What drives variation in corporate hedging: price expectations or risk?

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Introduction

There are two broad sets of theories for why firms use derivatives

1. Risk + Frictions
    - Financial distress is costly (Smith and Stulz, 1985)
    - Financial constraints disrupt investments in bad times (Froot, Scharfstein, and Stein, 1993)
    - Taxes: convexity (Smith and Stulz, 1985) and tax shields due to higher debt capacity (Leland, 1998)
    - Assessing true manager performance is hard (DeMarzo and Duffie, 1985)
    - Agency problems – managers/large shareholders are risk averse (Smith and Stulz, 1985)

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2. To make money based on their **expectations of future prices!**
   - Make use of private information (Stulz, 1996)
   - Harvest unconditional risk premia (Adam and Fernando, 2006)

Much academic research is devoted to testing risk + frictions theories...

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  - Dolde (1995), Tufano (1996), Mian (1997), Geczy, Minton, and Schrand (1997), Haushalter (2000), Graham and Rogers (2002), Campello, Lin, Ma, and Zou (2011), Bakke, Mahmudi, Fernando, and Salas (2016), Gilje and Taillard (2017),...

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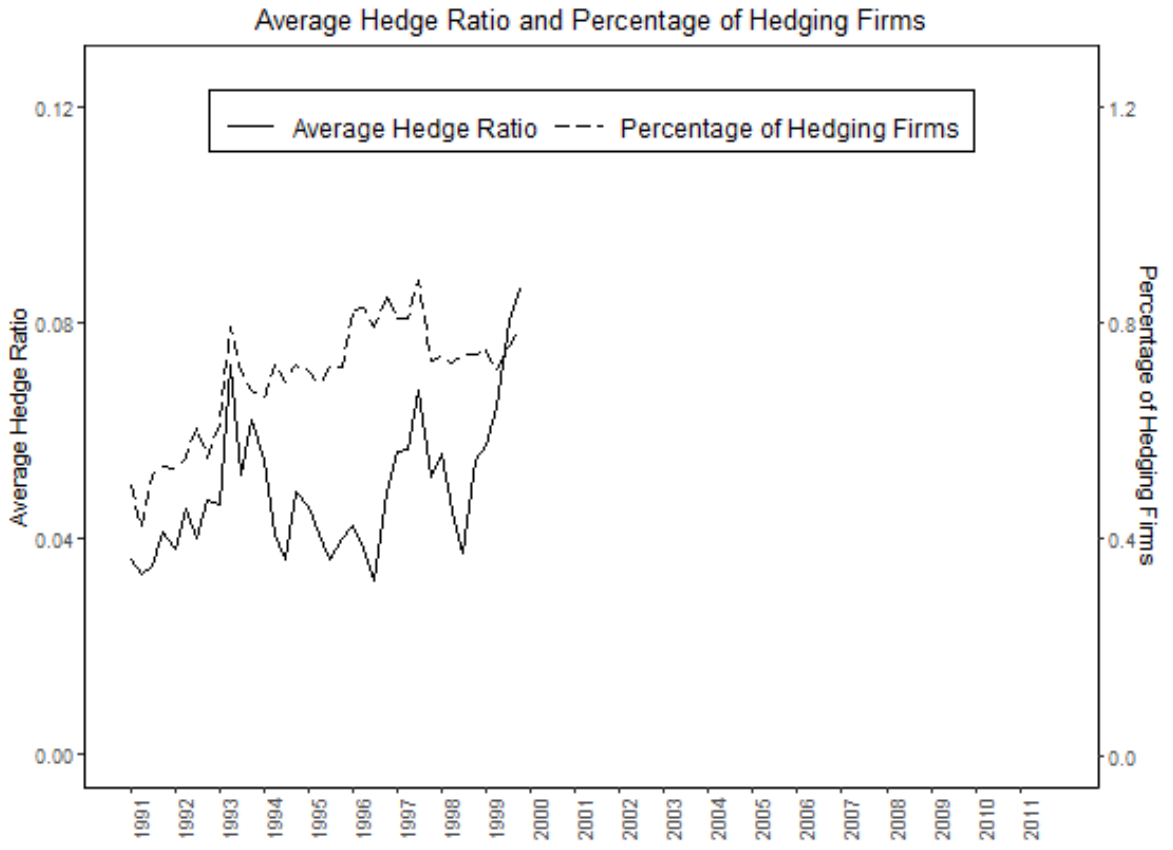
- Relatively few papers test price expectations
  - Brown, Crabb, and Haushalter (2006) and Adam, Fernando, and Salas (2017)
- Yet managers themselves emphasize price expectations or increasing cash flows on surveys
  - Bodnar, Hayt, and Marston (1998), Loderer and Pichler (2000), Glaum (2002)

We use an expanded sample of gold mining data to test both sets of theories

- Data on positions of gold miners used by Tufano (1996) (3 years), expanded by Adam and Fernando (10 years)



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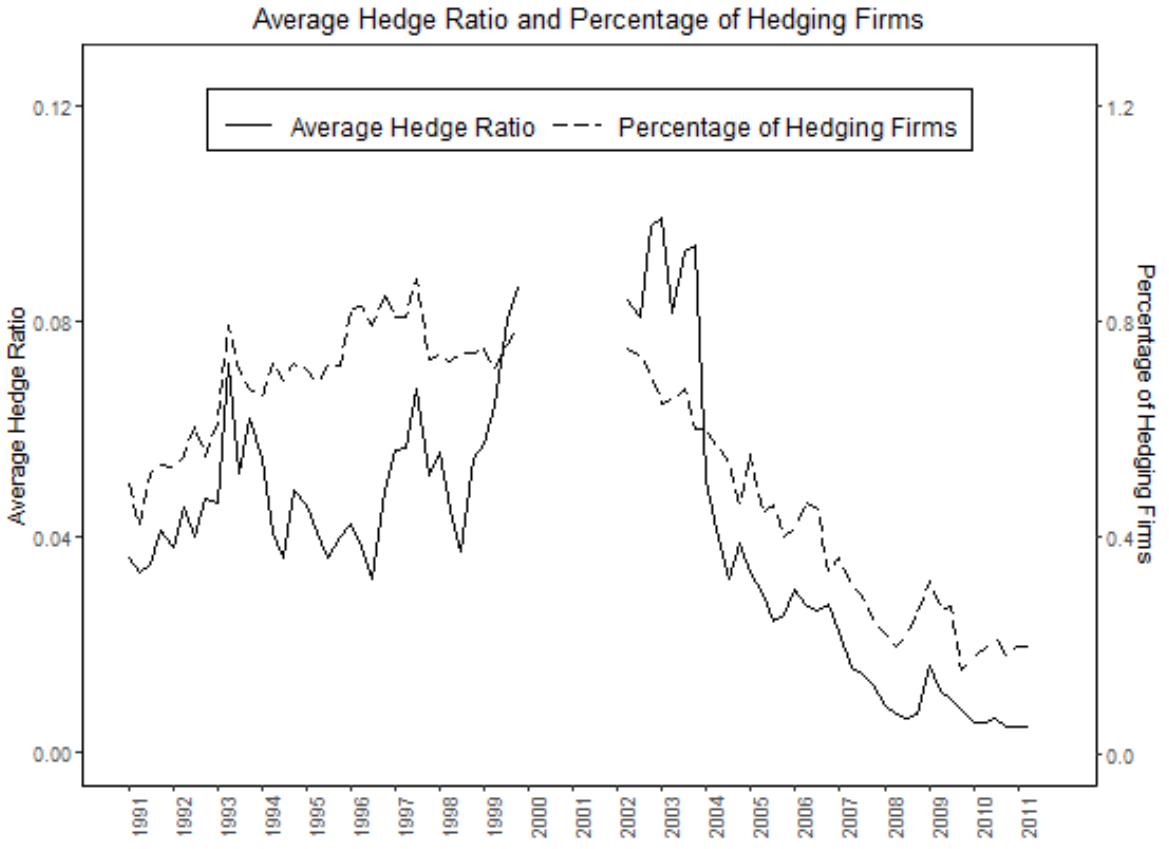
- We add 10 more years of data…



Something important must have changed for firms to change their behavior so dramatically. What?

- We test a simple price expectations based hypothesis:
  - Managers / investors believe gold prices are predictable and change hedge ratios based on their expectations of future gold prices
  - Expectations are based on extrapolating past gold returns. Firms reduce their hedging when gold prices have recently increased
  - But this is a bias: ex-post, extrapolation does not make them money

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- We also test 'Risk + Frictions' hypotheses
  - E.g. Increase in gold prices imply firms are less distressed and need less hedging

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… and little evidence that risk frictions stories can explain the decline

Data

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- Gold spot and futures prices: Datastream
- Other databases: Compustat, CRSP, CFMRC, Gold lease rates and the LIBOR-US rates

Hedge ratio

Americas Q4 2003	2004 Ounces	 Price/oz.	2005 Ounces	 Price/oz.	2006 Ounces	 Price/oz.
Inmet Mining						
Forward sales	128,300	333	108,300	342	103,400	356
Forward sales	10,350	366	13,500	367	13,500	369
Calls - sold	16,200	461	-	-	-	-
Total Committed	**154,850**	-	**121,800**	-	**116,900**	-
Puts - bought	16,200	375	-	-	-	-

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- The total net delta-adjusted ounces for each gold miner for the next three years of its hedging positions: including short and long positions in various types of forwards and options (Tufano (1996), Adam and Fernando (2006))

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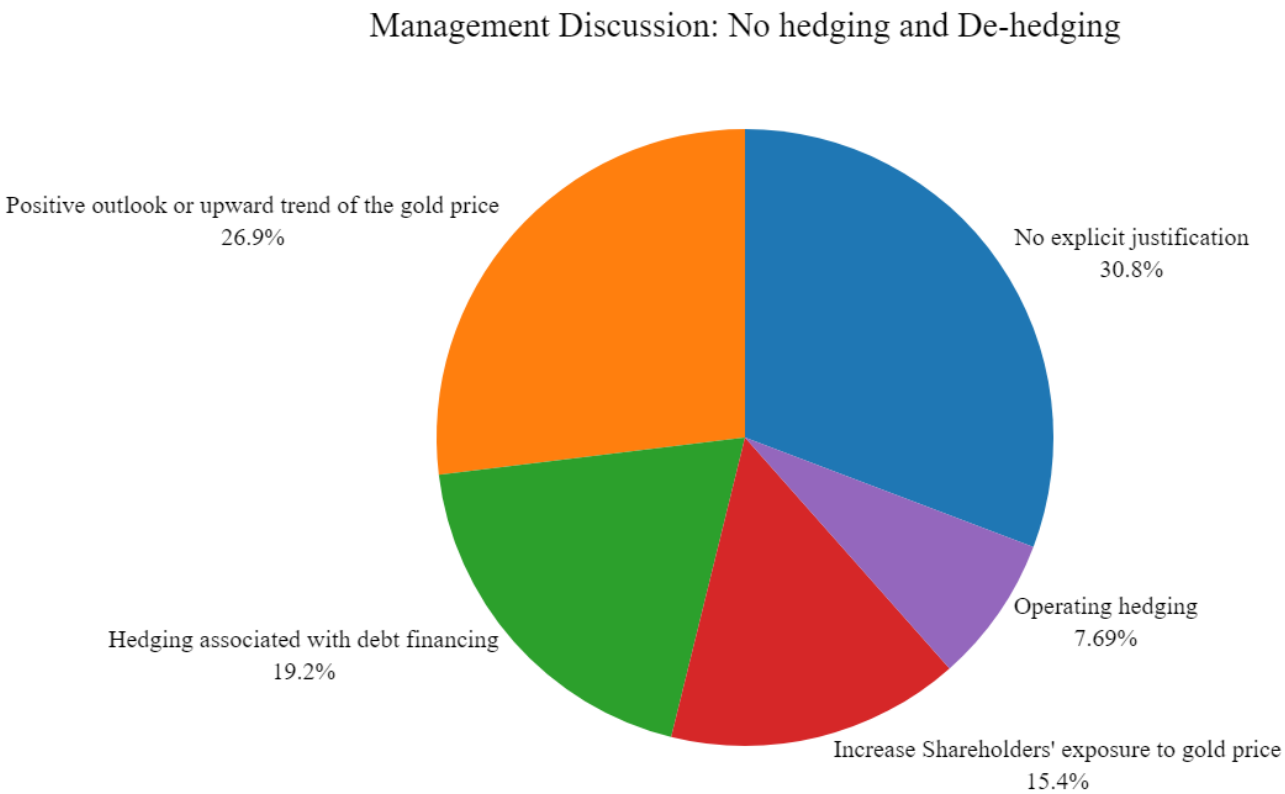
- The hedge ratio for firm i in quarter t is calculated using:

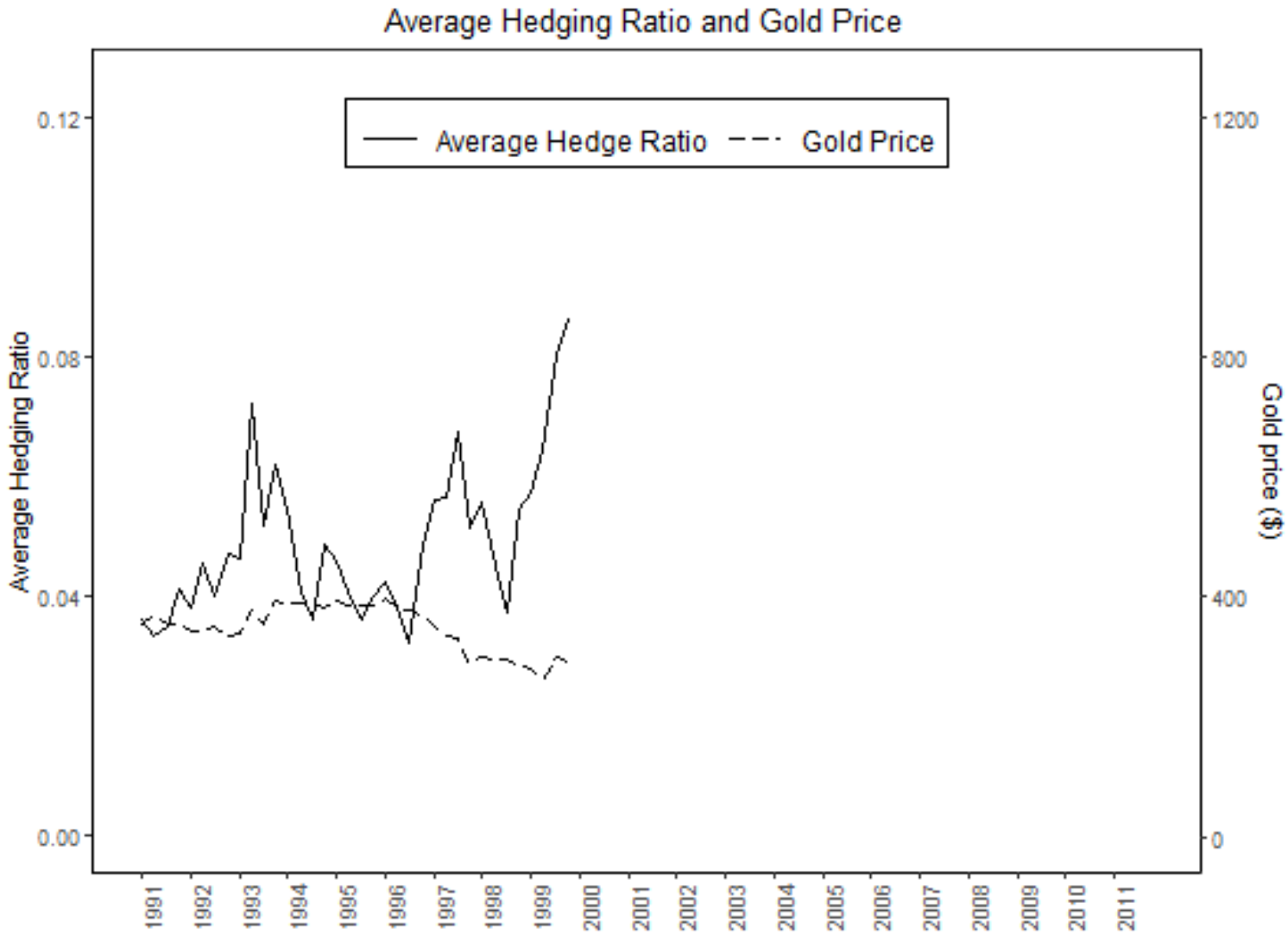
$$\text{Hedge ratio}_{i,t} = -\frac{\text{Total net delta-adjusted ounces}_{i,t}}{\text{Reserves}_{i,t}},$$

Key results

Managers in 10-Ks emphasize price trends in explaining why they de-hedged in the period of 2002–2004



Consistent with this justification, hedge ratios fell as gold prices rose



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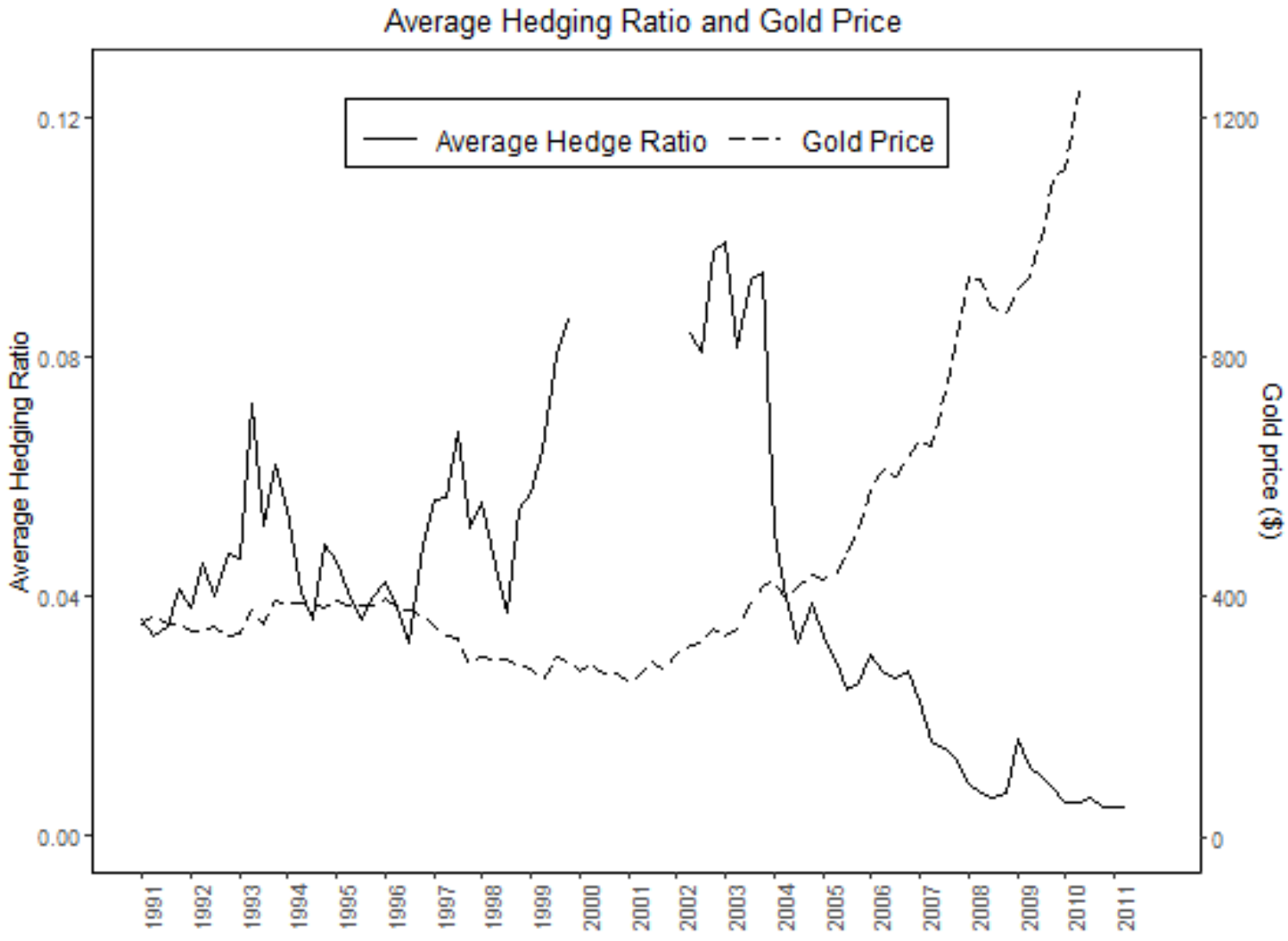


Past gold returns are the single best predictor hedge ratios and % of firms that hedge

	Average hedge ratio			Percent of hedging firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Short-term gold return	-0.053		0.046	-1.192***		-0.276
	(0.050)		(0.039)	(0.401)		(0.277)
Long-term gold return		-0.048***	-0.051***		-0.482***	-0.466***
		(0.006)	(0.007)		(0.044)	(0.047)
Constant	0.042***	0.042***	0.051***	0.051***	0.570***	0.653***
	(0.003)	(0.003)	(0.003)	(0.025)	(0.018)	(0.018)
Observations	73	73	73	73	73	73
R^2	0.016	0.450	0.461	0.111	0.624	0.629
Adjusted R^2	0.002	0.442	0.445	0.098	0.619	0.619

Gold price forecasts by analysts predict firm hedge ratios

	Dependent variable:					
	Average Ratio			Percent of Hedging Firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Short-term gold return	0.045		0.036	-0.285		-0.921**
	(0.039)		(0.092)	(0.276)		(0.339)
Long-term gold return	-0.051***		-0.064***	-0.465***		-0.615***
	(0.007)		(0.017)	(0.047)		(0.061)
Forecasted 1-year gold return		-0.687*	-0.564**		-4.217	-2.924***
		(0.348)	(0.222)		(2.661)	(0.814)
Constant	0.051***	0.061***	0.077***	0.655***	0.591***	0.805***
	(0.003)	(0.013)	(0.011)	(0.018)	(0.099)	(0.040)
Observations	73	12	12	73	12	12
R^2	0.461	0.281	0.772	0.630	0.201	0.942
Adjusted R^2	0.446	0.209	0.687	0.619	0.121	0.920

Forecast errors (realized - forecasted) of these forecasts are correlated with past returns, consistent with an extrapolation bias

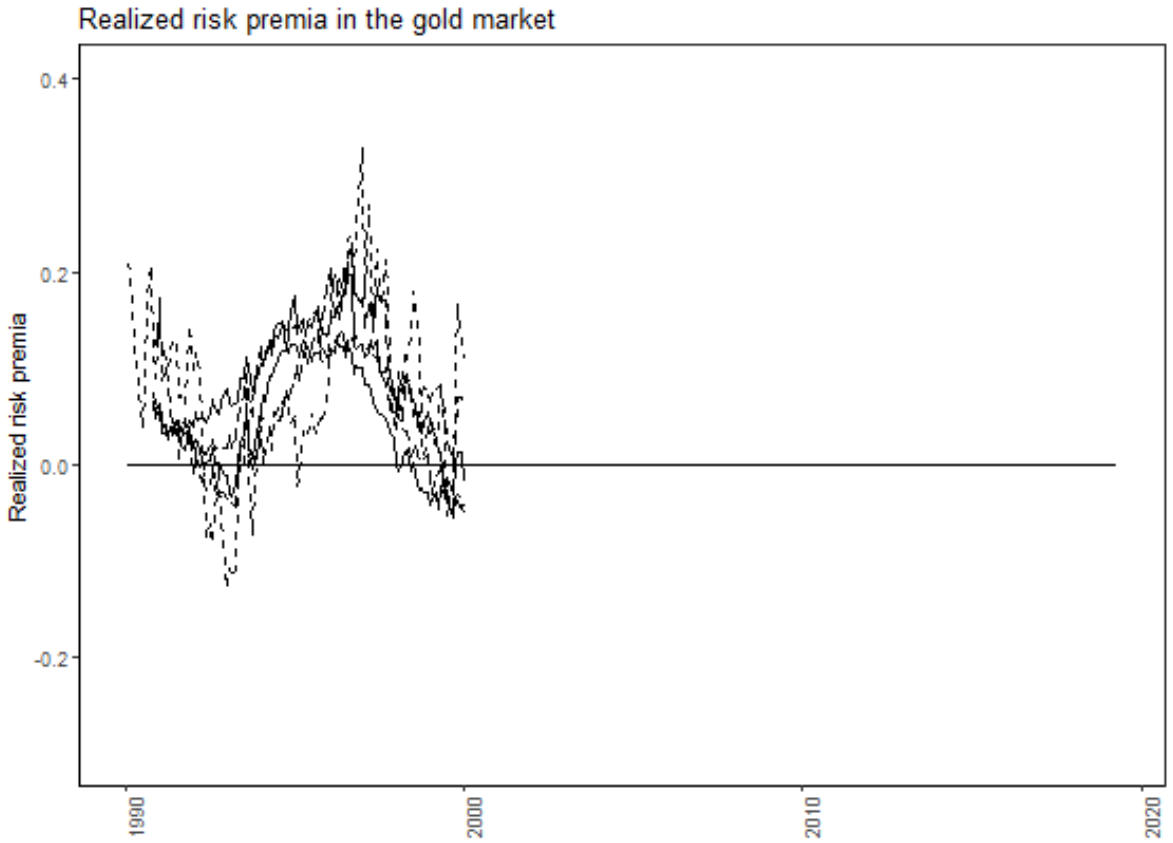
	(1)	(2)	(3)	(4)	(5)
Short-term gold return	-0.861***	-0.860***	-0.884***	-0.901***	-0.896***
	(0.084)	(0.097)	(0.080)	(0.083)	(0.090)
Long-term gold return		-0.003			
		(0.059)			
Risk-free rate			0.931	0.960	0.892
			(0.762)	(0.773)	(0.856)
GDP growth			0.003	0.008	0.010
			(0.010)	(0.011)	(0.014)
Inflation			-0.012	-0.027	-0.025
			(0.017)	(0.025)	(0.027)
SP500 return				-0.090	-0.074
				(0.106)	(0.129)
VIX					0.001
					(0.004)
Constant	-0.038**	-0.037*	-0.039	-0.016	-0.047
	(0.015)	(0.018)	(0.038)	(0.048)	(0.136)
Observations	18	18	16	16	16
R^2	0.867	0.867	0.931	0.936	0.936
Adjusted R^2	0.859	0.849	0.906	0.903	0.893

Adama and Fernando (2006) find that gold miners can generate cash flows by harvesting unconditional risk premia

- They find that $[F_{t,T} > E(S_T)]$
- That is, gold hedgers obtain higher prices on average by selling forward rather than holding gold to maturity and selling spot
- And thus hedging generates positive unconditional cash flows

$$\textit{Realized Risk Premium} = [1 + (F(t,T) - S(T))/F(t,T)]\text{^}(1/(T-t)) - 1$$

Is there an unconditional risk premium?



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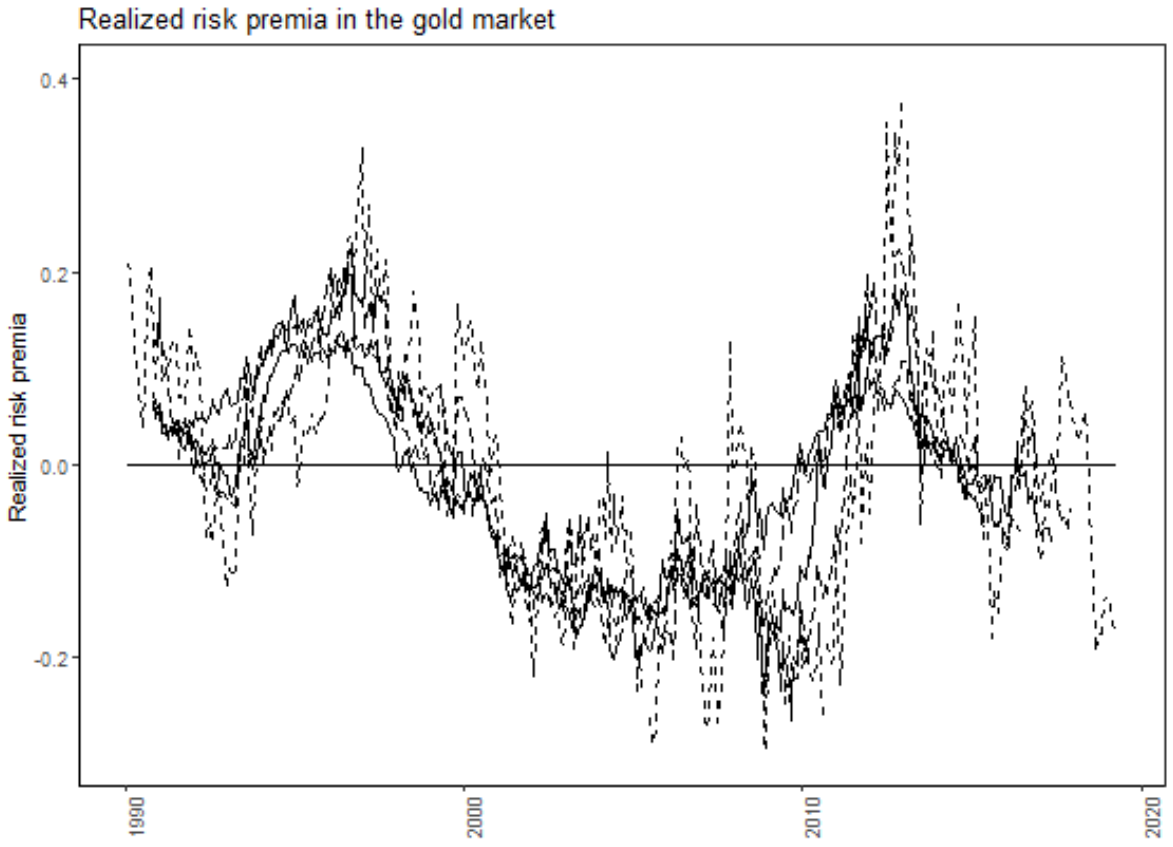
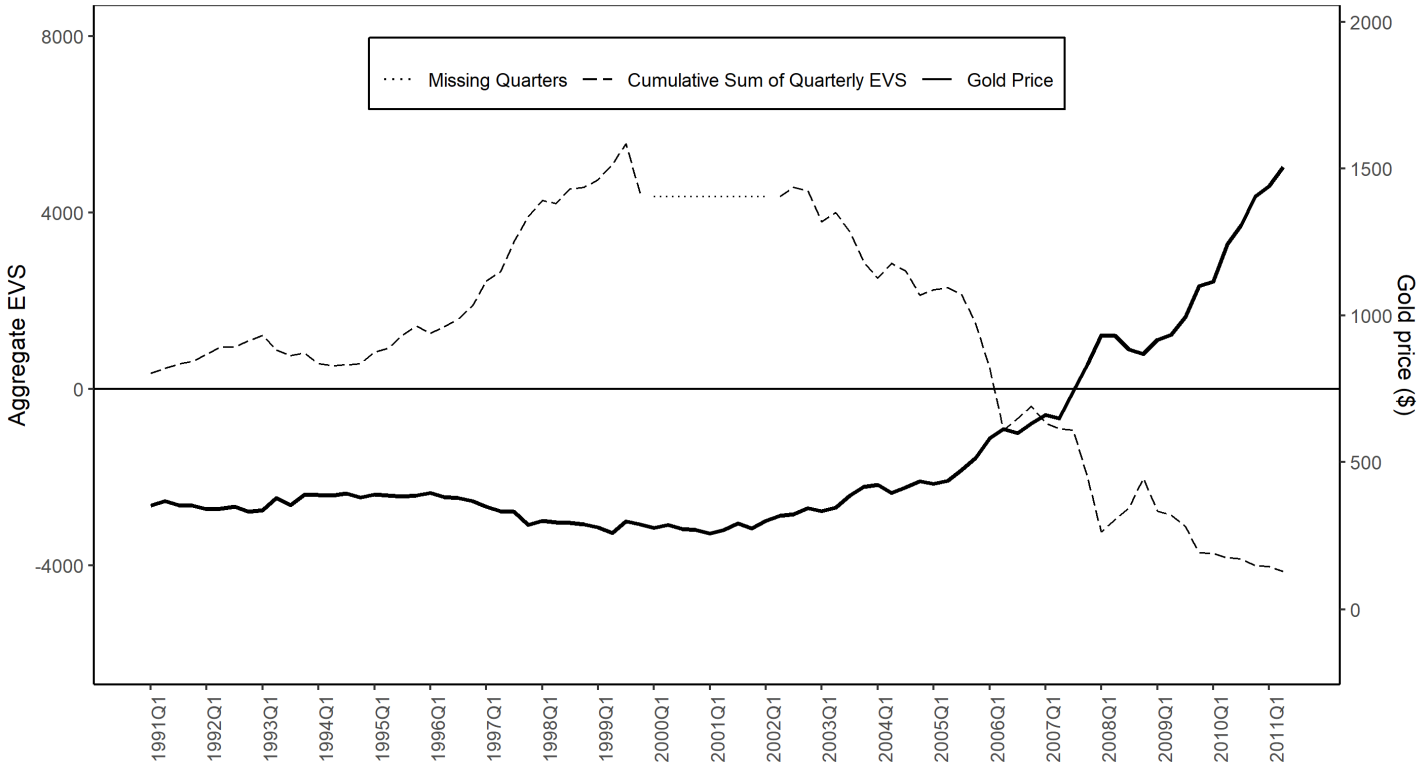


	1-year Premium
1990-1999	0.078***
	(3.036)
2000-2009	-0.107***
	(-5.364)
2010-2019	0.001
	(0.013)
1990-2019	-0.010
	(-0.262)

A conditional version of Adam and Fernando?

- Managers hedged when the expected premium was positive and stopped hedging when they realized it was zero
- If so, hedgers would make money…
- EVS: Economic Value Added of hedge positions, i.e., mark-to-market values of hedge positions



Do shareholders behave in a manner consistent with a belief that managers can predict commodity prices?

- Bertrand and Mullainathan (2001) find that managers are rewarded for good luck (their pay increases when oil prices go up)
- Might make sense in a world in which managers can chose whether to hedge and investors believe that prices are predictable
- If so managers should also be punished for bad luck!

Do shareholders behave in a manner consistent with a belief that managers can predict commodity prices?

	CEO Forced Turnover within One Year						
	OLS					Logit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hedging loss	0.002**	0.002**	0.002**	0.007*	0.007*	0.403**	0.298*
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.167)	(0.181)
Total asset				-0.002*	-0.001		-0.142***
				(0.001)	(0.001)		(0.049)
ROA				-0.014	-0.018		0.466
				(0.013)	(0.014)		(0.520)
Past return				-0.00001*	-0.00000		-0.037***
				(0.00000)	(0.00000)		(0.009)
Past volatility				0.00001***	-0.00000		0.025***
				(0.00000)	(0.00000)		(0.006)
Tobin's Q				-0.0003**	-0.0002*		-0.013
				(0.0001)	(0.0001)		(0.009)
Total compensation				-0.001	-0.001		0.013
				(0.002)	(0.002)		(0.087)
Age $>$ 60				-0.008***	-0.007***		-0.507***
				(0.002)	(0.002)		(0.177)
Tenure				-0.0005***	-0.0005***		-0.035***
				(0.0002)	(0.0001)		(0.011)
Constant	0.005***					-5.388***	-2.606***
	(0.0003)					(0.064)	(0.586)
Fixed Effects	No	Industry	Industry, year	Industry	Industry, year	-	-
Observations	60,673	60,673	60,673	12,949	12,949	60,673	12,949
R^2	0.0001	0.003	0.005	0.010	0.016		
Adjusted R^2	0.0001	0.002	0.004	0.006	0.012		

Relatively little evidence for Risk + Frictions in explaining the decline

Unconditional mean hedge ratios:

1991Q1-1999Q4: 0.0498 2002Q2-2011Q2: 0.0287

Difference: -0.0211

Does controlling for similar z scores, and other characteristics make the difference 0?

Differences in hedge ratios between treated and control firms

Method 1: 1 variable (Z-score)

Method 2: 3 variables (Total assets, Book leverage, Profitability)

Method 3: 8 variables (+ Investment, Dividend, Tax loss carried forward, Quick ratio)

Method	Difference	Robust S.E.	Z	p-value
Method 1	-0.020	0.003	-7.54	0.000
Method 2	-0.027	0.003	-10.60	0.000
Method 3	-0.023	0.006	-3.91	0.000

But some evidence for distress in the cross section

	Hedge ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
Selection Stage						
Short-term gold return	-2.170***	-2.238***			-2.208***	-2.004***
	(0.610)	(0.611)			(0.636)	(0.644)
Long-term gold return	-1.835***	-1.746***			-1.803***	-1.523***
	(0.127)	(0.138)			(0.144)	(0.167)
Gold volatility		-0.891			-0.229	-0.172
		(0.547)			(0.571)	(0.578)
Z-score			0.130***		0.122***	0.148***
			(0.025)		(0.028)	(0.036)
Total assets				-0.380***		-0.119**
				(0.045)		(0.059)
Profitability				0.549***		0.089
				(0.108)		(0.138)
Book Leverage				2.330***		1.282***
				(0.293)		(0.325)
N	2,627	2,627	2,478	2,478	2,419	2,419
L1	2,308.513	2,309.884	2,015.543	2,122.210	2,130.065	2,167.890
L0	1,191.721	1,191.721	1,167.734	1,167.734	1,145.114	1,145.114

But some evidence for distress in the cross section

	Hedge ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
Second Stage						
Short-term gold return	-1.454	-1.442			-1.343	-1.002
	(1.022)	(1.023)			(1.032)	(1.013)
Long-term gold return	-1.623***	-1.603***			-1.458***	-0.557**
	(0.233)	(0.244)			(0.252)	(0.281)
Gold volatility		-0.277			-1.341	-0.140
		(1.001)			(1.025)	(1.027)
Z-score			-0.155**		-0.128**	-0.006
			(0.062)		(0.063)	(0.074)
Total assets				-0.635***		-0.543***
				(0.086)		(0.104)
Profitability				-0.060		0.041
				(0.201)		(0.242)
Book Leverage				3.858***		3.581***
				(0.534)		(0.571)

Conclusions

- Dramatic decline in gold hedging over the 2002-2011 period
- Evidence consistent with a managers extrapolating past gold prices to expect higher prices in the future and hence reducing hedges
- Little to no evidence consistent with risk + frictions explaining the decline in hedging