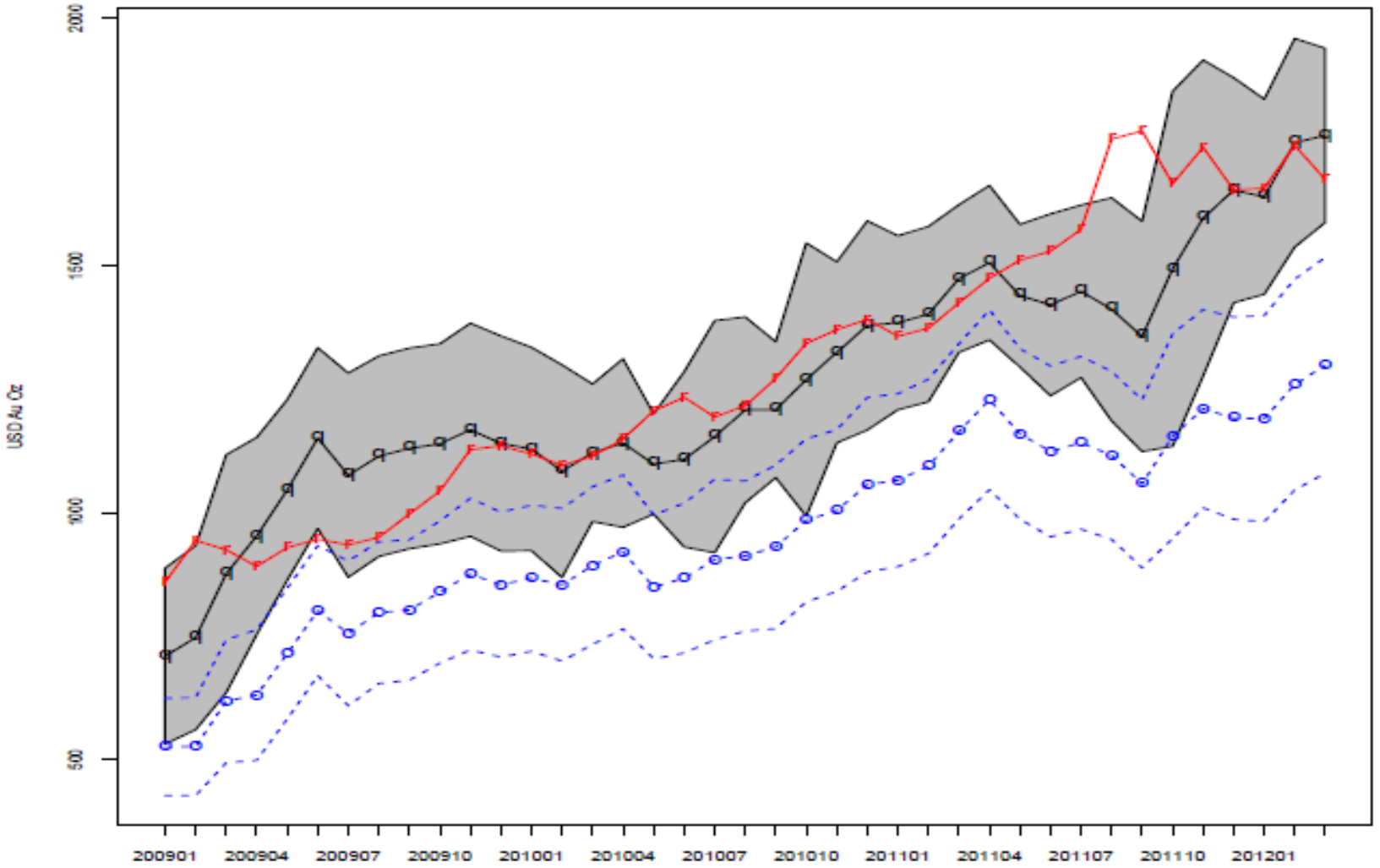
Quantile regression: an example with gold price



Pricing Gold: how much from where?



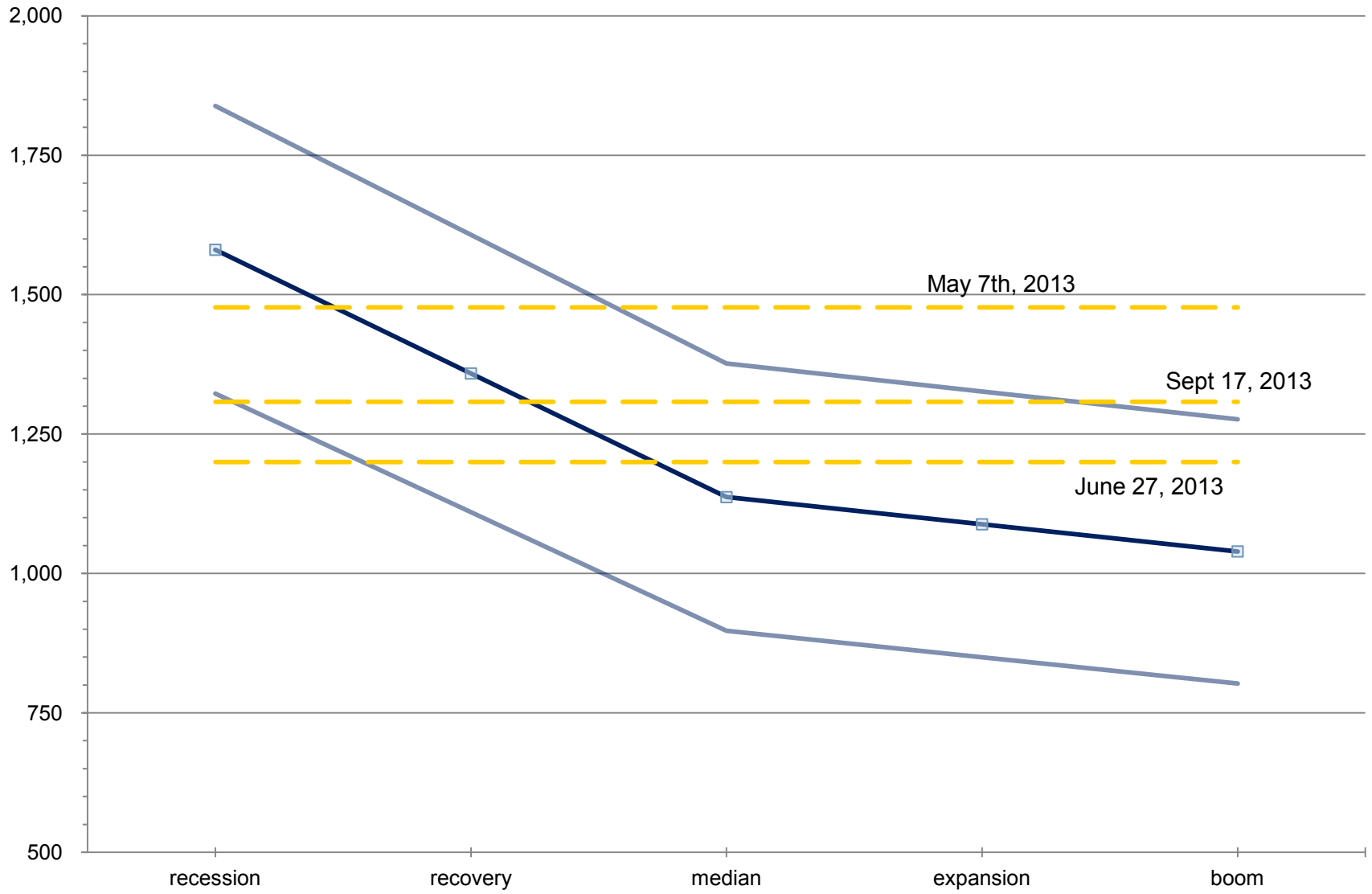
Pricing Gold: forecasts versus real prices (out of sample)



Economic Scenarios

Economic Scenario	Real Inflation	Expected Inflation	Unemployment	Nominal GDP	T-bill yield	USD Index	WTI
Recession	3.32	1.54	8.91	3.9	0.04	71.16	98.06
Recovery	2.99	2.02	7.16	4.31	1.77	78.76	90.57
Median	2.65	2.49	5.4	4.71	3.49	86.36	83.08
Expansion	2.69	2.55	5.23	4.98	3.6	88.66	80.98
Boom	2.72	2.61	5.05	5.24	3.7	90.96	78.87

Gold Prices (USD/Oz) corresponding to Economic Indicators



Key drivers: definitions

Variable	Definition
Oil	West Texas Intermediate (aka, Texas light sweet), USD/barrel
Unemployment	US unemployment rate
DJIA	Dow Jones Industrial Average (level)
TBILL	3-month US T-bill returns
Inflation	based on US CPI
GDP	US nominal GDP growth rate
USD Index	US dollar strength index

Disclosure/Disclaimer