Estimating the Effect of Price on Oil Production: Evidence from the Norwegian Continental Shelf

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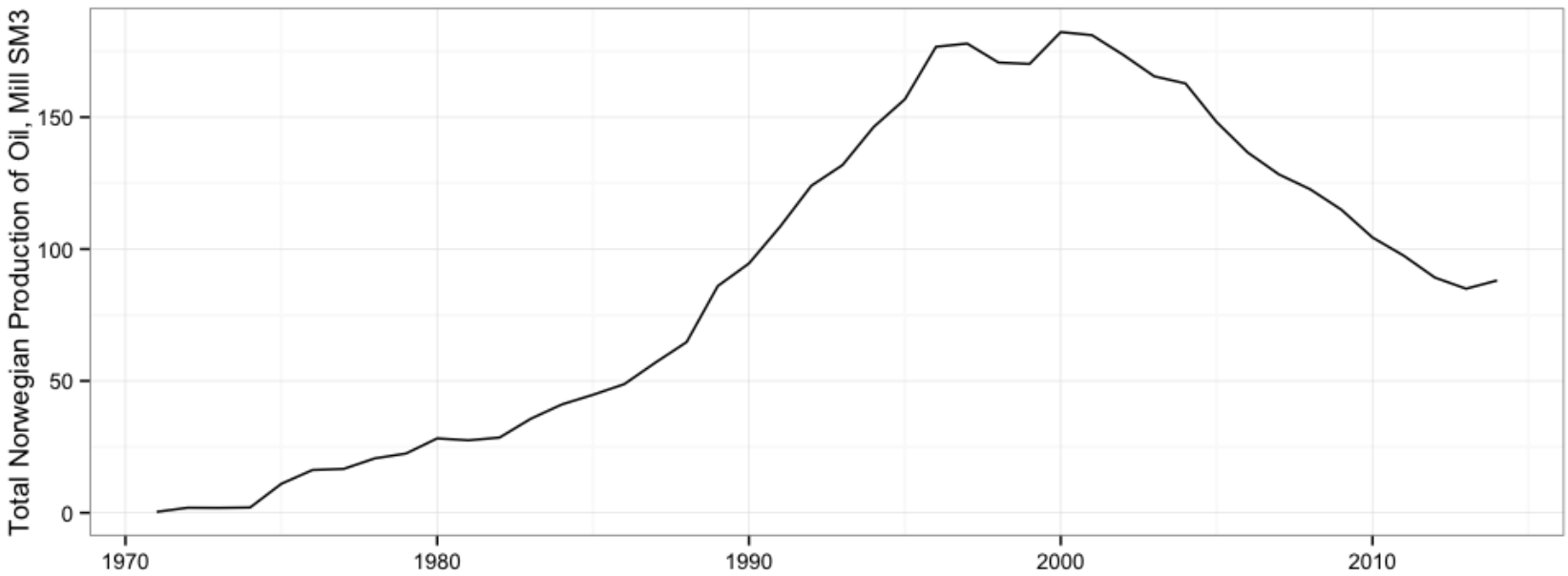
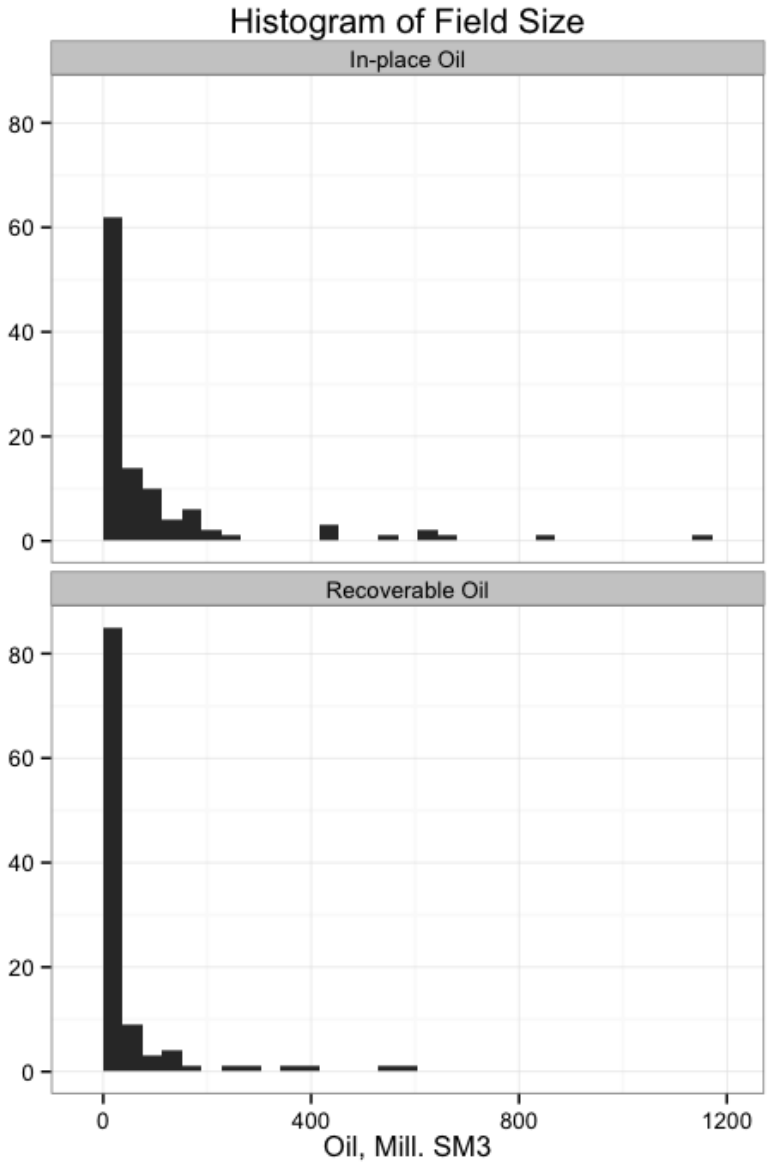
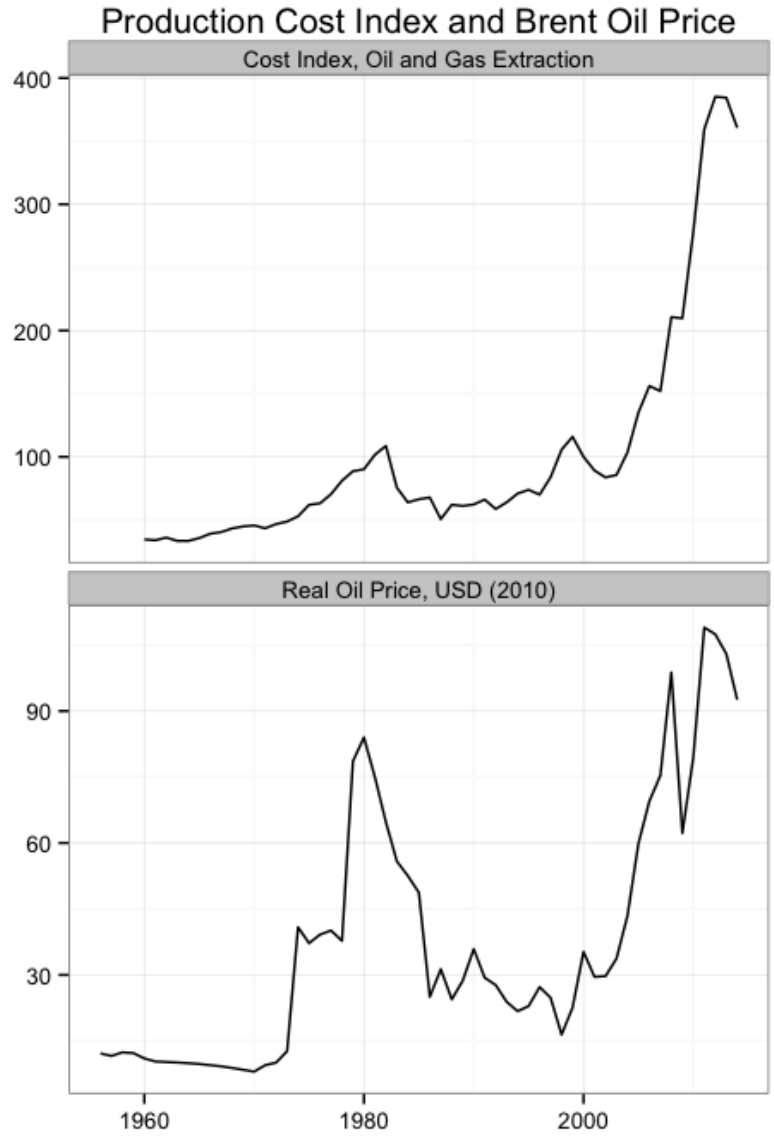
Main Results

- Use of semi-parametric models can be used to make non-biased estimates of oil-field production.
- No significant contemporary effect of oil price on field production.
- Slight lagged effect found after 2-4 years, magnitude of around 2-5%.


Yearly Oil Production, Mill SM3
0
10
20
30
1970
1980
1990
2000
2010

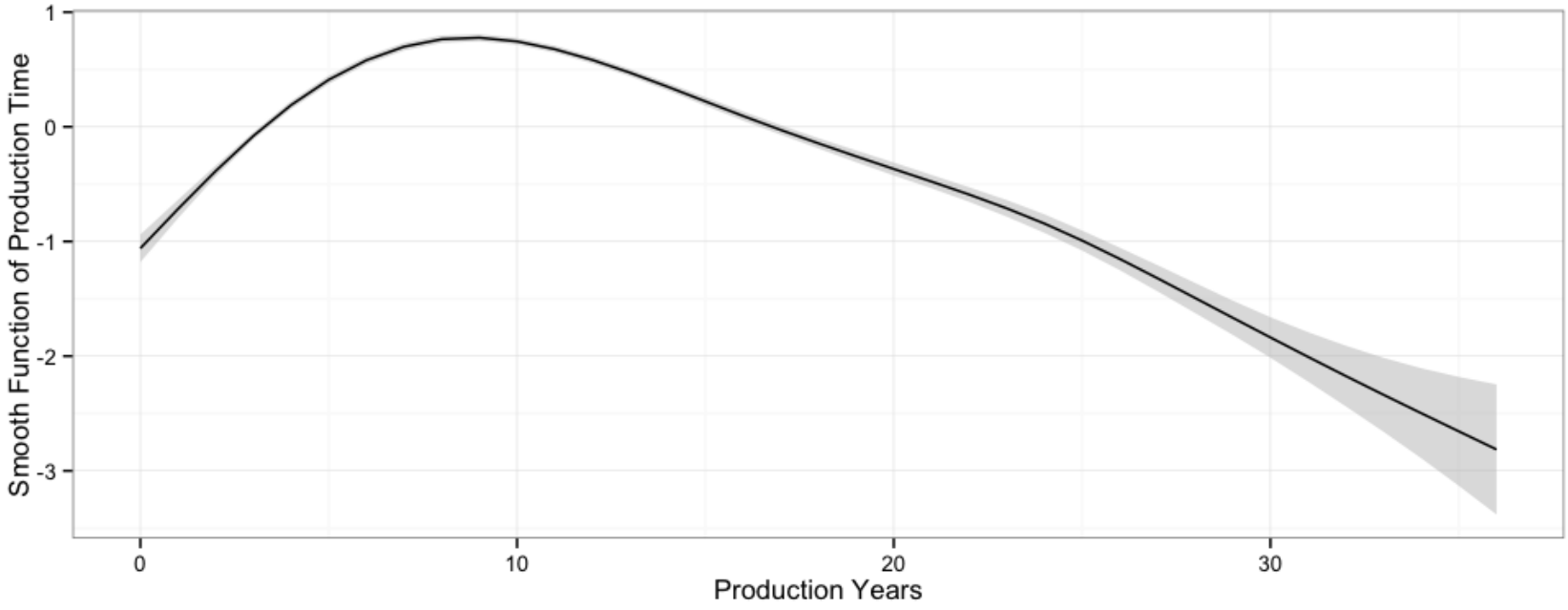

Total Norwegian Production of Oil, Mill SM3
0
50
100
150
1970
1980
1990
2000
2010

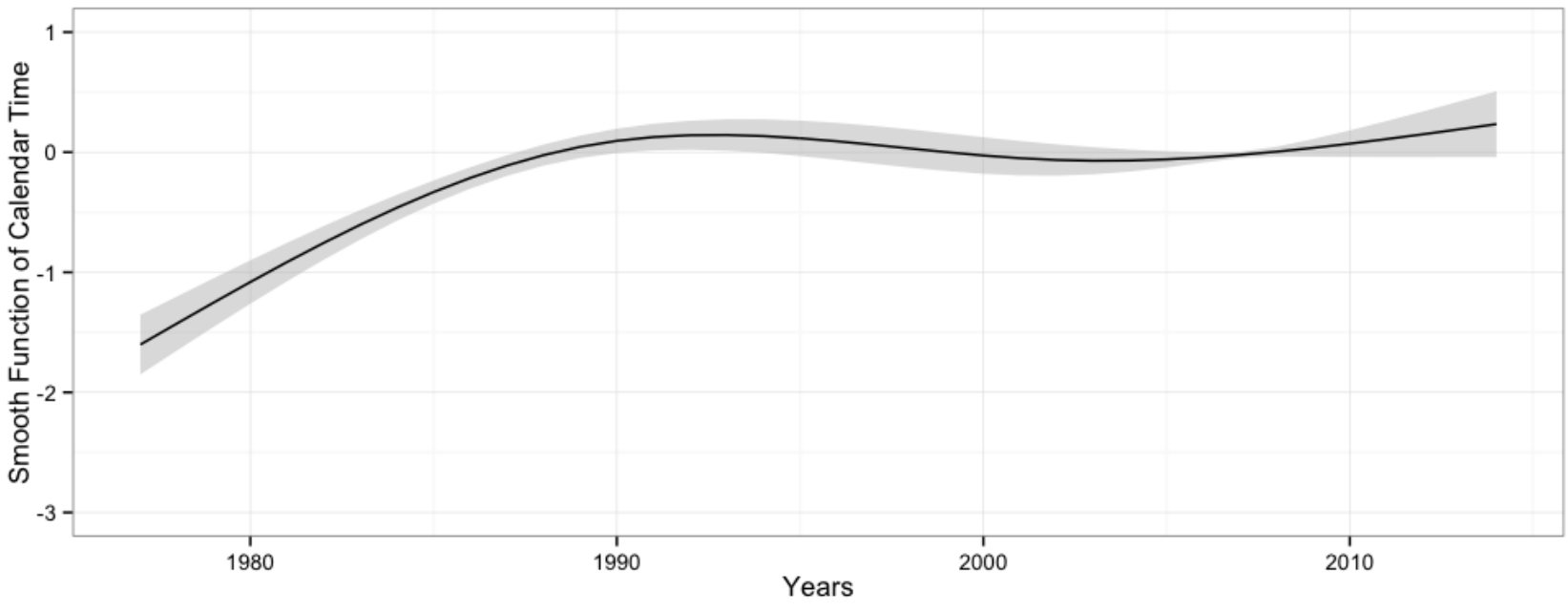

Histogram of Field Size
In-place Oil
Recoverable Oil
0
20
40
60
80
0
400
800
1200
Oil, Mill. SM3


Production Cost Index and Brent Oil Price
Cost Index, Oil and Gas Extraction
Real Oil Price, USD (2010)
100
200
300
400
30
60
90
1960
1980
2000

$$Log(production_{i,t}) = f(production\_time_{i,t}) + f(year_t) + \beta_1 in\_place\_oil_{i,t} + \beta_3 cost\_index_t + \beta_2 \mathbf{oil\_price\_lags_t} + \epsilon_{i,t} \quad (1)$$

$$\|\mathbf{y} - \mathbf{X}\beta\|^2 + \lambda \int_0^1 [f''(x)]^2 dx \tag{2}$$

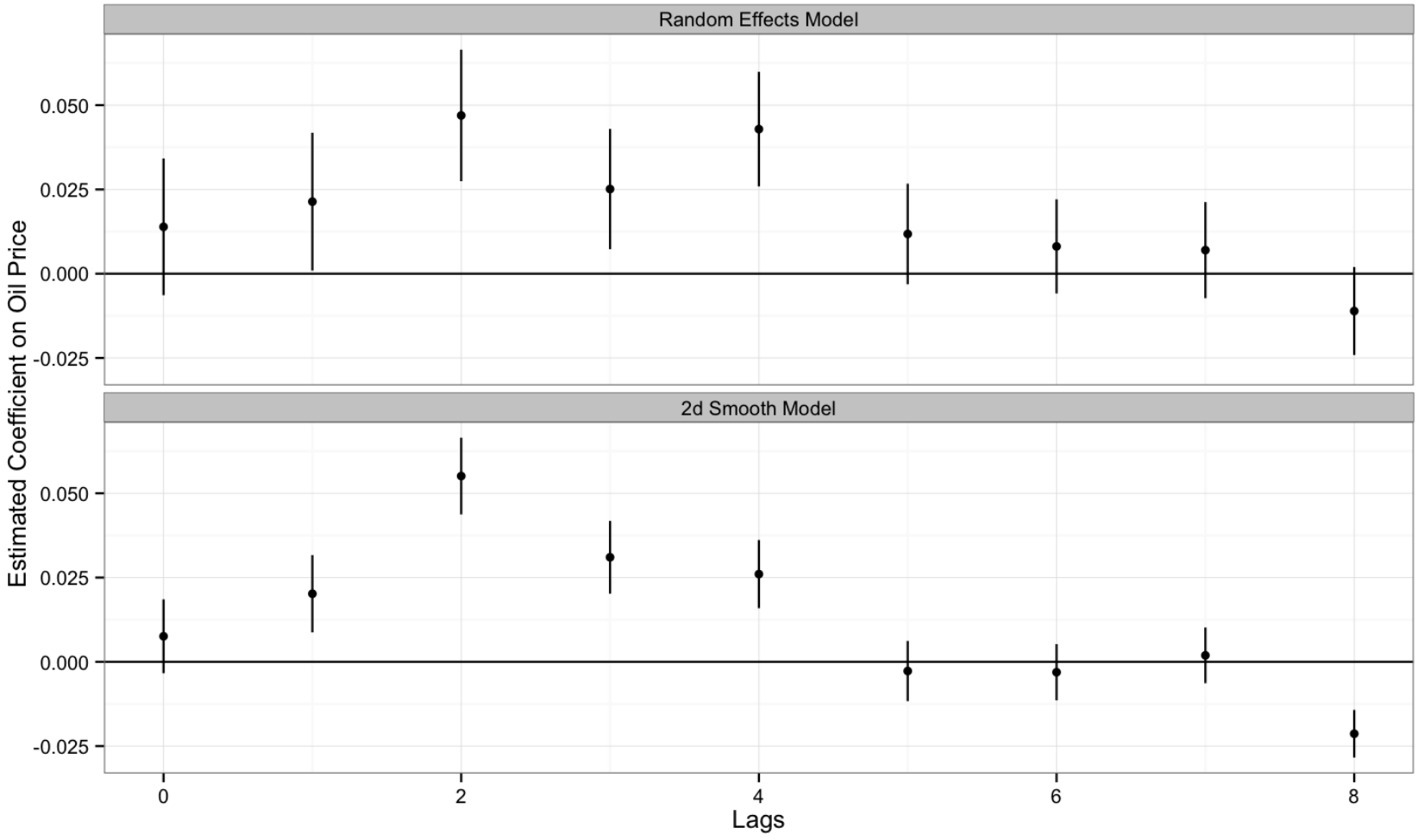

Smooth Function of Production Time
1
0
-1
-2
-3
0
10
20
30
Production Years

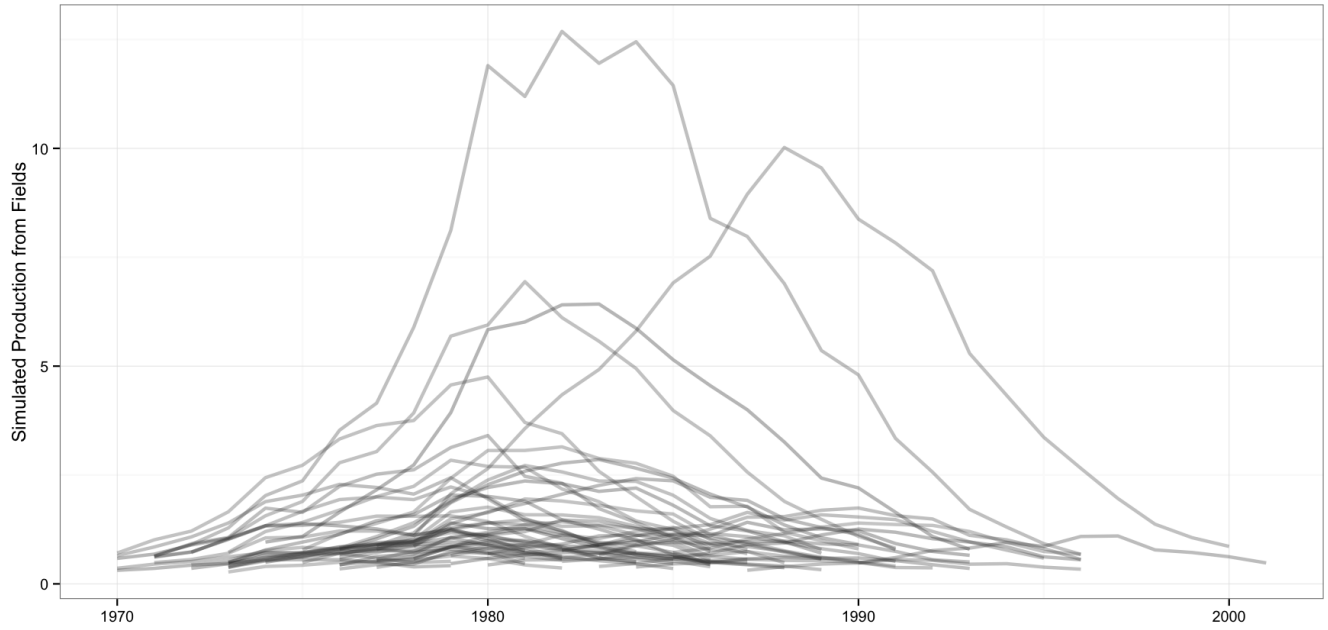

Smooth Function of Calendar Time
1
0
-1
-2
-3
1980
1990
2000
2010
Years

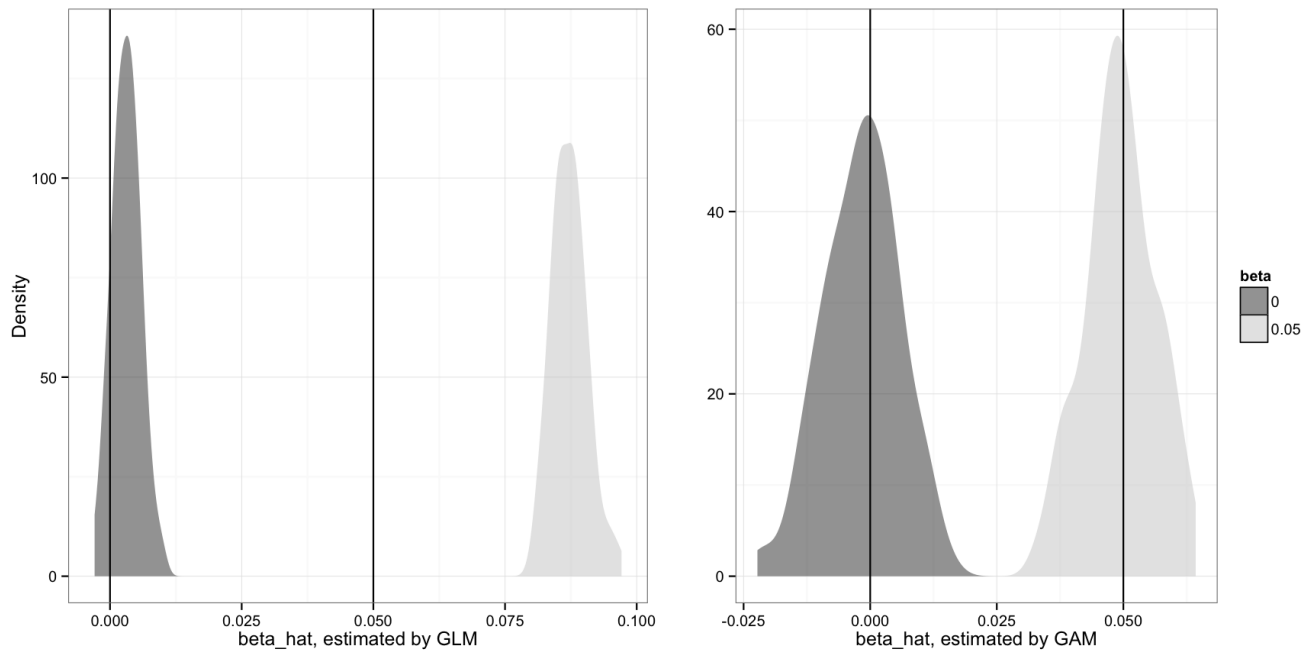
$$y_i = g(x_1, x_2) \tag{3}$$

$$\min \|\mathbf{y} - \mathbf{f}\|^2 + \lambda J_{22}(f) \tag{4}$$

$$J_{22}(f) = \left(\frac{\partial^2 f}{\partial x_1^2}\right)^2 + \left(\frac{\partial^2 f}{\partial x_1 \partial x_2}\right)^2 + \left(\frac{\partial^2 f}{\partial x_2^2}\right)^2 dx_1\, dx_2 \qquad (5)$$


Random Effects Model
2d Smooth Model
Estimated Coefficient on Oil Price
0.050
0.025
0.000
-0.025
0
2
4
6
8
Lags


Simulated Production from Fields
0
5
10
1970
1980
1990
2000


Density
0
50
100
0.000
0.025
0.050
0.075
0.100
beta_hat, estimated by GLM
0
20
40
60
-0.025
0.000
0.025
0.050
beta_hat, estimated by GAM
beta
0
0.05

Main Points

- Offshore producers are unlikely to be strategically adjusting production to short-term changes in the oil price

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- Offshore producers are unlikely to be strategically adjusting production to short-term changes in the oil price
- Some investment-led lagged response likely, but of modest magnitude.

Main Implications

- Oil production from exiting offshore fields inelastic to changes in oil prices.
- Most of effect on total extraction from offshore areas likely comes from geographic and technical expansion.